Assessment of large-scale IT infrastructure demand in India

December 2021

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1   Macroeconomic overview of India

1.1   Trend in GDP growth in India

GDP grew at 6.6% CAGR from fiscals 2012-20

In 2015, the Ministry of Statistics and Programme Implementation (MoSPI) changed the base year for calculating India's gross domestic product (GDP) between fiscals 2005 and 2012. Based on this, the country's GDP expanded at 6.6% compound annual growth rate (CAGR) to Rs 146 trillion in fiscal 2020 from Rs 87 trillion in fiscal 2012.

Fiscal 2020 estimates show the investment decline has added to the economy's woes

As per the second advance estimates, India's GDP grew 4.0% in fiscal 2020. Private consumption declined to a decadal low of 5.3% from 7.2% in fiscal 2019, hurt by the slowdown in spending by central and state governments and a muted private-sector appetite for fresh investments. Over the past four years, a sharp increase in government spending, especially on infrastructure (roads, railways, highways), has kept the overall investment spending growth at 8% on average. In fiscal 2020, though, government investment spending took a back seat. Meanwhile, weak consumption demand and low capacity utilisation kept investments in the manufacturing sector tepid.

Real GDP growth in India (new GDP series)
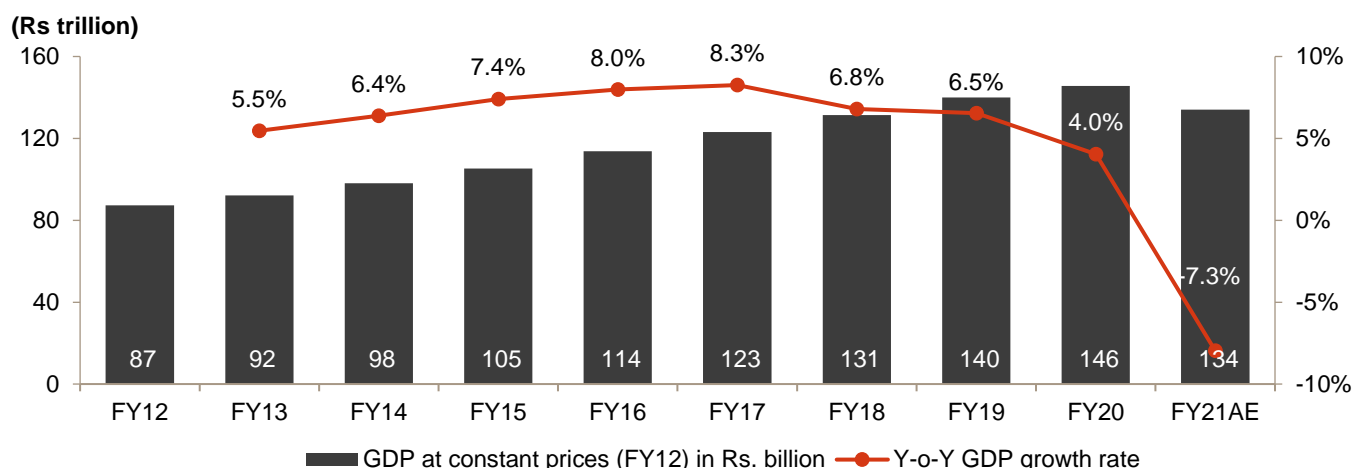
AE: Advance estimates

Source: Second advance estimates of national income 2020-21, Central Statistics Office (CSO), MoSPI, CRISIL Research

Gross value added (GVA) at basic prices (constant 2011-12 prices)

Rs trillion	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	CAGR
GVA at basic prices	81.1	85.5	90.6	97.1	104.9	113.3	120.7	128.0	133.0	124.5	4.9%
Y-o-Y growth (%)		5.4%	6.1%	7.2%	8.0%	8.0%	6.6%	6.0%	3.9%	-6.4%	

CAGR is between fiscal 2012 and 2021 Source: CRISIL Research

Economy contracted 7.3% in fiscal 2021

Fiscal 2021 has been a challenging year for the Indian economy, which was already experiencing a slowdown before the pandemic created the 'perfect storm'. Though data suggests there has been some pick-up in recent months, recovery is weak and uneven. GDP contracted 7.3% (in real terms) last fiscal, after growing 4.0% in fiscal

2020. At Rs 135.1 lakh crore last fiscal, India's GDP (in absolute terms) went even below the fiscal 2019 level of Rs 140.0 lakh crore. Also, after contracting in the first half because of the Covid-19 pandemic, the economy rebounded in the second half, growing 0.5% and 1.6% year-on-year in the third and fourth quarters, respectively. While the economy shrank as a whole in fiscal 2021, agriculture and allied activities, and electricity, gas, water supply and other utility services were the outliers, logging positive growth. On the other hand, the contact-intensive trade, hotels, transport and communication sectors, and services related to broadcasting were hit the most and continued to shrink in all the quarters. Construction – a labor-intensive sector – was also severely hit in the first half but rebounded in the second half.

India is getting back on its feet slowly, with divergent growth trends. The scars of the pandemic still continue to run deep for small businesses, the urban poor and most of the services sector. The gains made by the economy in the fourth quarter of fiscal 2021 seem to have fizzled out in the first quarter of fiscal 2022 because of the fierce second wave of Covid-19, leading to localised lockdowns in most states. At the same time, monetary policy has begun normalising, and some tightness in domestic financial conditions is inevitable. Against this backdrop, policy support remains critical, apart from action in the external environment. In fiscal 2021, the policy response to the pandemic focussed more on damage control and measures to support the economy. This fiscal, though, the government is expected to normalise some of the extraordinary or unconventional policy moves, while trying to ensure there is smooth revival in growth. Some of its biggest challenges ahead will be broad-basing growth to the services and labour-intensive manufacturing sectors and ensuring financial conditions stay supportive.

Real GDP growth (% year-on-year)
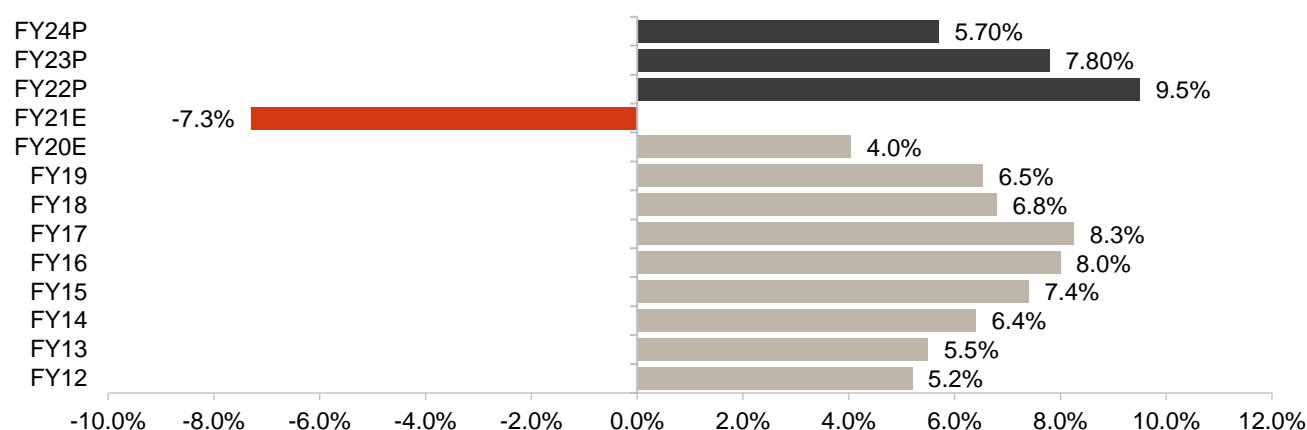
E: Estimated; P: Projected by CRISIL Research; GDP calls updated as of May 2021;
Source: Second advance estimates of national income 2020-21, CSO, MoSPI, CRISIL Research

Key fiscal measures announced by the Centre to deal with the pandemic impact

To mitigate the pandemic's negative impact on the economy, the Central government has announced a Rs 20.9 trillion package, amounting to 10% of the country's nominal GDP. The package is a mix of fiscal and monetary measures (to revive growth in the short term) and reforms (to boost long-term economic prospects). Liquidity support has been a major part of India's response so far. Globally, too, liquidity measures have played a lead role in policy response. The immediate fiscal cost to be borne by the government would be ~Rs 2.6 trillion, or 1.2% of nominal GDP. Further, execution of the government's measures to revive the economy and pace of implementation of the announced reforms are key monitorables.

Fiscal 2022 base case GDP growth to be 9.5%

CRISIL forecasts India's GDP growth to rebound to 9.5% in fiscal 2022 as four drivers converge:

1. **Weak base:** A 7.3% contraction in GDP in fiscal 2021 will provide a statistical push to growth next fiscal.

2. **Global upturns:** Higher global growth in 2021, i.e., world GDP up by 5.0%, advanced economies 4.3%, emerging economies 6.3%, should lift exports.

3. **Covid-19 curve:** India is witnessing the second wave of Covid-19 infections and at the same time learning to live with the virus, with the rollout of vaccines. These should broaden growth this fiscal, especially in the services and unorganised sectors.

4. **Fiscal push:** Stretch in the fiscal glide path and focus of Union Budget 2021-22 on capex are expected to have a multiplier effect on growth.

Risks to GDP growth

1. **A third wave this fiscal:** This could bring further disruption to mobility and economic recovery.

2. **Slower pace of vaccination:** Insufficient pick-up in pace of vaccinations, accentuating risks of a third wave.

3. **Elevated inflation:** Significant cost-push pressures on account of surging international commodity prices and supply disruptions has raised cost of production for manufacturing firms. Pass-through to consumer prices could further pose as a headwind to recovery in demand.

4. **Premature tightening of global monetary policies:** Resurgence of inflation globally could lead major central banks to unwind their extraordinary easy monetary policies sooner than expected. This could hit sentiment, possibly leading to capital outflows from the Indian economy and some tightening in domestic financial conditions.

In next three fiscals, India's growth to be greater than the global GDP

Chart title: (%, y-o-y)

India: FY20 4%, FY21E -7.30%, FY22P 9.50%, FY23P 7.80%, FY24P 5.70%

World: FY20 2.80%, FY21E -3.30%, FY22P 6%, FY23P 4.40%, FY24P 3.40%

Legend: India, World
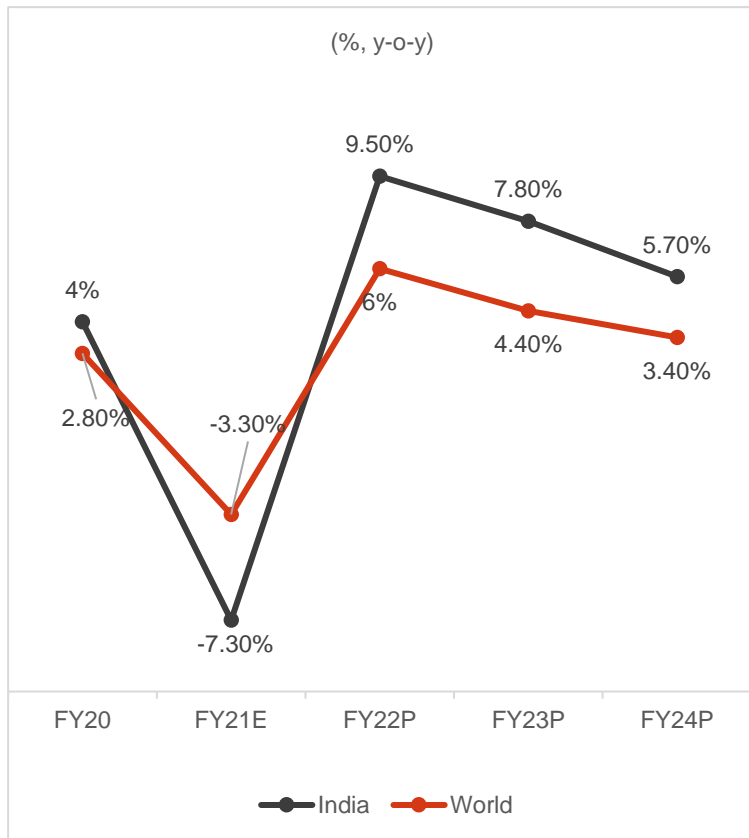
GDP growth to rebound to 9.5% in this fiscal on the back of a very weak base and the rising-global-tide effect.

CRISIL sees India's GDP growth rebounding to 9.5% this fiscal, due to a very weak base, flattening of the Covid curve, rollout of vaccinations, investment-focused government spending, and benefit from the 'rising global tide lifts all boats' effect. Yet, the economy is expected to reach pre-pandemic levels only by the second quarter (Q2) of this fiscal. Services will take longer to recover than manufacturing.

Over fiscals 2023-25, growth is seen averaging at 6.0-6.5% annually. In this scenario, strong growth in GDP is unlikely in the next three fiscals. CRISIL Research estimates the economy will see a permanent loss of ~12% real GDP due to this. Real GDP will catch up to the fiscal 2020 level only by fiscal 2022. Beyond fiscal 2022, India is seen growing faster than the world.

Note: Forecasts for World are for calendar year; FY20=2019; P: Projected; updated as of Jun 2021; India numbers for FY20 and FY21 are based on MOSPI latest GDP estimates and FY22 onwards are CRISIL Research estimates while World GDP growth rates are from IMF world economic outlook update as of April 2021
Source: S&P Global Ratings, CRISIL

Fiscal 2022 is also seen emerging as a story of two halves. The first half will be characterised by a base effect-driven recovery amid the challenge associated with resurgence in Covid-19 infections. But the second half should see a more broad-based growth, as vaccine rollout and herd immunity support sectors that are lagging. These include most of the services sectors, especially contact-based travel, tourism and entertainment. Also, stronger global growth should support India's exports to some extent. Revival will not be uniform across sectors, though. The rural economy has been more resilient than the urban, and manufacturing leads services in recovery. But trade has rebounded faster than the rest of the economy, with exports as well as imports scaling pre-pandemic levels.

The second wave suggests the pandemic remains an ongoing risk. India's second wave has wreaked havoc, with daily cases crossing a staggering 3 lakh in the week through April 25. India's daily infections recorded the highest number of cases in a single day among countries worldwide, and daily deaths crossed the peak of the first wave. Worryingly, their steep trajectory seems to be following that of daily cases. The March 2020 nation-wide lockdown led to a massive migrant exodus. This time, even though there have been no nationwide restrictions, the increasing number of cases have prompted states to announce localised restrictions and curfews in different forms. There has been no restriction on economic activity and the impact on GDP is expected to have limited downside risk. But with increase in cases in May 2021 and depending upon the restrictions, there is downside risk to GDP growth if the spread is not brought under control

Risks to the fiscal 2022 forecast

The base case of 9.5% GDP growth assumes that Covid-19 restrictions will continue and mobility will remain affected in some form or other, at least till August. The pace of economic recovery will also be a function of what the pace of vaccination is in the coming months. We find that countries with over 40% of their population vaccinated are seeing a faster and more broad-based economic recovery. The government plans to vaccinate India's entire adult population (68% of total population) by this December – a tall order even if there are sufficient vaccines available. CRISIL's base case is 70% of the adult population vaccinated by December.

There is one other scenario affecting our GDP forecast.

- Scenario 1: Moderate downside of 8% GDP growth assumes a third and a slower-than-anticipated pace of vaccination.

GDP growth in fiscal 2022%, y-o-y

9.5%	8.0%
Base case / Upside	Moderate downside
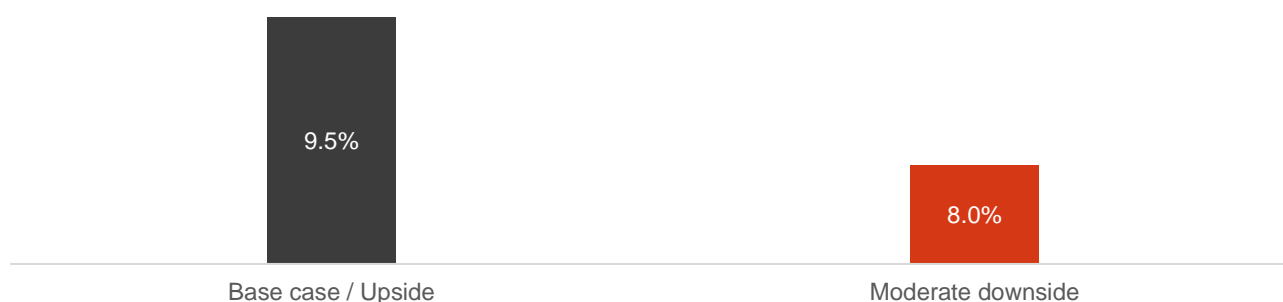
Source: S&P Global ratings, CRISIL Research, Jun 2021

India is expected to regain the top spot as the world's fastest growing economy in 2021

India was one of the fastest-growing economies in 2018 and 2019. In 2020, the GDP of all countries – including that of developed ones such as the US and the UK but except China's – is expected to de-grow, primarily due to the impact of the pandemic. As per provisional estimates from Government of India publications, India's GDP declined 7.3% in 2020(Fiscal year 2021). Further, the GDP growth of all major economies is expected to rebound in 2021 as economic activities resume and also due to the low base of 2020. As per CRISIL research and IMF estimates, among the major economies, India, with a growth rate of ~9.5%(Fiscal year 2022), is expected to be the fastest-growing in 2021, followed by China with 8.1%.

Real GDP growth by geographies

	2017	2018	2019	2020	2021P	2022P
Advanced Economies	**2.5**	2.2	**1.6**	**–4.6**	**5.6**	**4.4**
United States	2.3	3.0	2.2	–3.5	7.0	4.9
Euro Area	2.6	1.8	1.3	–6.5	4.6	4.3
Japan	2.2	0.3	0.3	–4.7	2.8	3.0
United Kingdom	1.2	1.3	1.4	**–9.8**	7.0	4.8
Emerging Market and Developing Economies	**4.8**	**4.5**	**3.6**	**–2.1**	**6.3**	**5.2**
China	6.9	6.7	5.8	2.3	**8.1**	5.7
India	6.8	6.5	4.0	**–7.3**	**9.5**	**7.8***
ASEAN	5.3	5.3	4.9	–3.4	4.3	6.3
Middle East and Central Asia	2.6	2.1	1.4	–2.6	4.0	3.7
World	**3.8**	**3.5**	**2.8**	**–3.2**	**6.0**	**4.9**

P: Projection as per IMF update

-- Numbers for India for year 2021 and 2022 are as per CRISIL research forecast. IMF forecast for CY20:-7.3% and CY21:9.5%,CY22:8.5%.

For year 2020 provisional estimates are used as per government of India publications.

Emerging Asia comprises the ASEAN-5 (Indonesia, Malaysia, Philippines, Thailand, Vietnam) economies, China, and India.

Source: IMF economic database, World Bank national accounts data and OECD national accounts data, CRISIL Research

Trend of real GDP growth rate (%) for major economies (2015-21P)
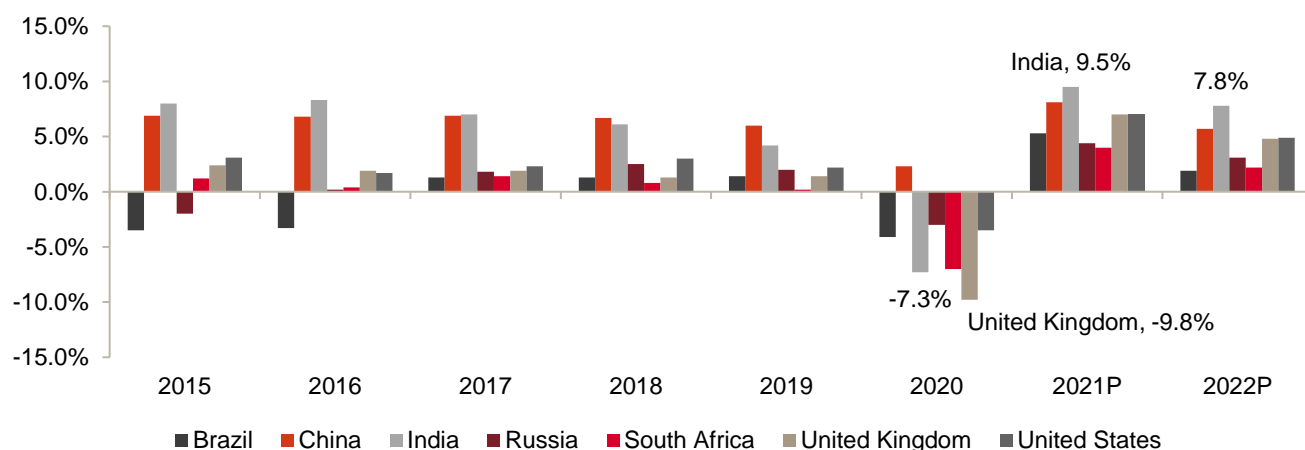
Note: Data for India represents financial year, forecasts for India are CRISIL Research forecasts

Numbers for India for year 2021 and 2022 are as per CRISIL research forecast. IMF forecast for CY20:-7.3% and CY21:9.5%,CY22:8.5%.

Source: IMF, CRISIL Research

1.2 Trend in per capita income levels

India's per capita income rose at healthy pace from fiscals 2012-20; per capita GDP growing at ~2.5x global per capita GDP growth rate

India's per capita income, a broad indicator of living standards, clocked ~5% CAGR from fiscals 2012-20, rising from Rs 63,462 to Rs 94,566. The growth in per capita income was led by better job opportunities, propped up by overall GDP growth. Moreover, population growth has remained fairly stable at ~1% CAGR. India's per capita income declined by 9.1% in FY21 to Rs 85,929 due to disruptions caused by Covid-19.

Table 1: Per capita net national income at constant prices

	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20RE	FY21PE
Per capita net national income (Rs)	63,462	65,538	68,572	72,805	77,659	82,931	87,828	92,085	94,566	85,929
Year-on-year growth (%)	2.1	3.3	4.6	6.2	6.7	6.8	5.9	4.8	2.7	-9.1

RE: Revised estimates   PE: Provisional estimates

Source: Provisional Estimates of Annual National Income, 2019-20, CSO, MoSPI, CRISIL Research

As per the International Monetary Fund (IMF) estimates, global GDP per capita grew at 1.2% CAGR from 2015-20. During the period, the year-on-year per capita GDP growth rate consistently fell to 1.4-2.1%. India's per capita GDP has clocked 3.2% CAGR during the corresponding period, growing ~2.5 times faster than the global per capita GDP. Going ahead, over the next five years until 2025, IMF forecasts India's GDP per capita would continue outpacing the global average, albeit at a slower pace. GDP per capita at the global level is expected to grow at ~5.2% CAGR during the corresponding period; for India it is expected to grow at ~7.8% CAGR.

Table 2: Per-capita GDP – Global and India (current prices) (United States dollar)

	2015	2016	2017	2018	2019	2020P	2021P	2025P	CAGR (2015-20)	CAGR (2020-25)
Per capita GDP – **Global** (current prices)	10,321	10,365	10,881	11,431	11,557	10,954	11,773	14,107	1.2%	5.2%
Per capita GDP – **India** (current prices)	1,606	1,732	1,982	2,006	2,098	1,877	2,031	2,729	3.2%	7.8%

P-Projected

Source: IMF, CRISIL Research

1.3 Review of private final consumption growth in India

Private final consumption expenditure to maintain dominant share in GDP

Private final consumption expenditure (PFCE) at constant prices clocked 6.8% CAGR between fiscals 2012 and 2020, maintaining its dominant share in the GDP pie, at ~57% or Rs 83.3 trillion. Factors contributing to this growth included good monsoons, wage revisions due to the implementation of the Pay Commission's recommendations, benign interest rates, and low inflation. PFCE declined by 9.1% in fiscal 2021 on account of the pandemic, where consumption demand was impacted on account of strict lockdown, employment loss, limited disposable spending and disruption in demand-supply dynamics.

PFCE (at constant prices)
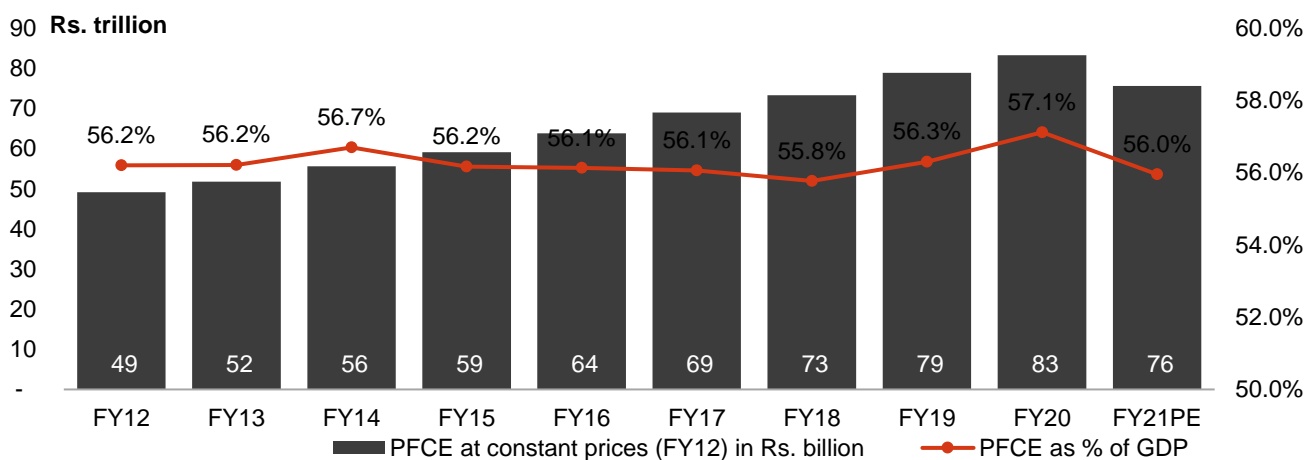
PE: Provisional estimates

Source: Provisional estimates of national income 2020-21, CSO, MoSPI, CRISIL Research

Consumption expenditure to be driven by discretionary items

CRISIL Research estimates basic items constituted 42.7% share of total consumption expenditure of Indian consumers in fiscal 2020, while discretionary items accounted for the remainder 57.3%, up from 53.4% in fiscal 2012, suggesting rising disposable income of households.

Broad split of PFCE consumption into basic and discretionary spending
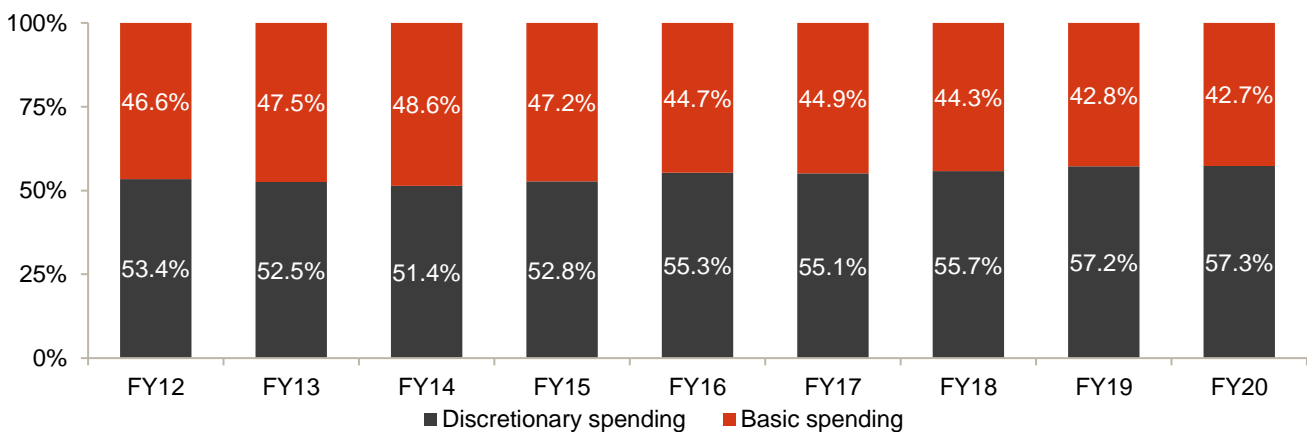
Note: Basic items include food, clothing and housing. Discretionary items include education, healthcare, electricity, water supply, footwear, personal care products, processed foods, alcoholic and non-alcoholic beverages, tobacco, narcotics, fuel and gas, furnishing and household equipment, vehicle and personal transportation, spending on recreation and culture, communication, restaurants and hotels, financial insurance and other financial services, and other items not elsewhere classified (n.e.c.)

Source: MoSPI, CRISIL Research

1.4 Macro-economic growth factors analysis for India

Rising taxpayer base to benefit Indian economy

Number of taxpayers in India

in million
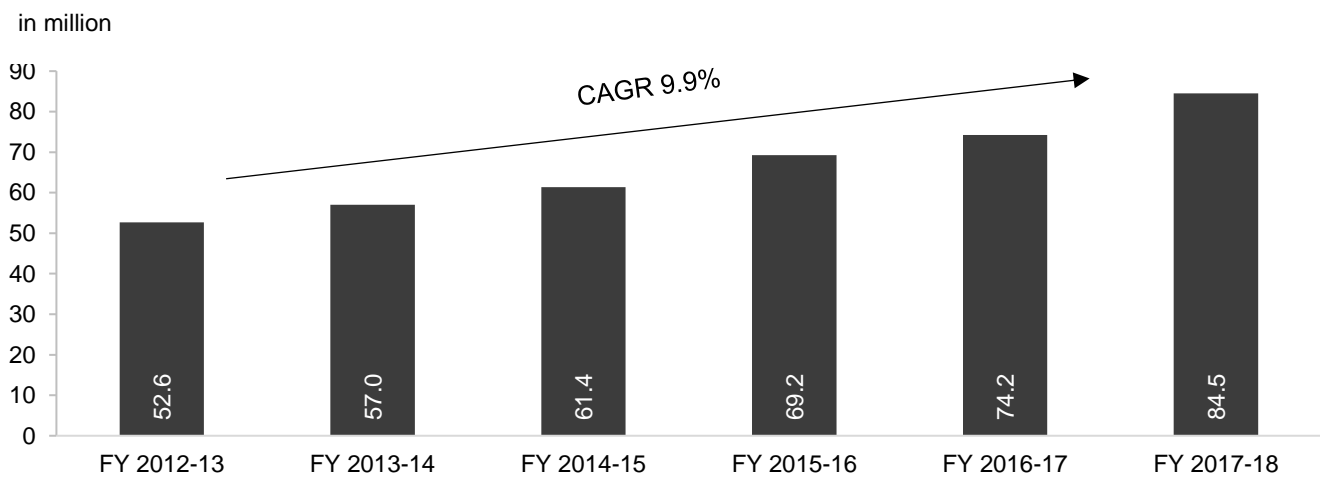
Source: www.incometaxindiaefiling.gov.in, CRISIL Research

In the past few years, there has been a continuous increase in India's taxpayer base. The base has expanded at 9.9% CAGR from fiscals 2013-18 as per the data provided by Income-Tax authorities in India. From the total number of taxpayers, the major contribution of ~95% is from the individuals, the remaining is contributed by AOP: Association of person (0.3%), BOI: Body of individual (0.0%), Company (1.0%), Firm (1.7%), HUF: Hindu undivided family (1.4%), AJP: Artificial juridical person (0.0%) and AOP trust (0.3%). The taxpayers for assessment year 2018-19 have increased by 13.8% from assessment year 2017-18.

IT e-returns Filed

	FY16	FY17	FY18	FY19	FY20	FY21	CAGR
Income-Tax return-wise receipt of e-return (in million)	43.3	52.9	67.5	66.8	67.8	73.9	FY16-21
y-o-y growth		22.0%	27.6%	-1.0%	1.5%	9.0%	11.3%
Number of tax payers	69.2	74.2	84.5	N.A	N.A	N.A	N.A
y-o-y growth		7.2%	13.9%	N.A	N.A	N.A	N.A

N.A – Not available Source: www.incometaxindiaefiling.gov.in, CRISIL Research

Also, the Income-Tax return-wise receipt of the e-return filing count shows there is a 9% increase from fiscal 2020 to fiscal 2021. E-return filing has increased at 3.1% CAGR from fiscals 2018-21. Considering this, it is expected the number of taxpayers would also increase for the recent years.

Registered Users for e-filing

	FY16	FY17	FY18	FY19	FY20	FY21	CAGR
Number of registered users for e-filing as in March (in million)	52.2	62.1	73.6	84.5	92.6	100.5	FY16-21
Growth		19.0%	18.5%	14.8%	9.6%	8.5%	14.0%

Source: www.incometaxindiaefiling.gov.in

There has also been a steady increase in the number of registered users for e-filing from 52.2 million in fiscal 2016 to 100.5 million in fiscal 2021. A steep rise in number of tax filers and eventual increase in tax revenue results in greater spending by the government and a rise in government expenditure. This is often directly linked with the health of macro-economic variables such as infrastructure, employment, defence, etc.

1.5   Working population in India

Increasing labour force participation

Labour force participation rate
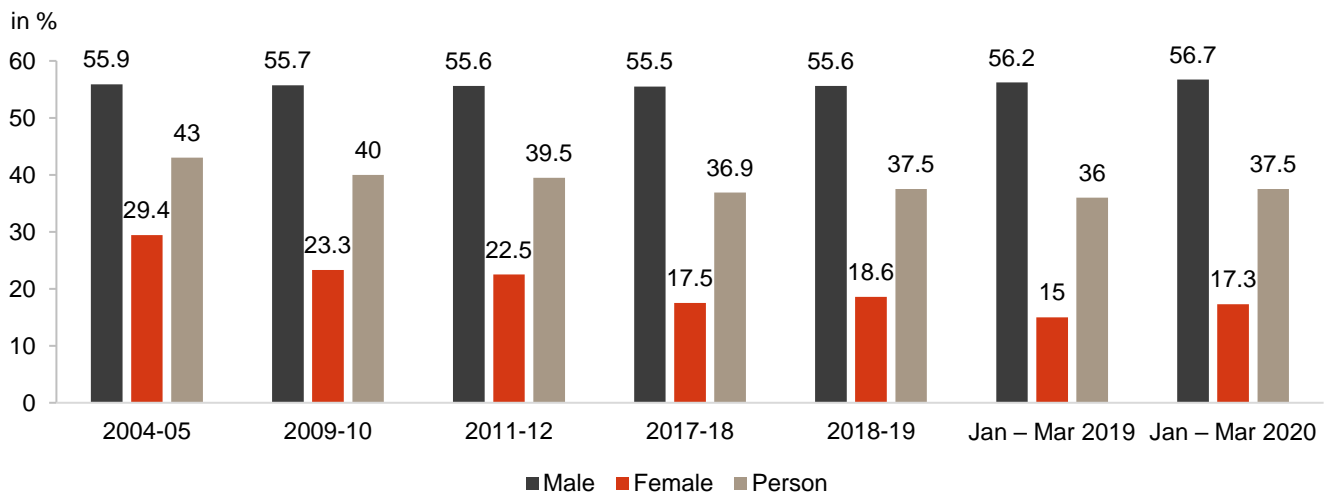
Source: The Ministry of Statistics and Programme Implementation (MoSPI), CRISIL Research

Based on the results of Periodic Labour Force Surveys (PLFS), the labour force participation has increased to 37.5% in January-March 2020 from 36.0% in January-March 2019. As per the PLFS, the size of the labour force in FY 2018-19 was estimated at ~518 million persons: ~488 million employed and ~30 million unemployed. Among the total employed, ~250 million were self-employed, ~122 million were regular wage/ salaried employees and ~115 million casual workers.

Industry-wise estimates on the workforce show the largest, ~215 million people, were employed in agriculture, which is still the largest employer with 42.5% of the workforce. This was followed by other services, where ~64 million people (13.8%) were engaged. Manufacturing and trade, hotels & restaurants each employed ~59 million people, with a nearly 12.1% and 12.6% share, respectively. The construction sector employed ~57 million people, with a share of 12.1%.

Employment in urban areas:

Percentage distribution of persons (of age 15 years and above)	January-March 2019			January-March 2020		
Categories	Male	Female	Person	Male	Female	Person
Self-employed	38.9%	32.8%	37.7%	39.3%	34.8%	38.3%
Regular wage /salaried employees	47.9%	58.2%	50.0%	48.5%	57.5%	50.5%
Casual labour	13.2%	9.1%	12.4%	12.2%	7.7%	11.2%

Source: The Ministry of Statistics and Programme Implementation (MoSPI), CRISIL Research

Among the total employed in urban areas for January-March 2020, 38.3% are self-employed, 50.5% are regular wage/salaried employees and 11.2% are casual workers. Self-employment is still the major source of employment; at the same time, the proportion of casual labour showed a decline. The quarterly PLFS covers only the urban areas and it may be seen that the proportion of males engaged as regular wage/salaried employees has increased during January-March, 2020 from January-March, 2019, while the decline was noticed for both males and females in the category of causal labours.

1.6 Demographic and age group overview of the Indian population

Increasing youth population gives India a demographic advantage

India: Age-wise distribution from 2009 to 2019
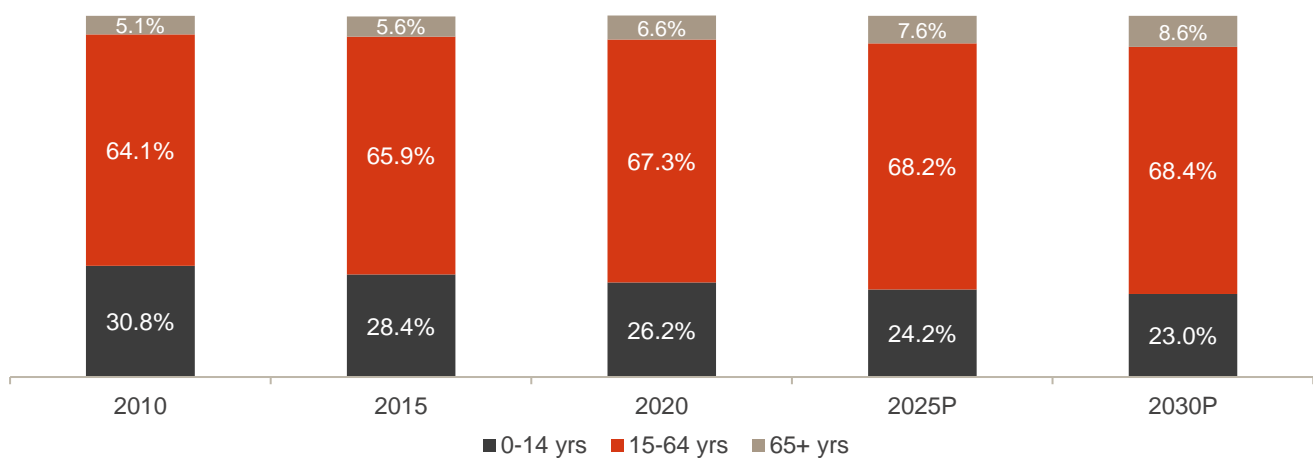
Source: UN population prospects, 2019

India is one of the largest countries in the world and its population is constantly increasing. In 2019, ~ 26.6% of the Indian population fell into the 0-14 year category, 67.0% into the 15-64 age group and 6.4% were over 65 years of age. The median age of India's population has been increasing constantly after a slump in the 1970s, and is expected to increase further over the next few years. However, in international comparison, it is fairly low; in other countries the average inhabitant is about 20 years older.

The life expectancy of Indians has also increased significantly over the past decade, which is an indicator of access to better health care and nutrition.

Indian population's median age to reach 31.4 years by 2030 versus global median age of 33.0

As per the United Nations, the median age of the global population rose to ~30 years in 2015 from ~22 years in 1970, with the more developed countries exhibiting median ages significantly above the global level. Hence, while the median ages in the United States and the United Kingdom were 39.8 years and 42.4 years, respectively, that of India was significantly lower at 28.2 years, indicating a favourable demographic dividend. Even among the BRIC (Brazil, Russia, India and China) countries, India's median age was the lowest, with Brazil, China and Russian recording median ages of 31.3 years, 37.0 years and 38.7 years, respectively.

This trend is expected to continue up to 2030, implying strong potential for increase in income and basic and healthcare spending, as a higher proportion of the population engages in employment activities.

Trend in median ages across key countries

Country	1970	1990	2010	2015	2020P	2030P
Brazil	18.7	22.4	29.0	31.3	33.5	37.7
China	19.3	24.9	35.2	37	38.7	43.0
India	19.4	21.1	25.1	26.7	28.2	31.4
Russian Federation	30.8	33.4	38.0	38.7	39.6	42.6
United Kingdom	34.2	35.8	39.6	40.2	40.8	42.4
United States	28.4	32.8	36.9	37.6	38.3	39.8
World	21.5	24.0	28.5	29.6	30.9	33.0

P: Projected

Source: UN population estimates, CRISIL Research

1.7 Population growth of India

India's population is projected to touch 1.5 billion by 2030

India's population clocked 1.6% CAGR from 2001 to 2011 to reach ~1.2 billion and comprised nearly 246 million households, as per Census 2011.

India's population growth

P: Projected

According to the UN's 'World Urbanization Prospects: The 2018 Revision', India and China, the top two countries in terms of population, accounted for nearly 37% of the world's population in 2015. The report projects India's population to increase at 1% CAGR to 1.5 billion by 2030, making it the world's most populous country, surpassing China (with 1.4 billion people by 2030).

Urbanisation likely to reach 40% by 2030

The share of urban population in India's total population has been rising over the years and printed at ~31% in 2010. People from rural areas move to cities for better job opportunities, education and quality of life. The entire family or only a few individuals (generally an earning member or students) may migrate, while the rest of the family continues to live in the native, rural house. This trend is expected to continue, with the United Nations report projecting that nearly 40% of the country's population will live in urban areas by 2030.

India's urban vs rural population
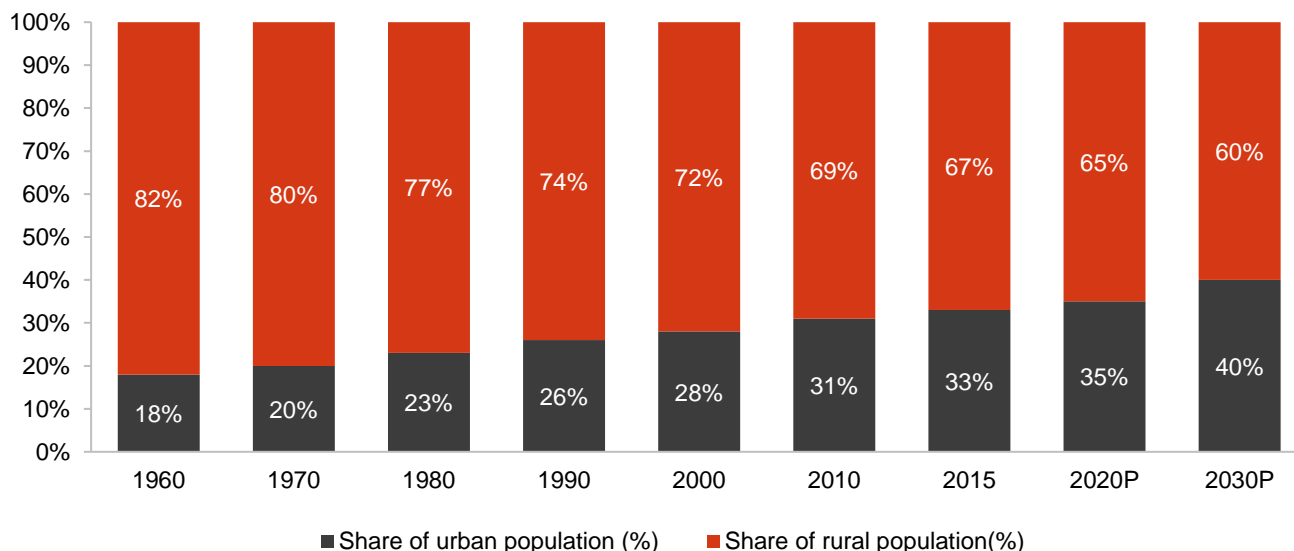
P: Projected
Source: World Urbanization Prospects: The 2018 Revision, United Nations, CRISIL Research

Decline in poverty level indicates rise in middle- and high-income group in India

The World Bank, in its report, 'Global Economic Prospects, January 2019', estimates the number of poor (defined as those living at or below the international poverty line of purchasing power parity of $1.90 per day) in India declined sharply, from 405 million people in 1981 to 175 million in 2015. In % terms, the share of poor in India's total population decreased from 57.4% to ~13.4% over the period, and was estimated at 8.4% in 2018. In 2020, the World Bank projected the absolute number of poor in India reduced to ~77 million people, thus lowering the % share to ~5.5%.

The decline in poverty has been attributed to improvement in macroeconomic parameters, such as growth of the economy, employment rate and income equality, and adoption of employment and other public welfare schemes by the government.

The trend indicates that the middle- and high-income groups in India have grown at a fast clip, from 42.6% in 1981 to 86.6% in 2015, and was estimated to reach 94.5% by 2020. A positive economic outlook along with growth across key employment-generating sectors, such as real estate, infrastructure and automobiles, is expected to have a cascading effect on overall per capita income levels of the population in the medium-to-long term as well. This, in turn, is expected to drive consumption expenditure and basic healthcare and discretionary spending.

Broad split of population into income groups

Share in %

	1981	1990	2010	2015	2018E	2020P
(total population, billion)	0.71	0.87	1.23	1.31	1.35	1.38
Middle- and high-income group	42.6%	52.6%	72.1%	86.6%	91.6%	94.5%
Low-income group	57.4%	47.4%	27.9%	13.4%	8.4%	5.5%

■ Low-income group ■ Middle- and high-income group
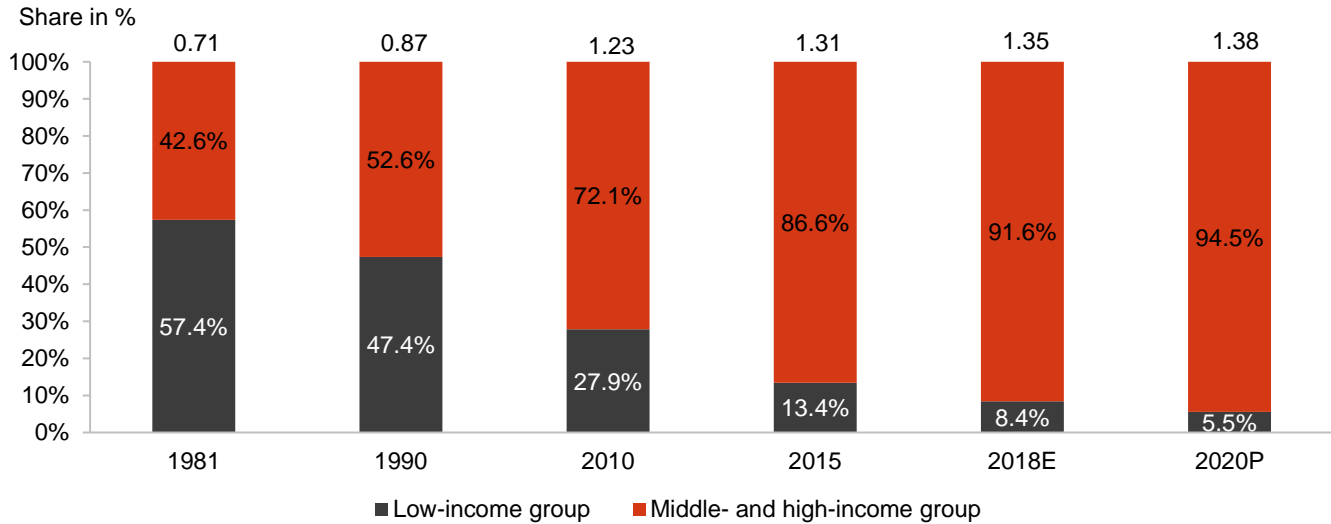
E: Estimated, P: Projected
Notes:
The values bar column indicates total population in billion for the respective years, as per UN population estimates
The World Bank defines poor as those living at or below the international poverty line of purchasing power parity of $1.90 per day. Data for 2018 is estimate, and data for 2020 is a projection and calculated using data from the World Bank (2018l)
The low-income group includes proportion of the population earning less than or equal to $1.90 per day; the middle- and high-income group includes the proportion of the population earning more than $1.90 per day
Source: World Bank, CRISIL Research

1.8 Internet penetration in India

Smartphones drive digital connectivity

Internet and broadband penetration in India has sustained a rapid pace. The number of internet subscribers was 795.2 million at the end of December 2020, with quarterly growth rate of 2.41% from September 2020 to December 2020.

Internet subscribers in India

in million
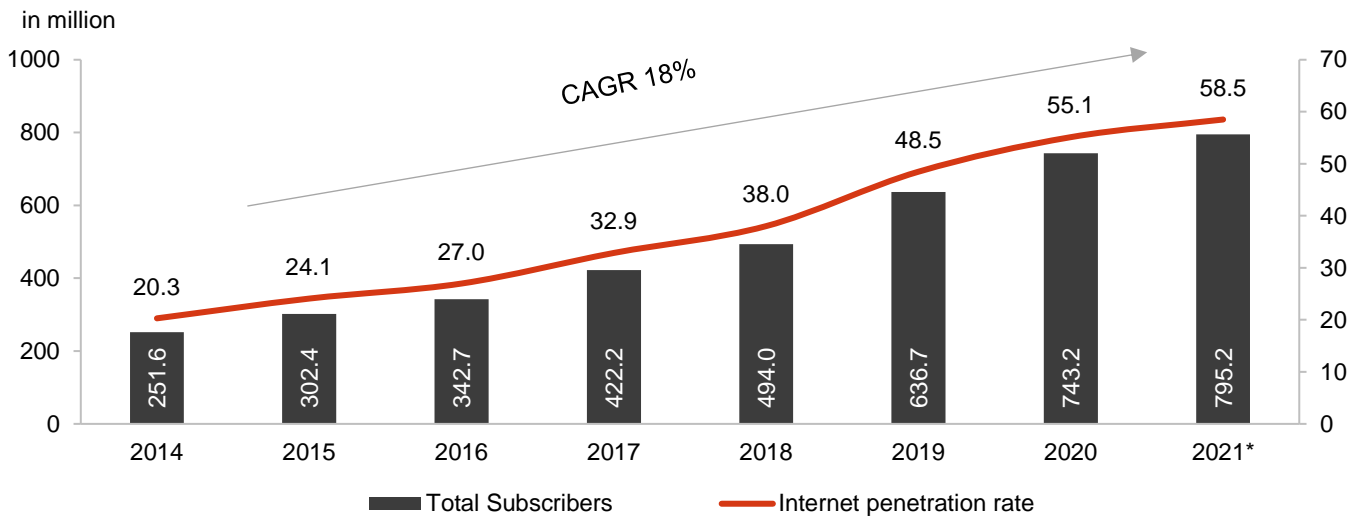
*2021 data for total subscribers is till December 2020
Source: Telecom Regulatory Authority of India, CRISIL Research

Internet penetration Outlook in India
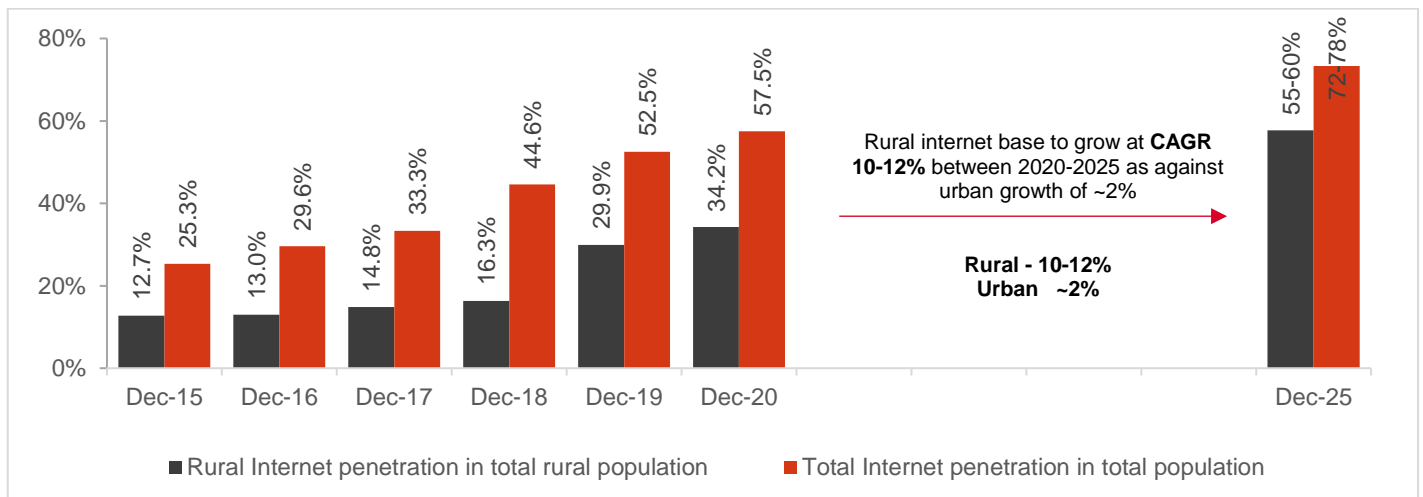
Source: Telecom Authority of India, CRISIL Research

Within the space, wired internet subscribers in India were only 25.5 million users, with the remaining 769.64 million subscribers wireless internet users.

Further, of the total internet subscriber base, broadband subscribers totaled 747.4 million (with quarterly growth of 2.9%) and narrowband users, 47.8 million (with quarterly growth of -4.7%) in India at end-December 2020.

Also, at end-December 2020, of the total internet subscribers, 96.7% were in the mobile wireless category, 3.21%, wired category, and 0.08%, fixed wireless category. This directly correlates to smartphones driving digital connectivity.

In fact, smartphones and lower data charges have ensured a sharp increase in internet penetration (number of internet subscribers per 100 population) - has increased to 58.5 in December 2020 from only 20.3 in fiscal 2014.

The rising number of internet subscribers in the country is a positive sign for the telecom industry. The pandemic is expected to have further fueled the number of internet users in the last quarter (January-March) of fiscal 2021, with the quarterly growth momentum expected to continue in fiscal 2022.

More internet users in the country would mean overall higher revenue for the industry, with companies also able to bank on increasing the average revenue per user (ARPU).

1.9 Financial inclusion in India

Banking the Unbanked

Of India's over 1.3 billion population, over 850 million, or 65% of the population, live in rural India. A large portion of this population is excluded from easy access to financial services.

Accessibility of financial services at affordable rates is a key driver for improving financial inclusion in the country. The larger aim of financial inclusion is to provide deeper penetration of banking services across the country, at affordable terms and conditions.

To this end, the Reserve Bank of India (RBI) has been continuously stimulating the banking sector to extend the banking network, by setting up brick-and-mortar branches, widening the scope of business correspondents, and installing ATMs / White Label AMTs (WLAs) in every tier town.

In fact, over the decade, measures such as opening of no-frills zero balance Jan Dhan accounts, Direct Benefit Transfer (DBT) scheme, issuance of RuPay cards and Kisan Credit Cards, Aadhaar-enabled schemes, and Unified Payment Interface have been implemented by the government.

These efforts are showing results, as can be seen by over 700% increase in the number of basic savings bank deposit accounts of 73.5 million in 2010 to 600.4 million in 2020. There has also been an increase in banking outlets in villages.

Growth in Bank Accounts and Banking Outlets in Villages
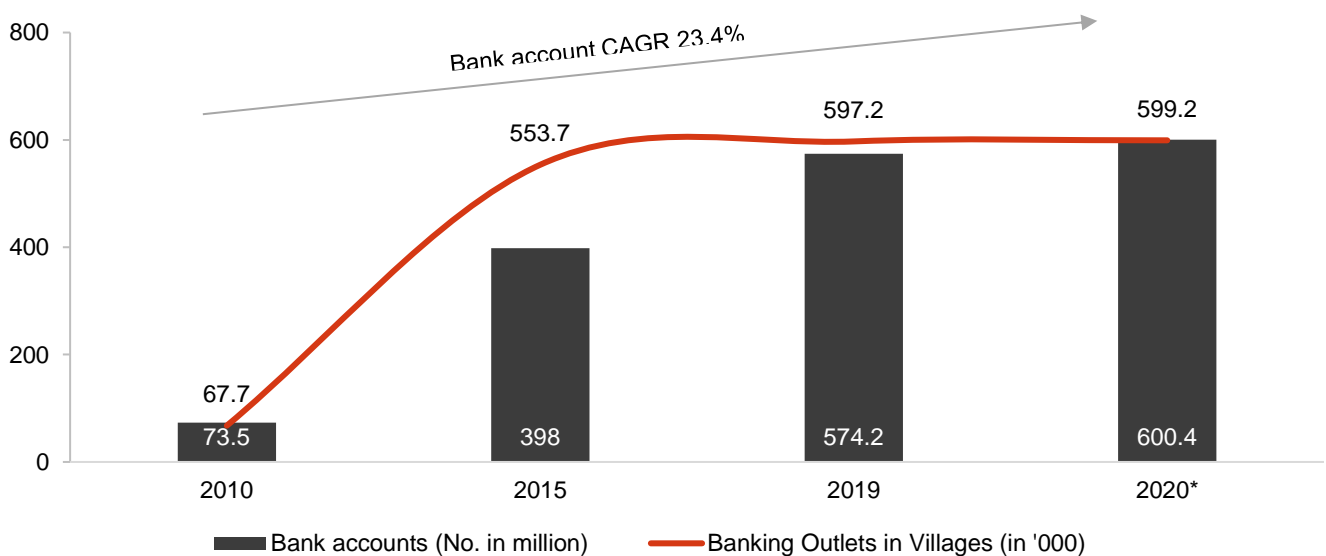
* Provisional data for 2020

Source: RBI: Credit Delivery and Financial Inclusion, CRISIL Research

As of April 28, 2021, the number of bank accounts opened under the government's flagship financial inclusion drive, Pradhan Mantri Jan Dhan Yojana, reached 423.06 million, and deposits in Jan Dhan bank accounts was over Rs. 1432.9 billion. Rural/ semi-urban bank branches contribute ~66%, in terms of total number of accounts.

Status of Pradhan Mantri Jan Dhan Yojana (PMJDY) as on 28th April, 2021 (figures in million)

Bank type	Beneficiaries at rural/ semi-urban bank branches		Beneficiaries at metro bank branches		Total beneficiaries	Deposits in accounts	No. of RuPay debit cards issued to beneficiaries
	No.	% of Total	No.	% of Total			
Public sector banks	205.9	62%	128.8	38%	334.6	11,15,747.6	264.0
Regional rural banks	66.5	88%	9.4	12%	75.9	2,73,227.7	34.4
Private sector banks	6.9	55%	5.6	45%	12.5	44,003.1	11.1
Grand total	279.2	66%	143.8	34%	423.1	14,32,978.4	309.6

Source: Pradhan Mantri Jan Dhan Yojana, CRISIL Research

Rising income is expected to enhance the need for banking services in rural areas, and, therefore, drive further growth of the sector.

The digital payments revolution will continue to trigger a tectonic shift in the way credit is disbursed in India, too. Debit cards have radically replaced credit cards as the preferred payment mode in India, post demonetisation. In April 2021, Unified Payments Interface (UPI) recorded 2,641.06 million transactions totaling Rs 4.93 trillion, representing year-on-year growths of 164% and 227%, respectively.

1.10 Government's outlay on promotion of digital payments

Digital payments to get huge boost in 2021

There has been a manifold increase in digital payments in the recent past. To further boost digital transactions, the finance minister in Union Budget 2021-2022 earmarked Rs 15 billion for a proposed scheme that would provide financial incentive to promote digital mode of payments. Initiatives such as tax audit exemptions for businesses based on digital payments usage and establishing of a financial technology hub were also announced.

Government Spending to Promote Digital Payments
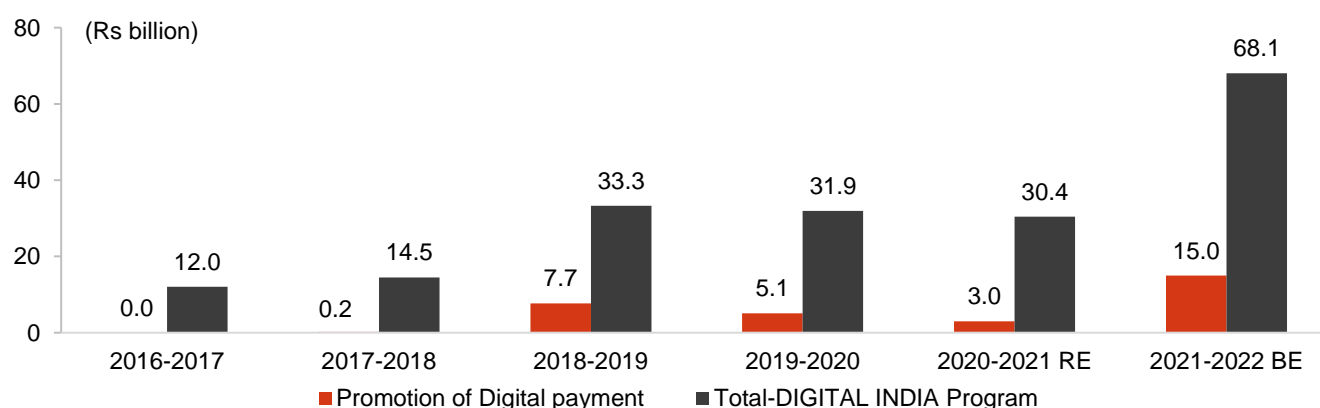
BE: Budget estimate RE: Revised estimate
Source: Union Budget, CRISIL Research

The government has been focusing on growing the digital payments ecosystem over the past few years. Budget announcements, direct budgetary allocations or indirect interventions, such as tax exemptions, caps on pricing structures, cashbacks, and measures to discourage cash-based payments, are some of the steps taken to encourage the expansion of digital payments.

Some of the key areas where the government and the regulator (RBI) have intervened are:

- RBI rationalised the merchant discount rate (MDR) in 2017, based on a merchant's turnover. MDR for debit card payments, were capped at 0.25% for transactions up to Rs 1,000 and 0.5% between Rs 1,000-2,000. Earlier, the MDR cap was 0.75% for transactions up to Rs 2,000 and 1% for over Rs 2,000.

- Zero MDR initiative was announced in Union Budget 2019–20, which has transformed the payments ecosystem. The policy dictated that no MDR would be charged on Unified Payments Interface (UPI) and RuPay payment modes to promote the acceptance of digital payments among merchants.

There have been other budgetary initiatives that have indirectly promoted the digital payments ecosystem:

- Union Budget 2019–20 announced that cash withdrawals exceeding Rs 10 million in a year were to be subjected to a tax deduction of 2% at source in order to discourage cash-based business payments

- In Union Budget 2020–21, the government announced it would increase the turnover threshold for the auditing of micro, small and medium enterprises accounts from Rs 10 million to Rs 50 million if 95% or more of the transactions were digital.

Digital payments by volume
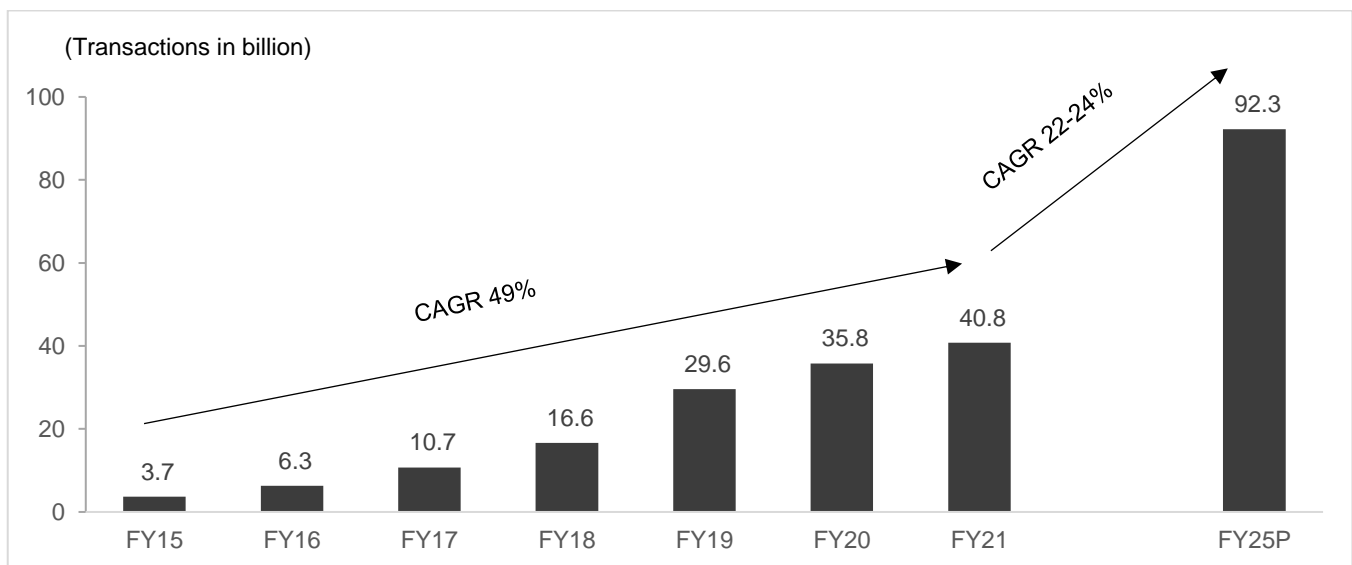
P: Projections, Source: CRISIL Research

Digital payments by value

(Rs Trillion)

FY15	823
FY16	920
FY17	1,122
FY18	1,370
FY19	1,630
FY20	1,623
FY21	1,379
FY25P	3,521

CAGR 15%
CAGR (15)%
CAGR 25-27%
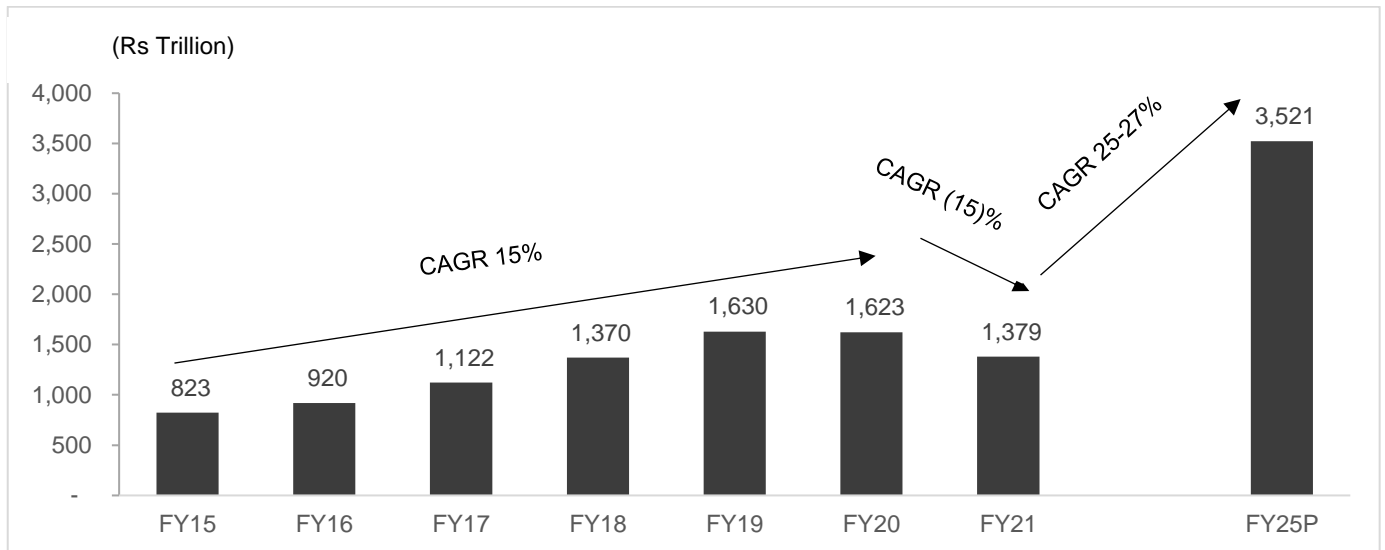
P: Projections, Source: CRISIL Research

1.11 Government expenditure on IT and telecom continues to rise

Government spending on IT and telecom has increased continuously, with telecom comprising bulk of the share, at ~86% in fiscal 2021.

Government expenditure on IT and telecom

(Rs billion)

	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021 RE	2021-2022 BE
Government expenditure on IT	34.4	40.0	62.5	56.5	55.5	97.2
Government expenditure on Telecom	237.9	238.0	206.1	284.0	411.1	587.4
Growth	18%	2%	-3%	27%	37%	47%
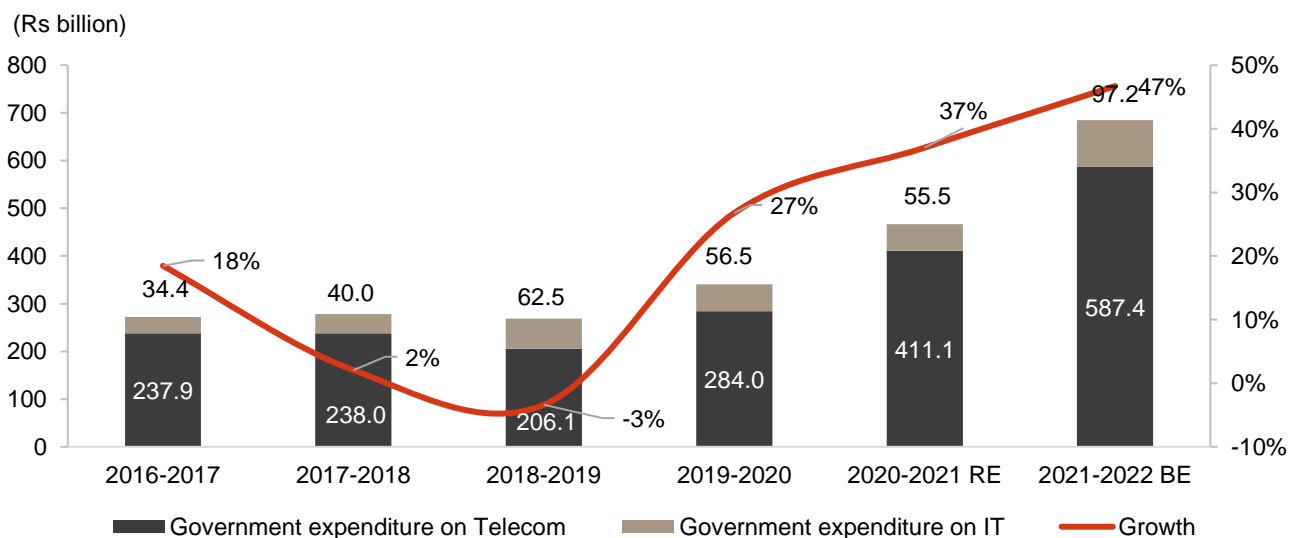
 BE: Budget estimate RE: Revised estimate
Source: Union Budget, CRISIL Research

As can be seen from the chart, from fiscal 2016, the outlay has been high owing to allocation towards BharatNet (a scheme to connect all gram panchayats with broadband) and Optical Fibre Network for the Defence services.

For Budget 2021-2022, out of the total telecommunication capital spending of 587.4 billion, 47% of the allocation was towards supporting public sector undertakings (PSUs; Rs 279.3 billion). This was mainly to provide for a revival plan of Bharat Sanchar Nigam Ltd. and Mahanagar Telephone Nigam Ltd. Also, a large part of the amount

was for pensions. In fact, 26% of the total allocation was towards pension (Rs 153.5 billion) and Rs 92 billion was allocated towards BharatNet.

1.12 Growth in Domestic IT and Telecom sectors led by digitalization and rural demand

Wireless and Wireline subscriber base to grow at 1% and 3% CAGR respectively between FY21-26

CRISIL Research estimates the number of wireless subscribers to touch ~1,215 million by fiscal 2026 growing at a CAGR of 1% from FY21-26. This growth is mainly driven by rural areas, given their low teledensity of 60% as of March 2021. The launch of 5G services, expected in fiscal 2023, will be a key monitorable.

In case of wireline, CRISIL Research expects the number of subscribers to grow by 3% over next five fiscals between FY21 and FY26. The growth can be attributed to by private players expansion of fixed broadband offsetting the decline in wireline subscribers from public sector.

Wireless Subscriber Base trend

million

CAGR 1%

CAGR 2%

FY16	1034
FY20	1158
FY21	1180
FY26F	1215-1225

Wireline Subscriber Base trend

million

CAGR (4)%

CAGR 4%

FY16	25
FY20	20
FY21	20
FY26F	23-24
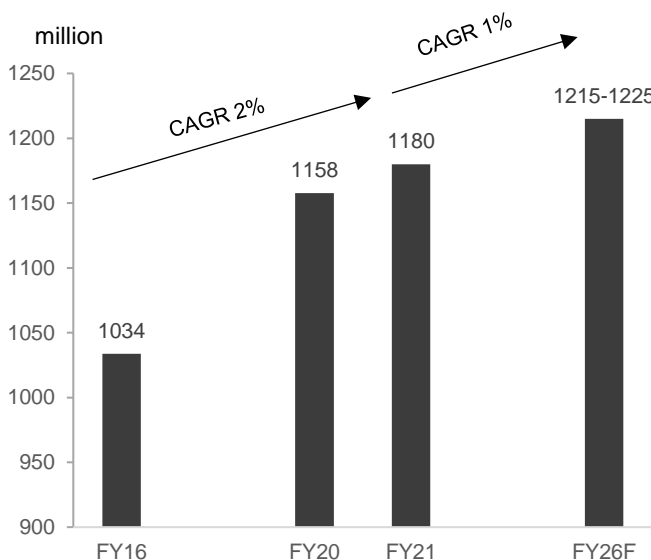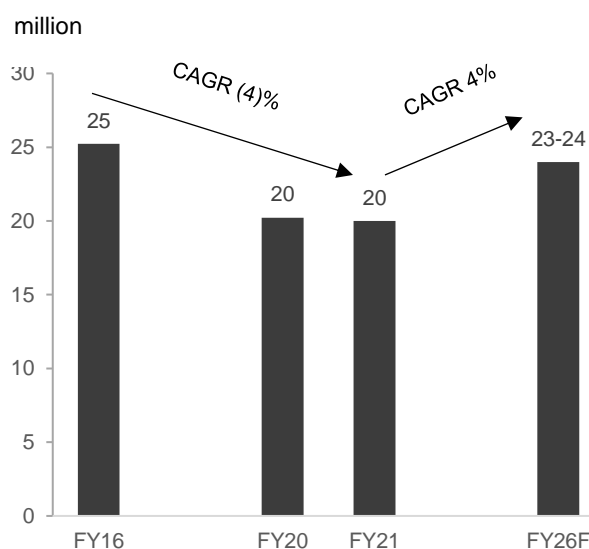
Source: TRAI, CRISIL Research

Domestic IT service and ITes sectors to grow led by digitalisation and e-governance initiatives

Over fiscals 2021-2026, CRISIL Research expects domestic IT services' revenue to log a compounded annual growth rate (CAGR) of 6-8%. The growth will be led by technology and platform upgradation, and e-governance initiatives of the central and state governments. Further, the government and its various agencies are expected to remain the largest contributor to domestic IT revenue.

Revenue of domestic IT-enabled services (ITeS), which encompass a wide range of services that rely on information technology as means of service provisioning and internet as transport medium, are expected to grow at a compound annual growth rate (CAGR) of 6-8% between fiscals 2021 and 2026. Growth in this segment will be

driven by an increase of volumes due to digitization. On sectoral front, volumes are expected to be driven by the banking, financial services and insurance (BFSI) and government segments.

Domestic IT Services revenue trend

Rs. billion
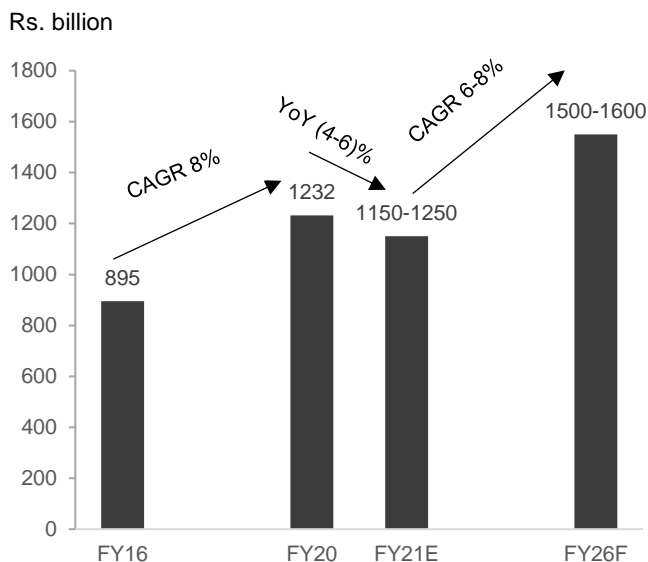
Domestic ITes revenue trend

Rs billion
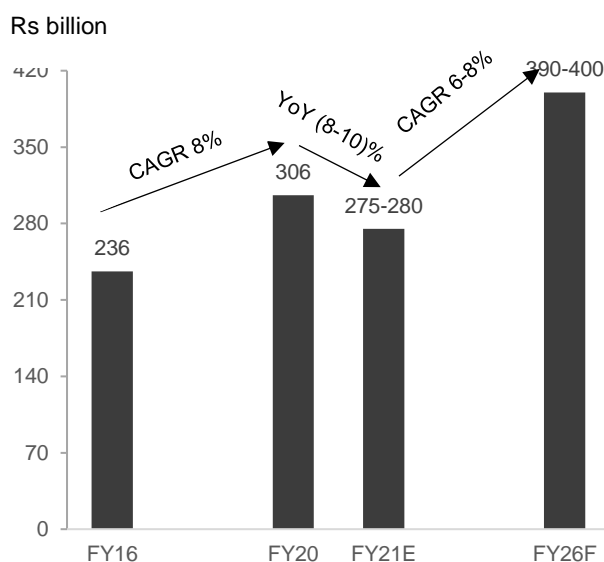
Source: NASSCOM, CRISIL Research

1.13 Digitisation aided by technology to play pivotal role in growth of economy

Technology is expected to play an important role by progressively reducing the cost of reaching out to smaller markets. India has seen a tremendous rise in fintech adoption in the past few years and has the highest fintech adoption rate *glob*ally of 87% which is significantly higher than the global average rate of 64% (Source: InvestIndia). Among many initiatives by the government, the Unified Payments Interface (UPI) is playing a pivotal role towards financial inclusion. It provides a single-click digital interface across all system for smartphones linked to bank accounts and facilitates easy transactions using a simple authentication method. The volume of digital transactions has also seen a surge in the past few years, driven by increased adoption of UPI. Apart from financial services industry, digitisation in other industries like retail will also play an important role in growth of economy.

UPI usage data statistics

As of month	No of banks live on UPI	Volume of transactions (million)	Amount of transactions (Rs billion)	YoY growth (on value basis) in transactions (%)
March 2017	49	9	28	NA
March 2018	91	178	242	764%
March 2019	142	800	1,335	452%
March 2020	148	1,247	2,065	55%
January 2021	207	2,303	4,312	99%

Source: National Payments Corporation of India (NPCI)

1.14 Key structural reforms: Long-term positives for the Indian economy

Financial inclusion

According to the World Bank's Global Findex Database 2017, the global average of adult population with an account (with a bank, financial institution, or mobile money providers) was ~69% in 2017. India's financial inclusion has improved significantly in the past three years, with the adult population with bank accounts rising from 53% (as per Global Findex Database 2014) to 80% in 2017 with concentrated efforts by the government to promote financial inclusion and the proliferation of supporting institutions. That said the rise in the number of bank accounts has not translated into a corresponding increase in the number of transactions and fruitful usage of those accounts. As per the World Bank's Global Findex Database 2017, 40% of the accounts did not make any deposit or withdrawal in the past year (2016), which indicates that although the account penetration has improved, usage of accounts is yet to improve.

The two key initiatives launched by the government to promote financial inclusion are the Pradhan Mantri Jan Dhan Yojana (PMJDY) and Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY). Under the PMJDY, the government's aim is to ensure that every household in India has a bank account which they can access from anywhere and avail of all financial services such as savings and deposit accounts, remittances, credit and insurance affordably. PMJJBY is a one-year life insurance scheme that offers a life cover of Rs 0.2 million at a premium of Rs 330 per annum per member, which can be renewed every year. The government has also launched the Pradhan Mantri Suraksha Bima Yojana (PMSBY), which is an accident insurance policy and offers an accidental death and full disability cover of Rs 0.2 million at a premium of Rs 12 annually. As per the Government of India, more than 100 million people have registered for these two social security schemes.

Pradhan Mantri Jan Dhan Yojana (PMJDY) launched in August 2014, is aimed at ensuring ensure that every household in India has a bank account which they can access from anywhere and avail of all financial services such as savings and deposit accounts, remittances, credit and insurance affordably. PMJDY focuses on household coverage compared with the earlier schemes that focused on coverage of villages. It aims to extend banking facilities to all within a reasonable distance in each sub-service area (consisting of 1,000-1,500 households) across India.

As on January 31, 2020, 417.5 million PMJDY accounts had been opened, of which, 66% were in rural and semi-urban areas, with total deposits of Rupees 1,377 billion.

GST implementation

Introduced on July 1, 2017, the GST is an indirect tax regime that subsumed multiple cascading taxes levied by the central and state governments. Its implementation has spawned structural changes in the supply chain and logistics network in the country. The crux of the GST mechanism is input tax credit, which ensures more players in the supply chain come under the tax ambit. As supply from only registered taxpayers will get input tax credit, businesses and stakeholders will insist on registration of their suppliers and traders, leading to an increase in the share of organised participants. The GST regime has been stabilising fast and is expected to bring more transparency and increase in formalisation, eventually leading to higher economic growth.

PLI scheme to boost manufacturing in the long run

The government has budgeted ~Rs 2 trillion to give incentives to the locally manufacturing units to 13 key sectors. The key sectors likely to get benefit from the scheme include automobiles, pharma, telecom, electronics, food, textile, steel and energy. By incentivising production subject to achieving the desired scale, the scheme aims to

spawn a handful of globally competitive large scale manufacturing units in the identified sectors. Furthermore, the government also hopes to reduce India's dependence on raw material imports from China. The scheme is expected to provide a boost to economic growth over the medium-term and create more employment opportunities as many of these sectors are labour intensive in nature.

Broad Sector	Segment	Budgeted (Rs. Bn)*	
Automobiles	Advance Chemistry Cell (ACC) Battery	181	751
	Automobiles & auto components	570	
Electronics	Mobile manufacturing and specified electronicComponents	409	521
	Electronic/technology products	50	
	White goods (ACs & LED)	62	
Pharma and medical equipment	Critical key starting materials/drug intermediaries and active pharmaceutical ingredients	69	253
	Manufacturing of medical devices.	34	
	Pharmaceuticals drugs	150	
Telecom	Telecom & networking products	122	122
Food	Food products	109	109
Textile	Textile products: MMF segment and technical textiles	107	107
Steel	Speciality steel	63	63
Energy	High efficiency solar PV modules	45	45
Total			**1972**

*Approved financial outlay over a five-year period
Source: Government websites; CRISIL Research

IBC a key long-term structural positive

The Insolvency and Bankruptcy Code (IBC) is a reform that will structurally strengthen the identification and resolution of insolvency in India. The IBC enhances the credit enforcement structure and provides certainty around the timeframes for insolvency resolution. It attempts to simplify legal processes, preserve value for creditors and provide them with greater certainty of outcome. With this reform, the RBI has sent a strong signal to borrowers to adhere to credit discipline and also encourage banks to break resolution deadlocks by introducing definite timelines. IBC will enhance investors' confidence when investing in India. Internationally, recovery rates have improved significantly after the implementation of bankruptcy reforms, as can be seen in the following table:

Country	Year of bankruptcy reform	Pre-reforms		Five years post-reforms	
		Recovery rate (%)	Time (years)	Recovery rate (%)	Time (years)
Brazil	2005	0.2	10.0	17.0	4.0
Russia	2009	28.2	3.8	42.8	2.0
China	2007	31.5	2.4	36.1	1.7
India	2016	26.0	4.3	43.0*	1.6*

Note: * As of 2019
Source: World Bank, CRISIL Research

Reduction in corporate tax rates to boost capital base of financial institutions

On September 20, 2019, the Finance Minister announced Taxation Laws (Amendment) Ordinance 2019 to make certain amendments in the Income Tax Act, 1961, to allow any domestic company an option to pay income tax at the rate of 22%, subject to the condition that they will not avail of any exemption/incentive. The effective tax rate for these companies will be 25.17% inclusive of surcharge and cess. Also, such companies will not be required to pay minimum alternate tax.

A company that does not opt for the concessional tax regime and avails of the tax exemption/incentive will continue to pay tax at the pre-amended rate. However, these companies can opt for concessional tax regime after expiry of their tax holiday/exemption period. After the exercise of the option they will be liable to pay tax at the rate of 22% and the option, once exercised, cannot be subsequently withdrawn. Further, in order to provide relief to companies which continue to avail of exemptions, the rate of minimum alternate tax has been reduced from 18.5% to 15%.

The recent amendments could boost the capital base of the financial institutions and help revive growth in the financial services sector, which has been battling with high NPAs, increasing defaults and liquidity concerns. This move could also revive the private capex cycle leading to credit growth in the economy.

1.15 Household savings to increase

India's slowing economy took a toll on much-needed savings too, with the savings rate touching a 15-year low, and household savings also falling. This has weakened India's macro-economic position which is already hobbled by low investment and rising external borrowing to fund capital needs. Household savings also declined as consumers spent more in purchasing durables and travelling. Indian households contribute to about 60% of the country's savings. But India remains favourable compared with emerging market peers such as Brazil.

According to World Bank, the savings rate, or the proportion of gross domestic savings (GDS) in GDP in the Indian economy has trended down in the past decade. India's GDS peaked at 36.8% of GDP in fiscal 2008 and dipped to 32.0% in fiscal 2009. That was largely on account of a sharp slowdown in public savings, as the government resorted to fiscal stimulus to address the external shock from global financial crisis (GFC).

CRISIL Research expects India to continue being a high savings economy. However, household savings as a percentage of GDP has been sliding since fiscal 2012, with its share in total savings falling significantly from 23.6% in fiscal 2012 to 18.0% in fiscal 2016. The household savings as % of GDP rose to 19.6% in fiscal 2020. CRISIL Research expects the household savings to increase further on account of expected decline in discretionary spending during the pandemic. However, the absolute amount of savings might not increase at the same pace since the GDP growth is expected to be negative in fiscal 2021.

We are also sanguine on savings rate increasing in the medium-term, as households become more focused post the pandemic-induced uncertainty on creating a nest egg for the future.

Savings rate has increased marginally in fiscal 2020
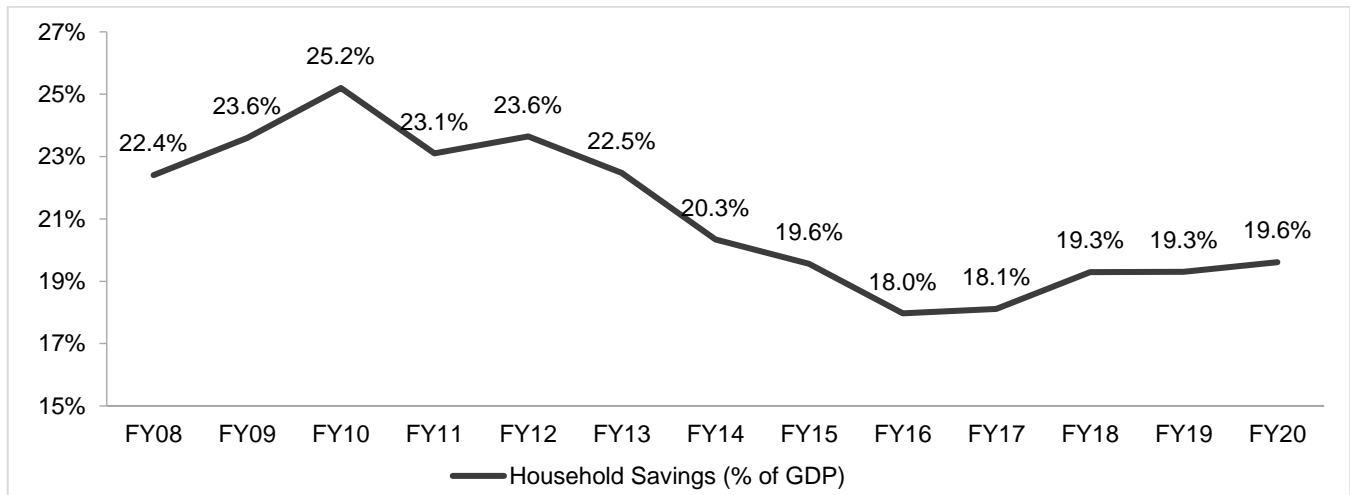
Note: E: Estimated

Source: Ministry of Statistics and Programme Implementation (MOSPI), RBI, CRISIL Research

Gross Domestic Savings rate: India vs other countries (2019)
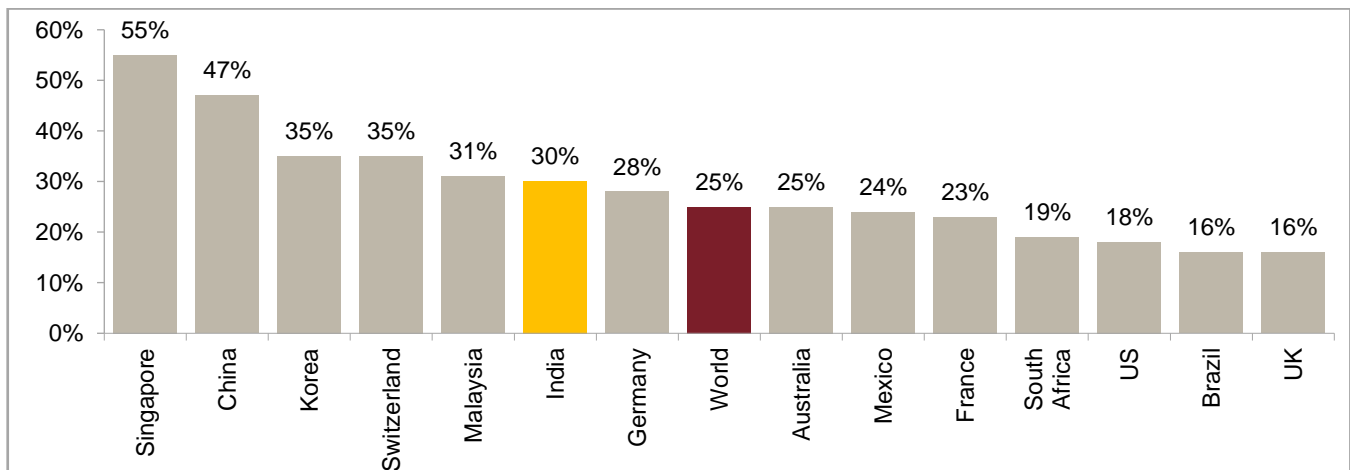
Source: World Bank, Handbook of Statistics on Indian Economy 2018-19, RBI, MOSPI, CRISIL Research

Gross domestic savings trend

Parameters (Rs billion)	Mar-13	Mar-14	Mar-15	Mar-16	Mar-17	Mar-18	Mar-19	Mar-20
GDS	33,692	36,082	40,200	42,823	48,251	54,807	57,770	63,860
GDP (At current prices)	99,440	1,12,335	1,24,680	1,37,719	1,53,917	1,70,900	1,88,870	2,03,510
Percentage of GDP	33.9%	32.1%	32.2%	31.1%	31.3%	32.1%	30.6%	31.4%
Household sector savings (net financial savings, savings in physical assets and in the form of gold and silver ornaments)	22,353	22,853	24,391	24,749	27,871	32,966	36,465	39,908
Percentage of GDP	22.5%	20.3%	19.6%	18.0%	18.1%	19.3%	19.3%	19.6%
Gross financial savings	10,640	11,908	12,572	14,962	16,147	20,564	21,341	22,846
Financial liabilities	3,304	3,587	3,768	3,854	4,686	7,507	7,784	6,641

Parameters (Rs billion)	Mar-13	Mar-14	Mar-15	Mar-16	Mar-17	Mar-18	Mar-19	Mar-20
Savings in physical assets	14,650	14,164	15,131	13,176	15,946	19,442	22,481	23,272
Savings in the form of gold and silver ornaments	367	368	456	465	465	467	427	431

Note: The data is for financial year ending March; Physical assets are those held in physical form, such as real estate, etc.

Source: MOSPI, National Accounts National Accounts Statistics, CRISIL Research

Household savings growth
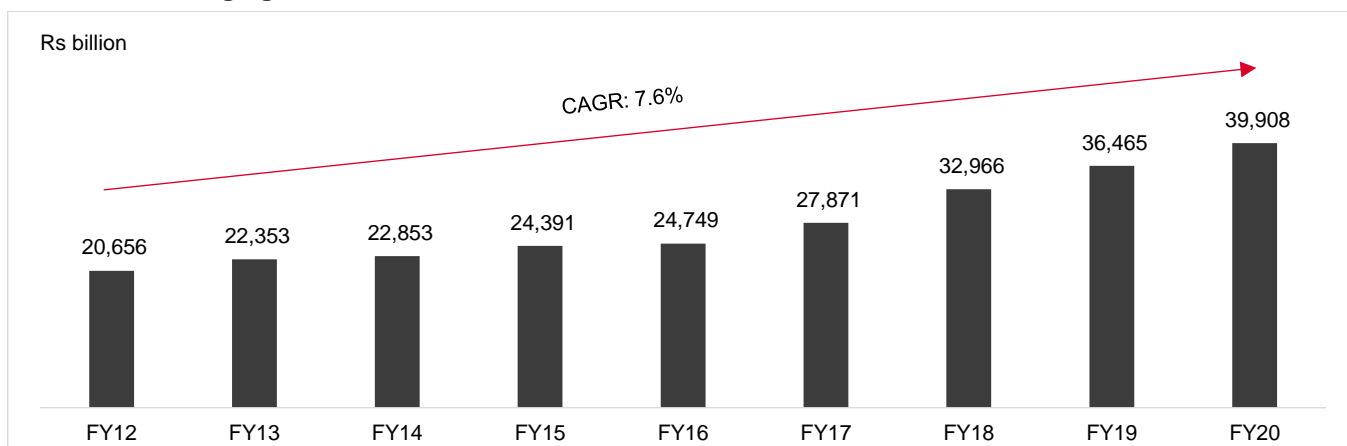
Note: The data is for financial year ending March

Source: MOSPI, CRISIL Research

Share of physical savings to remain stable in the wake of Covid

While households' savings in physical assets has declined to 58% in fiscal 2020 from 67% in fiscal 2012, financial savings has witnessed an uptrend to 41% in fiscal 2020 from 31% in fiscal 2012.

With volatility in the financial markets post Covid and the prevalent lower rates of return in the fixed income products on account of accommodative stance of the central bank, some proportion of savings is expected to continue to remain in the physical assets. In the long-term, with increase in financial literacy, we expect the share of financial assets as a proportion of net household savings to increase over the next five years, thereby boosting investments in assets such as insurance and mutual funds.
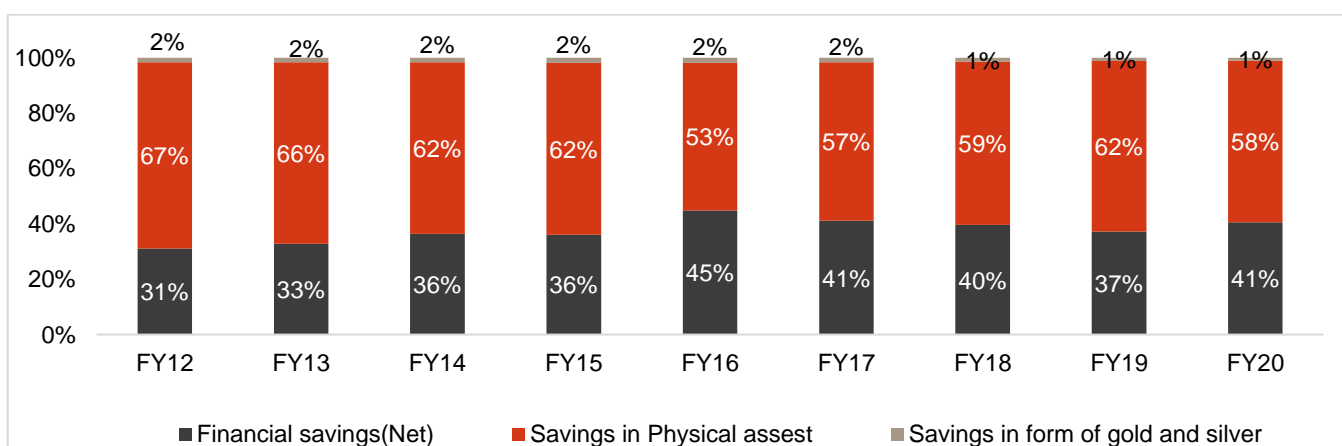
Note: The data is for financial year ending March

Source: Handbook of Statistics on Indian Economy 2018-19, RBI, MOSPI, CRISIL Research

1.16 Digitisation: Catalyst for the next growth cycle

Technology is expected to play a pivotal role in taking the financial sector to the next level of growth, by helping surmount the challenges stemming from India's vast geography, which makes physical footprints in smaller locations commercially unviable. Technology is conducive for India, considering its demographic structure where the median age is less than 30 years. The young population is tech savvy and at ease with using it to conduct the entire gamut of financial transactions. With increasing smartphone penetration and faster data speeds, consumers are now encouraging digitisation as they find it more convenient. Digitisation will help improve efficiency and optimise cost. Players with better mobile and digital platforms will draw more customers and emerge as winners in the long term.

Mobile and internet penetration: Higher mobile penetration, improved connectivity and faster and cheaper data speed, supported by Aadhaar and bank account penetration have led India to shift from being a cash-dominated economy to a digital one.

Data-savvy and younger users to drive adoption of smartphones
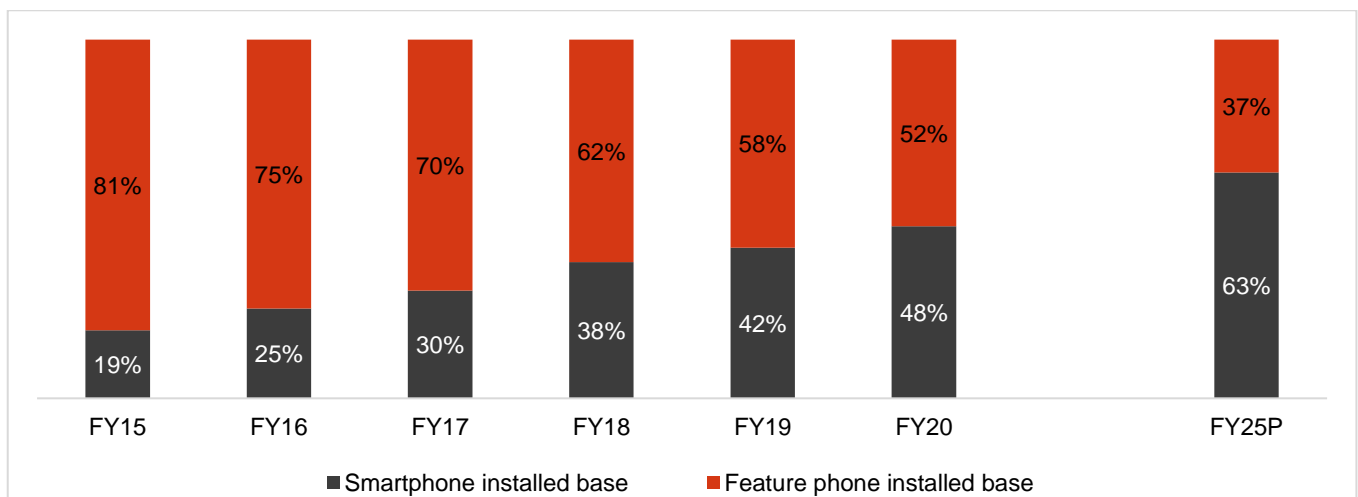
Note: P: Projected
Source: CRISIL Research

Data subscribers as a proportion of wireless subscribers to increase significantly through FY25
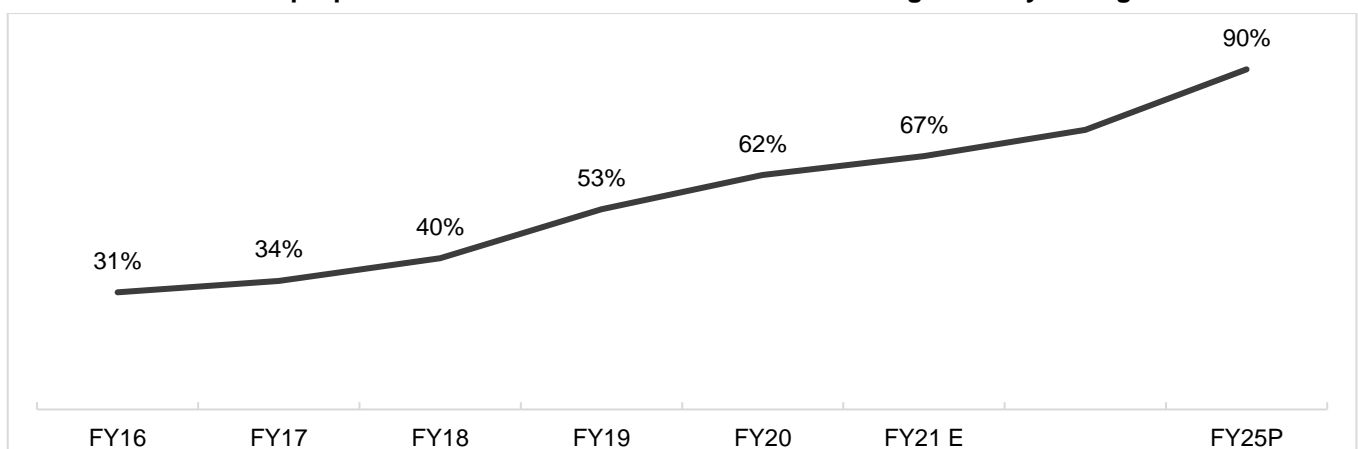
Note: P: Projected
Source: Telecom Regulatory Authority of India (TRAI), CRISIL Research

Rise in 4G penetration and smartphone usage

The digital revolution has paved the way for digital payments. India had 1,157 million wireless subscribers as of March 2020, and the number is growing at a steady pace every year. The reach of mobile network, internet and electricity is also expanding the digital payments footprint to remote areas. This is likely to increase the number of digital payment transactions.

All-India mobile and data subscriber base

Subscriber Type	FY16	FY17	FY18	FY19	FY20	FY21E	FY22P	FY25P
Wireless subscribers (million)	1034	1170	1183	1162	1157	1153	1162	1200
Data subscribers (million)	322	401	473	615	720	772	865	1078
Data subscribers as a proportion of wireless subscribers	31%	34%	40%	53%	62%	67%	74%	90%
4G data subscribers (million)	8	131	287	478	645	712	826	1078
4G data subscribers proportion	2%	33%	61%	78%	90%	92%	95%	100%

Note: P: Projected
Source: TRAI, CRISIL Research

Mobile data consumption in India has grown ~25 times in the past five fiscals at a CAGR of ~90%. The proportion of data subscribers is hence expected to rise to ~90% in fiscal 2025 from ~62% at FY 20. India's 4G data rates are among the lowest in the world. So, a combination of affordable handsets, growing consumer preference for data on the go and affordable data tariffs are set to accelerate the adoption of wireless internet in India, leading to a 4G data subscriber proportion at ~100%.

According to Bank of International Settlements, digital payments and per capita transactions in India are among the lowest compared with similar countries. The government has taken multiple initiatives to give a boost to digitalisation in the country. This includes biometric identification of all Indian citizens through the Aadhaar programme, financial inclusion through the 'Jan Dhan Yojana', launch of Aadhaar-enabled payment systems, and push to online tax filings. UPI, which is based on the immediate payment service or IMPS platform, allows a user to transfer money from one bank account to another bank account instantly, and is seen as the next big leap in digital payments. Recent initiatives aimed at addressing the structural issues around lending requirement including GST filings, government launched UPI 2.0.

Number of non-cash payments transactions per capita, per annum (CY 2019)
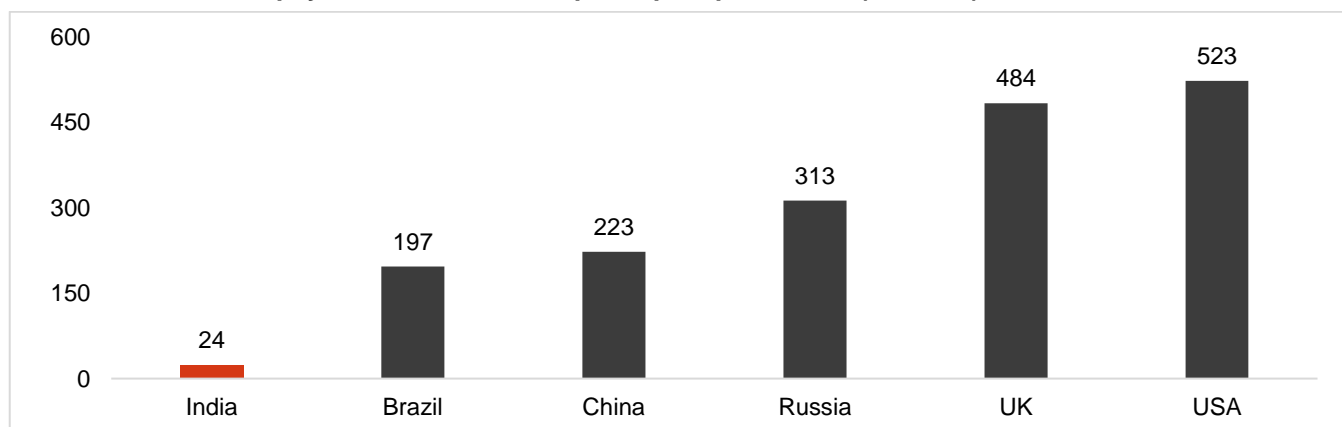
Source: Bank of International Settlements, CRISIL Research

Consumers are increasingly finding transacting through mobile convenient. CRISIL Research expects the share of mobile banking and prepaid payment instruments to increase dramatically over the coming years. In addition, CRISIL Research expects improved data connectivity, low digital payment penetration and proactive government measures to drive digitalisation in the country, transforming it into a cashless economy.

Government initiatives that have driven digital payments in India

The payments space has seen rapid innovation in the past few years, led by government and regulatory initiatives and changing consumer preferences. JAM (Jan Dhan, Aadhaar and Mobile), demonetisation of high-value currency notes in November 2016, implementation of GST and unveiling of the Unified Payments Interface, or UPI, are some of the notable regulatory initiatives that have spurred growth in the space.

The Digital India programme is a flagship programme of the Government of India with a vision to transform India into a digitally empowered society and knowledge economy. "Faceless, Paperless, Cashless" is one of professed aims of Digital India. Promotion of digital payments has been accorded highest priority by the Government of India to bring each and every segment of our country under the formal fold of digital payment services. The Vision is to provide facility of seamless digital payment to all citizens of India in a convenient, easy, affordable, quick and secured manner.

Aadhaar: Aadhaar, which literally means foundation, is a 12-digit unique identity number issued to Indians based on their biometric and demographic data. It is the world's largest biometric ID system, with over 1.2 billion enrolled members as of June 19, 2018. Over 99% of the citizens aged 18 and above are now enrolled.

Data collection for Aadhaar is done by the Unique Identification Authority of India under the Ministry of Electronics and Information Technology. Application programming interfaces (APIs) have been developed using Aadhaar to launch payment systems that allow real-time transactions with just a mobile phone.

It also enables the completion of an electronic KYC (know your customer) and the download of digital signatures. With bank accounts, driving license and mobile phone linked, an Aadhaar card is the most important identification card and has several key benefits.

JAM Trinity - Government on its side introduced JAM Trinity (Jan Dhan, Aadhaar and Mobile) in fiscal 2014 to integrate these infrastructure and digital financial inclusion. With this, the government improved its focus to provide easy access of banking facilities and enhance ability to digitize transactions. This expanded use of digital payments by the government for welfare and served as the biggest launchpad of the ambitious reform of Direct Benefit Transfer (DBT). The government has transferred more than Rs. 3.8 trillion in fiscal 2020 through 426 schemes. As of February 2021, total amount transferred through DBT has reached Rs. 14.2 trillion.

Bar chart showing Number of DBT schemes (red) and Funds transferred in Rs bn (dark) from FY16 to FY21, with a red arrow labeled "CAGR: 47%":

	FY16	FY17	FY18	FY19	FY20	FY21
Number of DBT schemes	59	142	437	440	426	318
Funds transferred (In Rs bn)	619	747	1,909	3,298	3,816	4,316
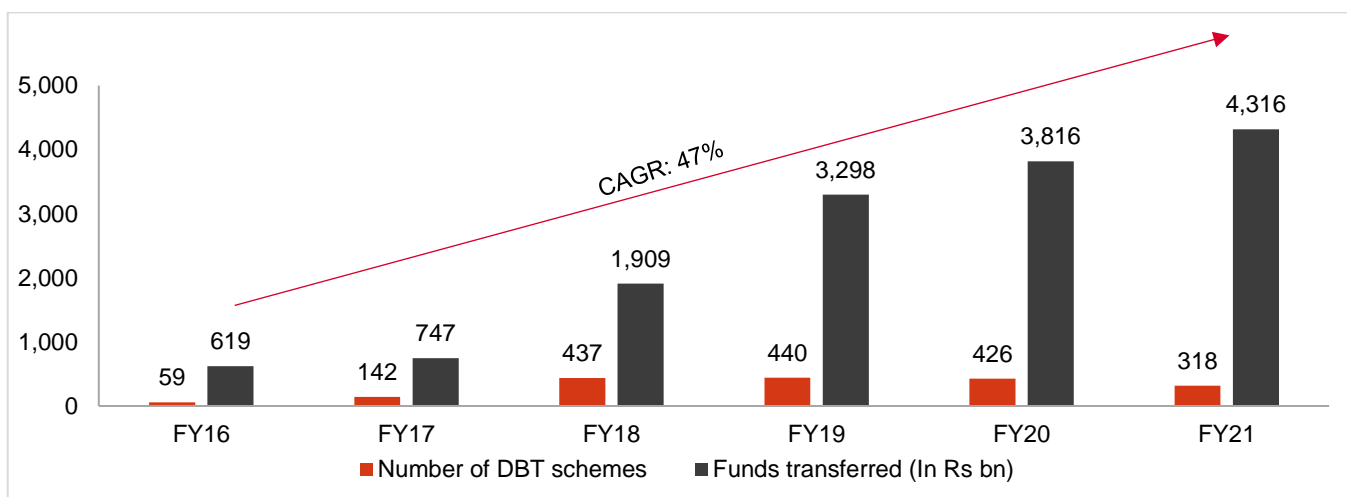
Source: DBT, CRISIL Research

Demonetisation: On November 8, 2016, the Government of India announced the demonetisation of Rs 500 and Rs 1,000 notes in order to curb black money, corruption, counterfeit currency and terror funding. This has led to increase in transparency, formalisation and digitisation in the country. Customer preference has shifted from cost factors to convenience and ease of performing transactions. Several payment processing firms and FinTech companies leveraged demonetisation to penetrate the market. In an effort to expand their market share and attract customers, many players offered loyalty points, instant cashbacks and referral rewards to their users which further fuelled customer acceptance towards digital modes of payments and transactions.

UPI - A crucial contributor to the Indian digital payments market was the introduction of India's real-time payments platform, Unified Payments Interface (UPI). In 2016, National Payments Corporation of India (NPCI), the country's umbrella organization for payments and the central infrastructure that was created by the Reserve Bank of India (RBI) and Indian Banks Association (IBA), introduced a method called UPI – Unified Payments Interface. This collaborative effort was focused on making India a cashless economy and driving digital payment inclusion.

UPI is a payments system that facilitates instant fund transfer between two bank accounts on a mobile platform, without requiring any detail of the beneficiary's bank account. UPI, which is based on the immediate payment service or IMPS platform, allows a user to transfer money from a bank account to another bank account instantly, making it simpler from a customer perspective. It supports both Peer-to-Peer (P2P) and Peer-to-Merchant (P2M) financial transactions, as well as various other value-added non-financial transactions like real-time balance check and transaction history, to name a few.

The ease of usage enabled the UPI system to clock its first 1 billion monthly transactions by November 2019 and double within a year to record 2.07 billion transactions in October 2020. In January 2021, UPI transactions reached 2.3 million with value of transactions touching Rs 4.3 trillion.

Role of RBI – RBI plays a pivotal role in monitoring and supervising the payments system in India. The Payment and Settlement Systems Act, 2007 provides for the regulation and supervision of payment systems in India. The Act empowers RBI to supervise the payment systems in India. Reserve Bank has been continuously setting goals and targets in the form of Payment Systems Vision document, every three years since 2001, presenting the road map for improving the payment systems of our nation. Empowering every Indian with access to a bouquet of e-payment options that is safe, secure, convenient, quick and affordable is Reserve Bank's Payment System's Vision for 2019-2021.

In September 2016, the RBI had proposed setting up of an account aggregator. These account aggregators would provide granular insights into customers' financial assets or their borrowing history with the requisite consent. The four major financial regulators — RBI, Insurance Regulatory and Development Authority (IRDA), Pension Fund Regulatory and Development Authority (PFRDA) and Securities and Exchange Board of India (SEBI) – came together to allow regulated entities under their control to share data with account aggregators after taking user consent. This framework will lead to significant reduction in loan processing time and costs as financial data can be shared digitally.

With the intention of accelerating innovations and to foster competition in the payments sector, RBI in August 2020 allowed private players to set up, manage and operate retail payment systems, officially described as a New Umbrella Entity (NUE). The NUE will offer innovative payment systems to enhance access, customer convenience and safety. Those who receive the license will set-up, manage and operate new payment systems in the retail space, including ATMs, points of sales, remittance services, Aadhaar-based payments. The entity will also operate clearing and settlement systems for banks. It will be responsible for identifying and managing risks and preventing from fraud in its network and monitor retail payment system developments and related issues in the country and internationally. Currently, six consortiums have applied to RBI for NUE license for retail payments.

Role of NPCI - RBI has authorized various Payment System Operators (PSOs) such as NPCI, CCIL, ATM networks, TReDS platform providers, to name a few, to operate payment systems in India. National Payments Corporation of India (NPCI) was established in 2008 by RBI and Indian Banks' Association as an umbrella organization for operating retail payment systems in India. The role of NPCI is to provide infrastructure to the banking system in India for physical and electronic payment systems. NPCI has rolled out a variety of innovative retail payment products viz., IMPS, RuPay card scheme, UPI, NACH, Aadhaar-enabled Payments System (AePS), Aadhaar Payments Bridge System (APBS), NETC, *99# (USSD based) and BBPS. Further, NPCI's alliance with international network partners (Discover Financial Services, Japan Credit Bureau and China Union Pay) has paved the way for international acceptance of RuPay.

Increasing share of digital channels in domestic monetary transactions

The share of different channels in domestic money transfer has changed significantly over the past five years. Banks, for example, are witnessing a change in customer behaviour with fewer customers visiting bank branches for transactions. This change in behaviour was led by demonetisation when cash transactions slowed down, many new accounts were opened and digital banking witnessed a surge in use and continued its growth trajectory. The preference has also shifted from cost factors to convenience and ease of performing transactions, which helps in saving time spent in queues, not disturbing the daily working hours and avoiding any potential monetary loss.

Digital transactions in volume terms

(In bn)

Note: P: Projected; Digital transactions includes RTGS – excluding interbank clearing, ECS, NEFT, IMPS, NACH, cards and prepaid instruments; Non-digital transactions include cheques/paper clearing and ATM transactions. Amount above each bar indicates volume of transactions in the year.
Source: RBI, CRISIL Research

Digital transaction in value terms

(Rs Tn)

Note: P: Projected; Digital transactions includes RTGS – excluding interbank clearing, ECS, NEFT, IMPS, NACH, cards and prepaid instruments; Non-digital transactions include cheques/paper clearing and ATM transactions Amount above each bar indicates value of transactions in the year.
Source: RBI, CRISIL Research

1.17 India at 100 in UN E-Government Development Index

Even after a concerted push by the government, India ranked a low 100 in the 2020 UN E-Government Development Index, which ranks the 193 UN-member states. While the rank is four places lower than the previous survey of 2018, the country had jumped 22 places, to 96, in that survey.

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E-Government Development Index Rank 2020	E-Government Development Index Rank 2014

	2020 Rank		2014 Rank
India	100	India	118
Indonesia	88	Indonesia	106
Viet Nam	86	Thailand	102
South Africa	78	Viet Nam	99
Mexico	61	South Africa	93
Thailand	57	China	70
Brazil	54	Mexico	63
Malaysia	47	Brazil	57
China	45	Malaysia	52
Italy	37	Italy	23
Germany	25	Germany	21
France	19	Denmark	16
Japan	14	Estonia	15
USA	9	UK	8
UK	7	USA	7
Australia		Japan	
Estonia		France	
Denmark		Australia	

Source: UN E-Government Development Index, CRISIL Research

Nevertheless, a lot more needs to be done on parameters of process re-engineering, data privacy and making services more citizen-friendly. Lack of widespread digital literacy in hinterlands poses a challenge as well.

To be sure, the Indian government has been focusing on widening the digital footprint in the country. In 2006, it launched National e-Governance Plan, with 27 mission mode projects focusing on banking, land records or commercial taxes; and later, in 2015, the ambitious Digital India programme. Currently, there are several government initiatives, such as Passport Seva, DigiLocker, online public distribution system, UPI, and Aarogya Setu, which have earned universal accolades. Also, most ministries in the government are now paperless, and decision-making is much faster and more transparent.

Indeed, e-governance has huge potential of bringing much-needed transparency and accountability in the public service delivery mechanisms, and can help lift citizen trust in public institutions.

India has embraced digital payments as well, and as per the RBI, Indians now make over 100 million digital transactions every day — a five-fold jump from 2016.

1.18   India's digital revolution: Bridging the digital divide

The government launched Digital India in July 2015 to transform the country into a knowledge-based economy and digitally-empowered society. The core vision is divided into three broad components – (i) digital infrastructure as a core utility for citizens, (ii) governance and services on demand and (iii) digital empowerment of citizens. The initiative includes plans to develop better digital infrastructure in rural areas and to boost the existing digital economy. Since inception of the programme, the government has been consistently scaling the initiative, increasing the outlay by 23% year-on-year to Rs 39.58 billion for fiscal 2021.

Major Nine Pillars of Digital India

Broadband highways	**E-governance**
• Broadband for all - Rural and urban	• Business process re-engineering
• National Information Infrastructure	• Electronic databases
	• Workflow automation
	• Public grievance redressal

Electronics manufacturing
• Target net zero imports
• Focus areas - big-ticket items

Universal access to phones
• Universal access to mobile connectivity
• Increased network penetration and coverage of gaps of ongoing programme

eKranti – Electronic delivery of services
• e-ducation and e-healthcare
• Technology for planning, security, farmers, financial inclusion, and justice

IT for Jobs
• Train individuals in towns and villages for IT jobs
• Telecom services providers to train rural workforce

Public internet access programme
• CSCs-mad viable, Multifunctional endpoints for service delivery
• Post offices to become multi services centres

Information for all
• Online hosting of information and documents
• Government pro-actively engages through social media
• 2-way communication

Early harvest programmes
• Public wifi hotspots, wifi in all universities
• e-books, biometric attendance

Major milestones and schemes under Digital India

Digital India covers the development of broadband highways, universal access to mobile connectivity, public internet access, e-governance, etc. Major schemes and projects that are part of Digital India are: Aadhaar, Smart Cities Mission, BHIM UPI, RuPay, GSTIn, GeM (Government e-Marketplace), DBT, and DigiLocker.

Infrastructure enhancement

The government has also initiated the ambitious Bharat Net programme to connect 2.5 lakh gram panchayats with fibre-optic network; ~1.4 lakh gram panchayats have been connected, so far. Promoting digital inclusion is also a core component of the initiative, with programmes like Common Service Centres that enable delivery of services through the internet in rural areas. The programme also works to promote employment in rural areas in digital and allied services.

Development of technology startup ecosystem

India is home to 9,300 technology startups, making the country the third-largest tech startup ecosystem in the world. A large number of these startups are in niche areas, such as artificial intelligence (AI), blockchain, analytics, and cybersecurity. In order to create a conducive ecosystem, the Ministry of Electronics and Information Technology (MeitY) has launched programmes such as Technology Incubation and Development of Entrepreneurs, and is promoting Electronics System Design and Manufacturing skill development and setting up of incubation centres that are working to promote indigenous technology.

Global interest in Digital India

The government has also collaborated with major global technology companies to realise its vision. Google is collaborating with the Indian Railways to set-up free Wi-Fi services at 100 major railway stations in India. Microsoft has worked with the Government of India on the Digital India initiative, with the most recent contribution being

'Digital Governance Tech Tour', a national programme that helps deliver critical Artificial Intelligence (AI) and intelligent cloud computing skills to government officials in charge of IT.

Some of the major initiatives recently undertaken across major sectors / departments in India are:

Particulars	Purpose/vision	Benefits	Progress
e-Aadhaar	• Provide virtual identity to Indian residents • Digitally-signed and password-protected electronic copy of Aadhaar	• For delivery of various social welfare programmes • Enables portability and eliminates diversion of Public Distribution System (PDS), reduces manual intervention, faster delivery of LPG cylinders, and facilitates access to digital services of the government	Over 1.24 billion Aadhaar cards have been issued residents of India
FASTag (e-toll)	An electronic toll collection system that employs radio frequency identification technology, and is operated by National Highways Authority of India	• Saves fuel and time • Ease of use • Promotes cashless transaction	As per information provided by the National Payments Corporation of India (NPCI), the total number of FASTag users at end-February 2021 was ~28.4 million.
UPI	Merges multiple bank accounts into a single mobile application (of participating banks), bring several banking features under one application, and for seamless fund routing and merchant payments	• Easy authentication process • National interoperability and real- time money transfer • User-friendly	Currently, there are 220 banks on UPI, with volume of ~2,641 million and transactions totaling ~Rs. 4,936.6 billion in April 2021
DBT	Aimed at transfer of subsidies and cash benefits directly to people through their Aadhaar-seeded bank accounts to reduce leakages and delays, owing to flow of fund across administrative offices till it reaches the beneficiary	• Reforming government delivery system by re-engineering existing process in welfare schemes for simpler and faster flow of information/funds • Ensuring accurate targeting of the beneficiaries • Reduction of fraud	Public Financial Management System recorded highest number of transactions in a single day on March 30, 2020 of 21.9 million, largely driven by DBT payments. For fiscal 2021, total beneficiaries were 119.1 million through a total of 14 schemes, such as PM-KISAN, MGNREGA

Economic impact of Digital India

Digital India can create up to $1 trillion of economic value from the digital economy in 2025, as per MeitY. It is also expected that India's digital economy could generate productivity and output sufficient to support 55-60 million workers in 2025. It can play a key role in employment generation, labour productivity, business development, and revenue generation as well.

According to a World Bank report, 10% growth in mobile and broadband penetration increases per capita GDP by 0.81-1.38% in developing countries. At present, India is the second-largest internet market, with ~795 million broadband users. This suggests tremendous economic opportunity, as the tele-density in rural India is merely 58.85% where over 65% of the population resides. Also the Covid-19 pandemic has led to work-from-home culture, which will lead to increase in subscribers as well as ARPUs.

Social impact of Digital India

Social sectors, such as education, healthcare, and banking, were constrained to reach most citizens because of limitations of illiteracy, ignorance, poverty, insufficient funds, etc. These challenges have resulted in an imbalanced

growth in the case of rural areas and urban areas. Through Digital India, the government aims to bridge this gap, and enhance the livelihood in rural India.

Also, poor literacy rate in India is the result of unavailability of physical infrastructure in rural areas. Digital India will help provide real-time education and partially address the lack of teachers through virtual classrooms. Mobile and internet banking can enhance financial inclusion. Challenges such as poor doctor-patient ratio, high infant mortality rate, etc can be addressed through digital solutions. Digital platforms can also make farmers aware of crop choices, seed varieties, the weather, plant protection solutions, cultivation practices, and market information.

Indeed, Digital India is giving a boost to entrepreneurship and enhancing access to health, education and public utilities. It is revolutionising governance via speedy and transparent delivery of services to citizens, ensuring their participation and empowering them with a conducive environment to connect and grow. Another important attribute of Digital India is digital inclusion with technology that is transformative, affordable and sustainable.

Road ahead

There is no doubt that Digital India has been a success in its first six years of its launch. However, it is imperative that an accelerated focus is placed on certain core components, such as enhancing digital literacy and accessibility, to truly realise the potential of India's digital economy. Though the government has developed state-of-the-art systems and enabling schemes, there is a need to strengthen cybersecurity frameworks and promote privacy of citizens on urgent basis. The Personal Data Protection Bill, 2019 that is under consideration by the government is a step in this direction.

2 Assessment of PAN card issuance in India

2.1 Introduction to PAN card

Protean and UTIITSL offer PAN card-related services on behalf of ITD

Permanent Account Number (PAN) is a ten-digit alphanumeric number issued by the Income Tax Department (ITD) under the provisions of section 139A of the Income Tax Act, 1961. It is issued by the Indian Income Tax Department under the supervision of the Central Board for Direct Taxes (CBDT) and serves as an important proof of identification. It is also issued to foreign nationals (such as investors) and is not acceptable as proof of Indian citizenship. PAN enables the department to identify/ link all transactions of the PAN holder with the department. The PAN verification process helps 'investment advisors' approved by SEBI, the RBI, banks, housing finance companies, insurance companies, mutual funds, depository participants, educational institutions established by regulatory bodies, Central and state government agencies, stock exchanges, commodity exchanges and clearing corporations to verify the authenticity of PAN provided by individuals or entities for financial transactions. These transactions include tax payments, TDS/TCS credits, returns of income, specified transactions, correspondence and so on. The online PAN verification facility has assisted in the development of strong due diligence and compliance mechanism needed for fulfilling regulatory as well as business requirements across the BFSI sector.

The issuance of PAN, its verification, delivery and maintenance works on public-private partnership (PPP) model as it is economic, efficient, and effective. Currently, Protean eGov Technologies Ltd. is one of two companies providing PAN services in India on behalf of the Government of India. The other authorized company is UTI Infrastructure Technology and Services Ltd (UTIITSL). Services offered by the two players include processing of applications, collecting, handling and verifying of personal documents such as proof of identity, age and address, seeking clarification from applicants, printing the card and the letter and then mailing it. Protean has established PAN service centres and TIN facilitation centres at various places in major cities of India. Anyone wishing to obtain PAN can apply offline by submitting the application form along with the related documents and prescribed fees at the PAN application centre. One can also apply for PAN online on the website of Protean eGov Technologies Ltd.

There are two types of PAN applications:

- **Application for allotment of PAN:** This application form should be used when the applicant has never applied for a PAN or does not have PAN allotted to him.

- **Application for new PAN card or/and changes or corrections in PAN data:** Those who have already obtained their PAN and wish to obtain the new PAN card or want to make some changes / corrections in their PAN data, are required to submit their applications to get it updated.

The application details are forwarded to ITD after digitization of the submitted form. In case of application for allotment of PAN, a new PAN is allotted by the ITD. Protean/UTIITSL prints the PAN card after allotment of PAN by the ITD and dispatches it along with an allotment letter to the respective applicant.

In case of a request for new PAN card or/and changes or correction to be made in the PAN data, the application is forwarded to the ITD for updating the database. After confirmation from ITD, a new PAN card is printed and dispatched to the applicant.

Normally, the application is processed and the PAN card is dispatched in two weeks, provided the application is in order in all respects.

2.2 PAN card allotment in India

Total PAN card allotment has gone up 3x in the last eight fiscals

PAN card is mandatory to file tax returns in India. A PAN card is issued to all those people/entities who form the taxpayer base. A taxpayer is an individual or corporation who pay taxes annually on earnings as per the provisions of the Income Tax Act. The Act applies different tax rates depending on the category of taxpayers. It categorises taxpayers as individuals, Hindu undivided family (HUF), association of persons (AOP), body of individuals (BOI), firms, companies, government, local authorities, AOP (trust), and artificial juridical person (AJP). Till date, over 97% of the total allotments have been made to individuals.

Increase in the number of PAN allotments is a reflection of the efforts made by the government to widen the taxpayer base. Increasing emphasis on financial inclusion in the country, widening the usage of PAN cards, expanding the formal economy and overall GDP growth in the nation have led to expansion of the taxpayer base, which, in turn, has increased the number of PAN card allotments in the last decade.

Total allotment of PAN cards in India (in million)
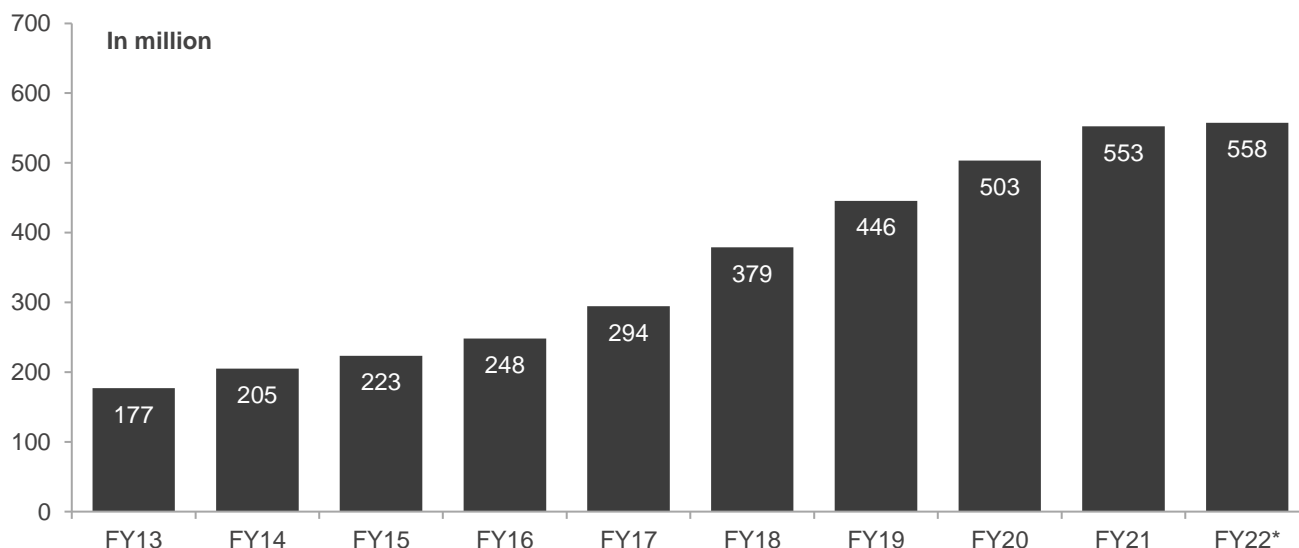
*Only till May 2021
Source: Company documents, CRISIL Research

Annual allotment of PAN cards (in million)
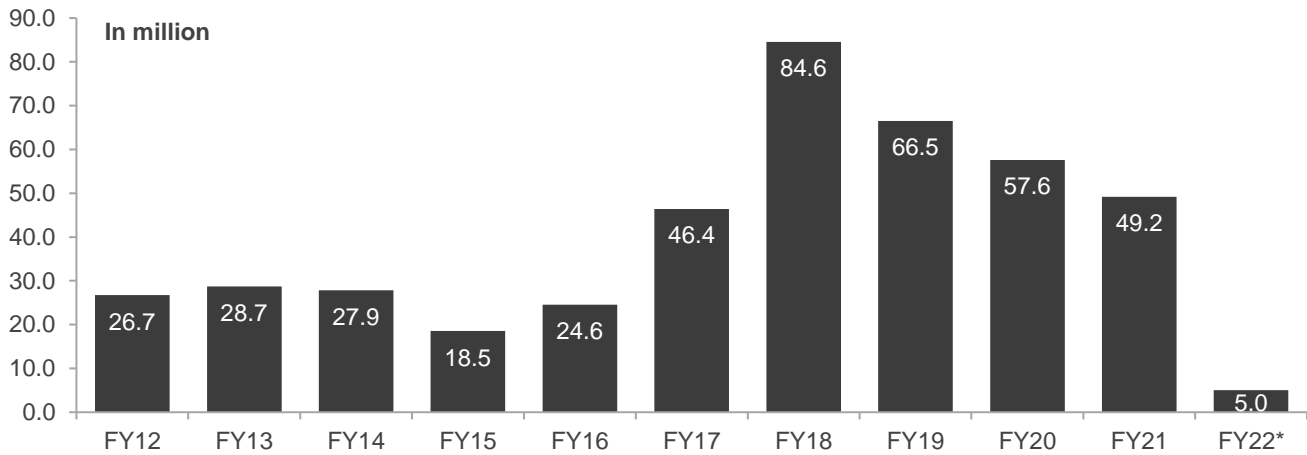
*Only till May 2021
Source: Company documents, CRISIL Research

Protean remains market leader in PAN card issuance, however, instant PAN has been gaining traction since its inception

Protean eGov Technologies Ltd. is a leading PAN service provider in India and had market share of 46.8% in the new PAN card allotments in fiscal 2021. The company processes PAN applications on behalf of the Income Tax Department, GoI. On an average, in fiscal 2021 Protean managed 125,000 PAN applications per day and over 3 million applications per month, which includes new PAN card issuance and PAN card update application. Protean has also incubated and pioneered Aadhaar e-KYC based paperless PAN application facility with issuance of PAN within 2 hours.

A new facility was introduced in Budget 2020 where individuals can get instant PAN through their Aadhaar without having to submit a detailed application form. The facility was introduced to ease the PAN allotment process for individuals. On applying for instant PAN through Income Tax India website, the instant PAN is issued in PDF format with no additional charges. This facility has been developed based on experience from Aadhaar e-KYC based facility developed by Protean and is made available as a free service on e-filing portal of ITD. As the process to get instant PAN is easier and consumes much lesser time than traditional PAN card application processes and is free of cost, the application process for instant PAN is gaining popularity. However, in such cases, PAN applicants use facility made available by Protean for requesting printed physical PAN Card, as same is not available in Instant PAN facility.

Market share of annual allotment of PAN cards
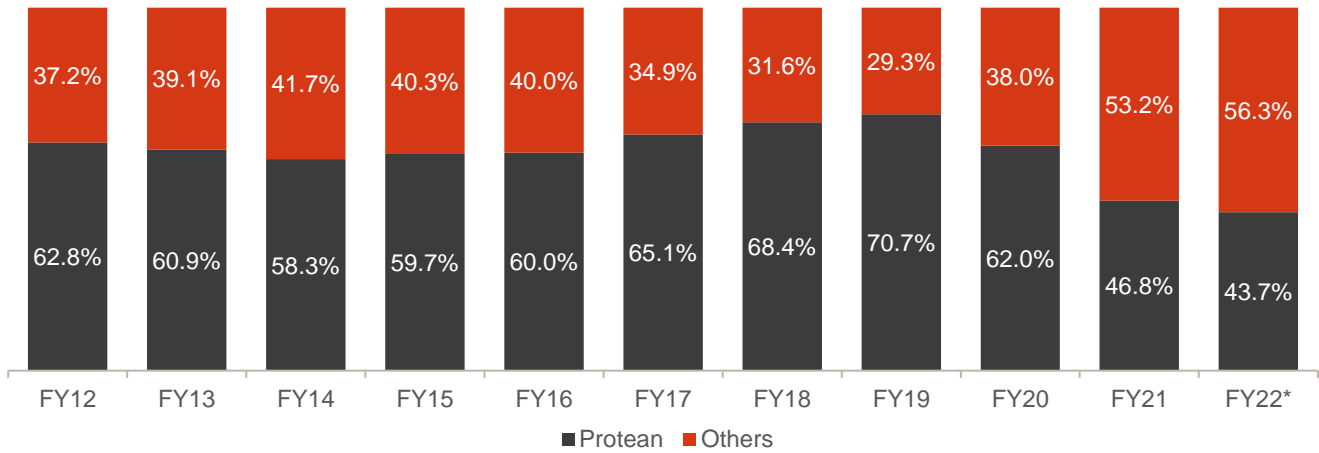
Protean holds more than half of the market share in PAN card allotments

Market share in PAN card allotment from introduction (year 1972) till May 2021
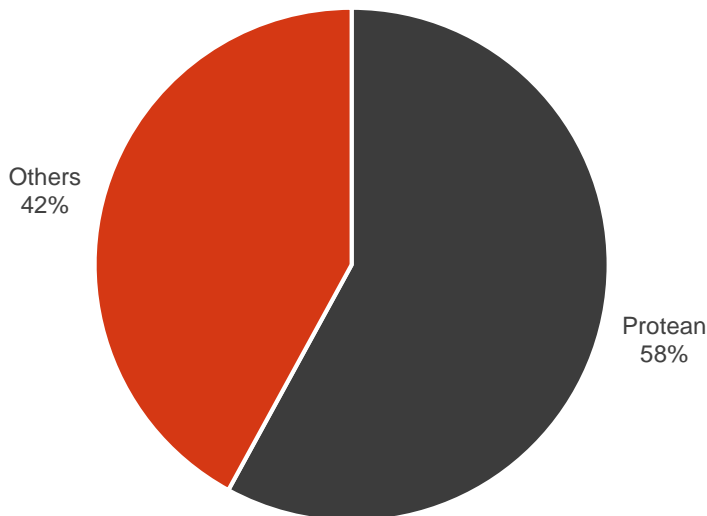
More than half of the individual PAN card allotments fall in the 19-40 years age bracket

Demographically, India is a young country with the median age of its population at ~28 years. Of India's population, more than 60% is in the working age group, which is 19-59 years of age. This is evident from the PAN cards allotted till March 2019. Of the total allotments, 55% have been made to people belonging to the 19-40 years age group. In fact, the 19-50 year age bracket accounts for almost three-quarters of the total PAN cards allotted.

Age-wise allotment of PAN card as of March 2019

Legend:
- <=18 Years
- >18 and <=30
- >30 and <=40
- >40 and <=50
- >50 and <=60
- >60
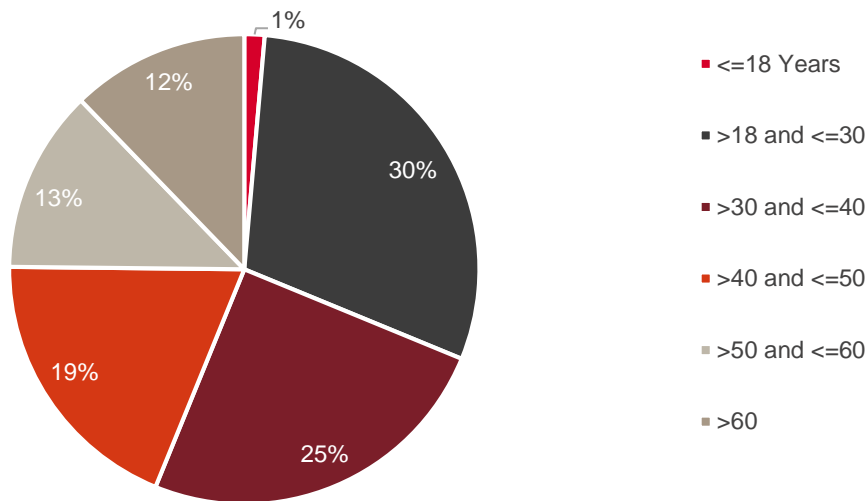
Source: Income Tax Department, CRISIL Research

On average, 50-60 million PAN cards expected to be allotted annually till fiscal 2025

PAN card allotment is expected to be driven by expansion in taxpayer base, growth in financial inclusion, thereby mandating the usage of PAN cards, working age population, GDP growth, and increasing contribution of the formal economy. Considering the past growth trend in the number of allotments and the demographic and economic scenario of India, total PAN card allotment is expected reach 750-800 million by fiscal 2025.

Expected total number of PAN card allotments
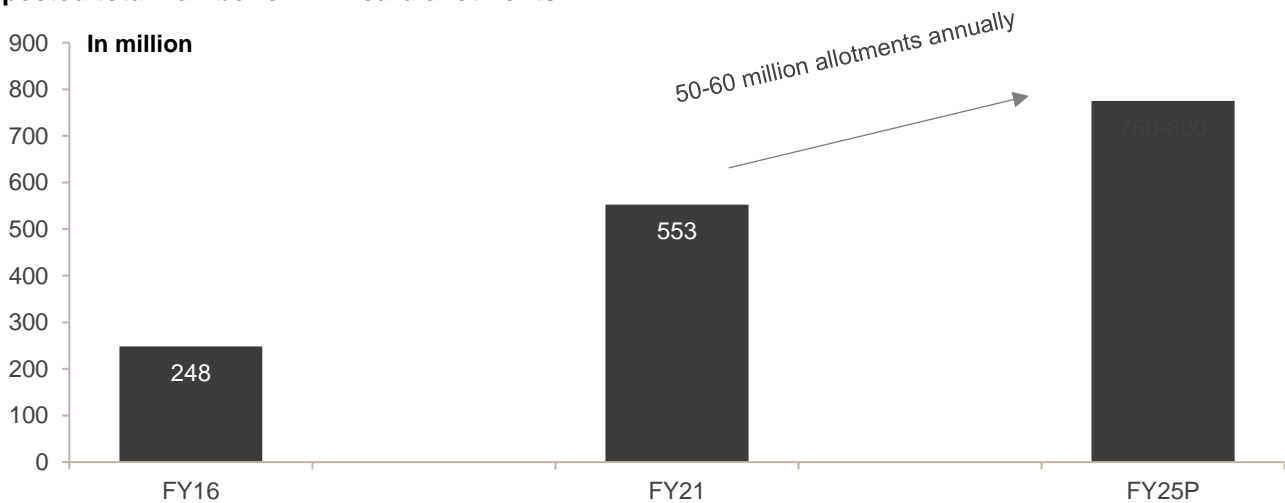
Source: CRISIL Research

2.3 Revenue from PAN card issuance

Application charges differ based on the type of PAN card required

If physical PAN card is required:

While submitting PAN application form, the applicant needs to indicate whether physical PAN card is required. If the applicant opts for physical PAN card, then the physical PAN card is printed and dispatched to the

communication address. The e-PAN card is dispatched in PDF format to the e-mail ID, if mentioned, in the PAN application form.

Charges applicable for dispatch of physical PAN card

Particulars	Fees (excluding GST, in Rs)	Fees (including GST, in Rs)
PAN applications submitted at TIN facilitation centres / PAN centres	91	107
PAN applications submitted online using physical mode (i.e. physical documents forwarded)	91	107
PAN applications submitted online through paperless modes (e-KYC & e-sign / e-sign scan based)	86	101
Request for Reprint of PAN card submitted through separate online link	42	50

Source: CRISIL Research

If physical PAN card is not required:

At the time of submission of the PAN application, the applicant needs to indicate if the physical PAN card is not required. In such cases, providing the email ID is mandatory and the e-PAN card is sent to the applicant's email ID. The physical PAN card will not be dispatched in such cases.

Charges applicable for dispatch of e-PAN card

Particulars	Fees (excluding GST, in Rs)	Fees (including GST, in Rs)
PAN applications submitted at TIN facilitation centres / PAN centres	61	72
PAN applications submitted online using physical mode (i.e. physical documents forwarded)	61	72
PAN applications submitted online through paperless modes (e-KYC and e-sign / e-sign scan based)	56	66

Source: CRISIL Research

2.4 Growth drivers for PAN card issuance

Further growth in financial inclusion schemes would augment PAN card issuance

Financial inclusion refers to a method in which every individual in the society is provided with banking and financial solutions and services irrespective of their earnings. With an aim to provide banking services for the unbanked population in the country, the Government of India started the National Mission for Financial Inclusion (NMFI), namely Pradhan Mantri Jan Dhan Yojana (PMJDY), in 2014. In order to implement this scheme, a digital pipeline has been set up linking the Jan-Dhan account with the Aadhaar card of the account holder. Under PMJDY, a basic savings bank deposit account can be opened at any branch or business correspondent outlet by persons not having any other account.

In addition to this, the Reserve Bank of India (RBI) along with National Bank for Agriculture and Rural Development (NABARD) has undertaken several steps such as issue of Kisan Credit Cards, improving the banking network in remote areas, increasing the number of ATMs, linkage of self-help groups with banks, etc.

Apart from those mentioned above, the Government of India has also introduced other schemes to promote financial inclusion, such as

Stand-Up India scheme

In order to promote economic growth through entrepreneurship and job creation, Government of India on 5th April 2016 has introduced standup India scheme. This scheme enables underserved population of economy such as scheduled castes (SCs), scheduled tribes (STs) and women entrepreneurs to avail a loan through scheduled commercial banks between Rs 1 million to Rs 10 million in setting up a greenfield enterprise across manufacturing, service and trading sectors, thereby enabling them to contribute in economic growth. As per PIB, over 1,14,322 accounts have availed this scheme as of 23rd March 2021 since inception.

Pradhan Mantri Mudra Yojana (PMMY)

PMMY is launched by the Government of India through Micro Units Development & Refinance Agency Ltd. (MUDRA) on April 8, 2015. This scheme provides loans to non-corporate, non-farm small/micro enterprises up to an amount of Rs.1 Million and are classified as mudra loans. These loans can be availed through Commercial Banks, RRBs, Small Finance Banks, MFIs and NBFCs. As of fiscal 2021, number of loans sanctioned under this scheme stand at 51 million growing at CAGR of 8% from FY16.

Number of PMMY loans sanctioned (In Million)
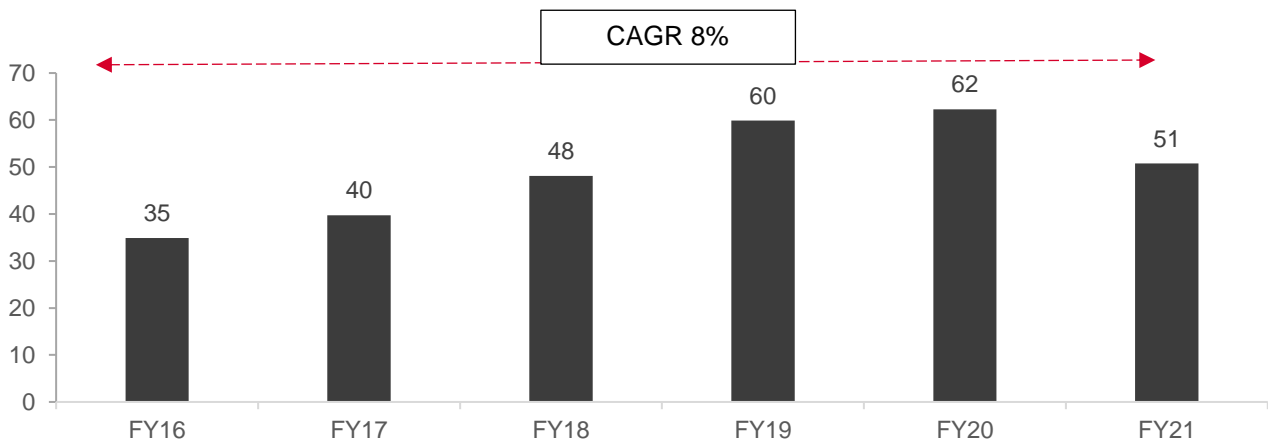
Source: MUDRA, CRISIL Research

Pradhan Mantri Suraksha Bima Yojana (PMSBY)

PMJJBY has been launched by Government of India as of 9th May 2015. The main objective of this scheme is to provide an insurance for underprivileged population of the society in the age group of 18-70 having a bank account at a premium of Rs 12 per annum. Number of enrollments under this scheme have grown at a CAGR of 10% from 35 million in FY18 to 47 million in FY21.

Persons enrolled each year under PMSBY (In Million)

In million

CAGR 10%

FY18	FY19	FY20	FY21
35	20	31	47
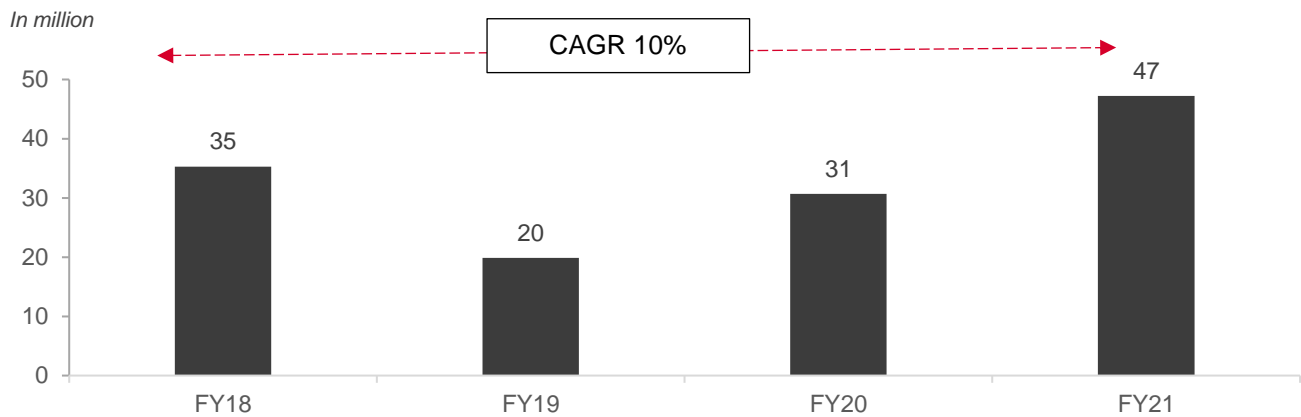
Source: www.jansuraksha.gov.in*, CRISIL Research*

Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY)

PMJJBY has been launched by Government of India as of 9th May 2015. The main objective of this scheme is to provide a renewable life insurance for underprivileged population of the society in the age group of 18-50 with an insurance cover of Rs 0.2 Million at a premium of Rs 330 per annum. Enrollments under this scheme have from FY18 at a CAGR of 14% reaching 33 million enrollments by the end of FY21.

Persons enrolled each year under PMJJBY (In Million)

In million

CAGR 14%

FY18	FY19	FY20	FY21
22	6	10	33
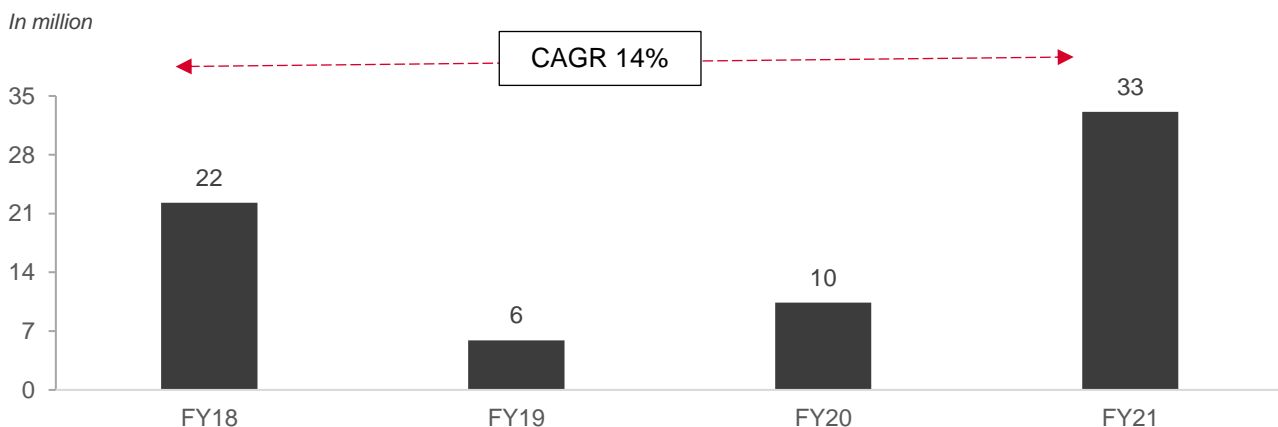
Source: www.jansuraksha.gov.in*, CRISIL Research*

Atal Pension Yojana(APY)

Announced in the union budget 2015-16, APY was launched as of May, 2015 and is administered by Pension Fund Regulatory and Development Authority (PFRDA). The main aim of the scheme is to provide benefits of pension especially to the workers in unorganized sectors. This scheme acts an extension to existing National Pension Scheme (NPS) and a replacement to earlier existing Swavalamban Pension Yojana. All the members can avail the scheme through NPS architecture. Number of subscribers for APY has seen a healthy growth of 62% CAGR from FY16 to FY21.

Number of subscribers for APY scheme (In Million)

In million

Chart showing number of subscribers: FY16: 3, FY17: 5, FY18: 10, FY19: 15, FY20: 21, FY21: 28. CAGR 62%
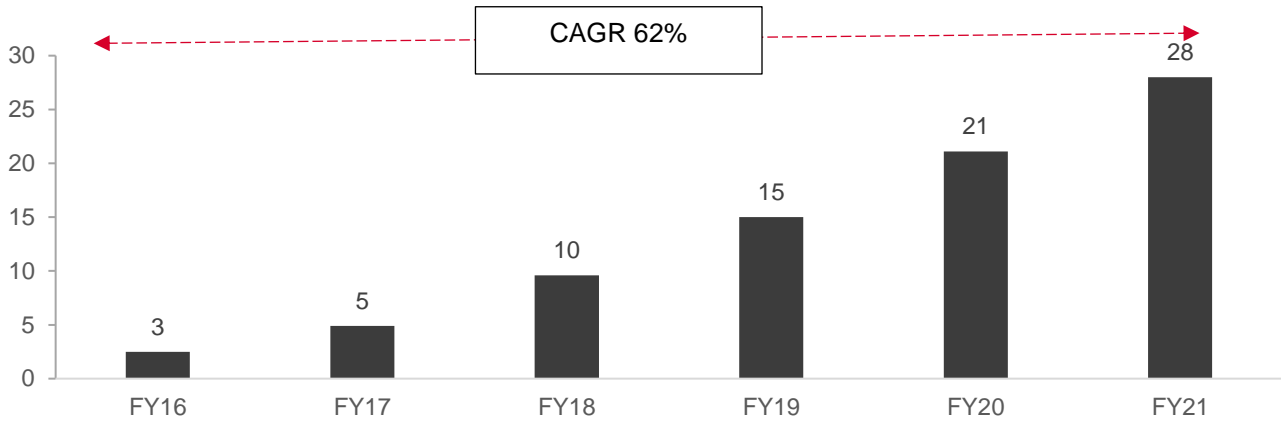
Source: PFRDA, CRISIL Research

With PAN being accepted as of the proofs that need to be submitted to avail the above-mentioned schemes, further penetration of these schemes would also support growth in PAN card applications and services.

Wider taxpayer base would propel growth in PAN card applications and services

PAN has been made mandatory for every individual to transact with the ITD of India. The taxpayer base in India, has seen a continuous rise over the years. It has grown at a CAGR of 9.9% from FY13 to reach 84.5 million in FY18. Of the total taxpayers, individuals account for a significant share of 95%. This growth can be attributed to initiatives taken by Government of India such as demonetisation implemented in November,2016 which has brought in new tax payers into the system leading to increase in number of tax payments.

In addition to this, implementation of Goods and Service Tax (GST) which has led to the increase in compliance and also reduced the rate at which tax has to be paid bolstered the growth in number of tax payers.

Other than above mentioned factors, going forward, schemes introduced by the Government of India, such as PMJDY, PMMY, etc, would further increase the tax-paying population. This, would lead to greater need for issuance of PAN cards to the untapped population in the country.

This also creates an opportunity for other services such as PAN updates arising from the need to change name, address, and re-issuance in case of a lost card. With the government's efforts to widen the tax base and increase transparency by promoting paperless transactions, volumes for PAN cards is expected to grow.

Number of taxpayers in India
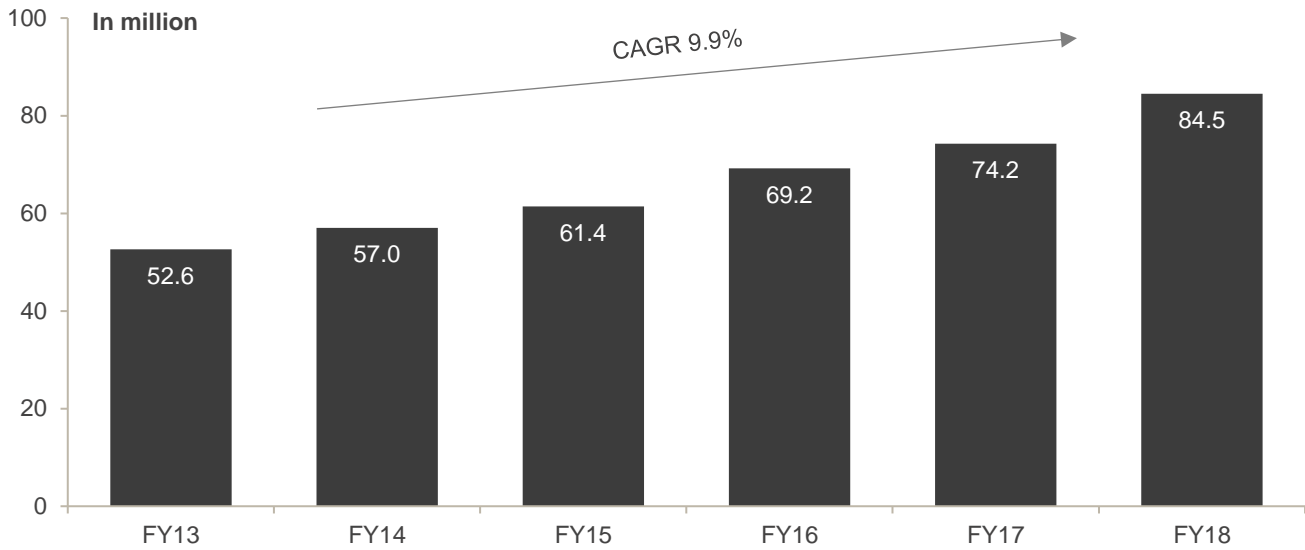
Source: Income Tax Department, CRISIL Research

Transactions mandating quoting of PAN expected to boost PAN card applications

PAN card enables the ITD to link the transactions undertaken to a particular person or an entity. In turn, it also facilitates retrieval of financial transactions done. In order to expand the tax base in the country, the Government of India has mandated quoting the PAN for a particular set of transactions.

List of transactions where PAN needs to be quoted

Sr no	Nature of transactions	Value of transactions
1	Sale or purchase of a motor vehicle or vehicle other than two-wheeled vehicles	All transactions
2	Opening an account [other than a time deposit and basic savings bank account] with a banking company or a co-operative bank	All transactions
3	Making an application for issue of a credit or debit card	All transactions
4	Opening of a demat account with a depository, participant, custodian of securities or any other person with SEBI	All transactions
5	Payment in cash to a hotel or restaurant against bill at any one time	Amount exceeding Rs 50,000
6	Payment in cash to any foreign country or payment for purchase of any foreign currency	Amount exceeding Rs 50,000
7	Payment to a mutual fund for purchase of its units	Amount exceeding Rs 50,000
8	Payment to a company or an institution for acquiring debentures or bonds issued by it	Amount exceeding Rs 50,000
9	Payment to the Reserve Bank of India for acquiring bonds issued by it	Amount exceeding Rs 50,000

Sr no	Nature of transactions	Value of transactions
10	Deposits of cash during any one day with a banking company or a co-operative bank	Amount exceeding Rs 50,000
11	Purchase in cash of DD(demand drafts or banker's cheques) from a banking company or co-operative bank	Amount exceeding Rs 50,000
12	Time deposit with a bank, post office, nidhi companies, NBFCs	Amount exceeding Rs 50,000 per day and 0.5 million per year
13	Payment for prepaid instruments, issued by RBI to a banking company or co-operative bank in a year	Amount exceeding Rs 50,000
14	Payment for life insurance premium in a year	Amount exceeding Rs 50,000
15	A contract for sale or purchase of securities (other than shares)	Amount exceeding Rs 0.1 million per transaction
16	Sale or purchase of unlisted shares	Amount exceeding Rs 0.1 million per transaction
17	Sale or purchase of any immovable property	Amount exceeding Rs 1 million

Source: Income Tax Department, CRISIL Research

Further to the above-mentioned transactions, the Central Board of Direct Taxes (CBDT) has mandated that all transactions exceeding Rs 0.2 million (irrespective of mode of payment) need to quote PAN. Lowering of limits of financial transaction which mandate quoting of PAN would boost PAN card application and online verification of PAN. With increasing financial transactions expected to increase in future, coupled with a wider taxpayer base, PAN card penetration in India is likely to increase further.

Growing rural economy and internet penetration to aid growth in PAN applications

Financial inclusion of individuals is less in India, when compared with its urban counterparts. As of Census 2011, only 54.46% of the rural households availed banking services, whereas 67.68% of urban households availed banking services. In order to reduce the gap and build financial awareness among the rural population, the Government of India has undertaken initiatives such as PMJDY for opening a no-frills bank account. As of June 16, 2021, the number of accounts opened under this scheme reached 423.1 million with deposits of over Rs 1,432.9 billion.

In addition to this, the government, through its Digital India programme, has introduced common service centres (CSC) for availing e-governance services in villages. These services are driven by growth in internet penetration in rural areas which has increased from 10.7% (of total rural subscribers) in December 2014 to 34.6% (of total rural subscribers) in December 2020 at a CAGR of 22%.

In other terms, internet penetration among Indian rural population has increased from 12.7% in December 2015 to 34.2% in December 2020. Going forward, CRISIL Research expects internet penetration in total rural population to reach 55-60% by end of December 2025. This increase is bolstered by growth in rural internet subscriber base at a CAGR of 10-12% between 2020 and 2025.

Growth in internet penetration coupled with many of above mentioned services requiring PAN card as one of the proofs of identity, would drive demand for PAN card applications in rural India.

Status of PMJDY as of April 28, 2021

Bank name/ Type	Number of beneficiaries at rural/semi-urban centre bank branches (million)	Number of beneficiaries at urban metro centre bank branches (million)	Number of total beneficiaries (million)	Deposits in accounts (Rs billion)	Number of Rupay debit cards issued to beneficiaries (million)
Public sector banks	205.9	128.8	334.6	1,115.7	264.0
Regional rural banks	66.5	9.4	75.9	273.2	34.4
Private sector banks	6.9	5.6	12.5	44.0	11.1
Total	279.2	143.8	423.1	1,433.0	309.6

Source: PMJDY, CRISIL Research

Internet penetration in rural India
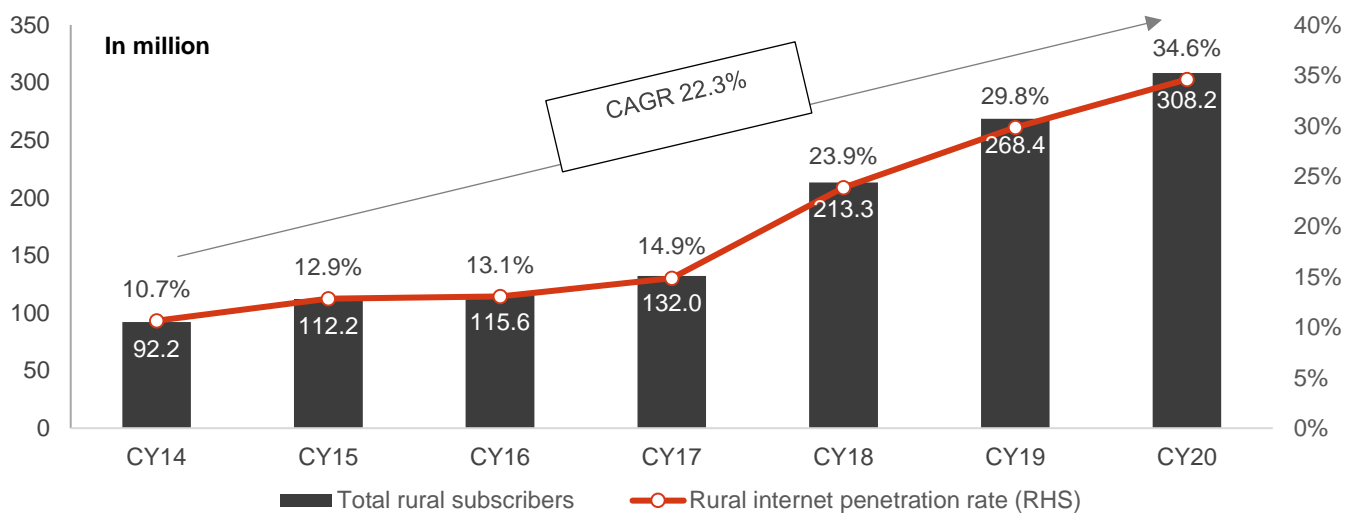
Source: Telecom Authority of India, CRISIL Research

Internet penetration Outlook in India
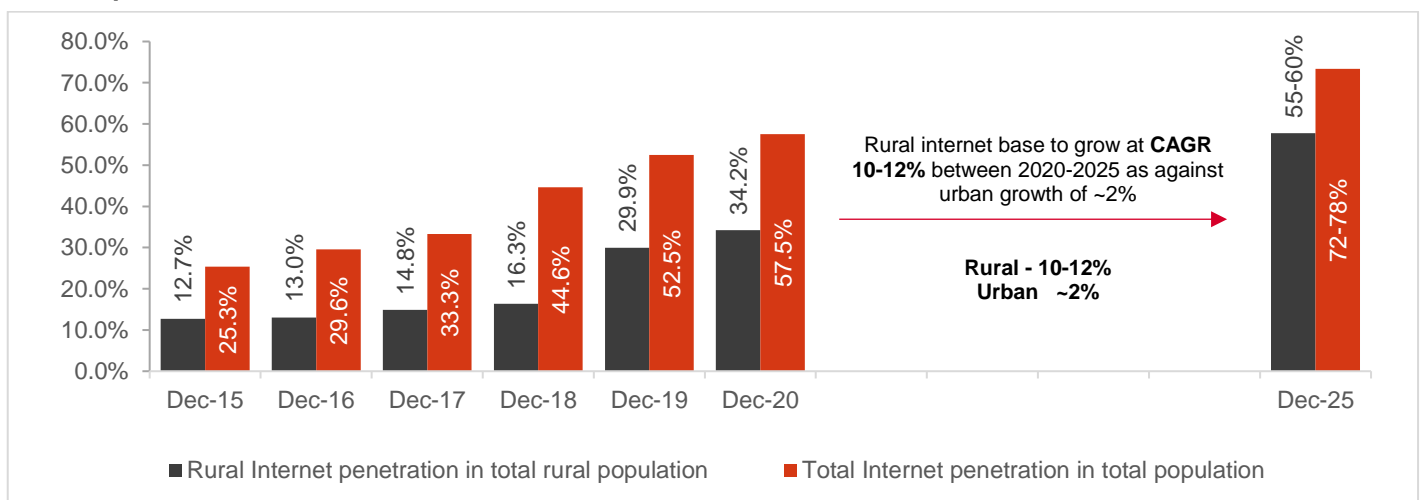
Source: Telecom Authority of India, CRISIL Research

India's per capita GDP expected to grow faster than global average

India's per capita income, a broad indicator of living standards, clocked a CAGR of ~5% from fiscals 2012 to 2020, rising from Rs 63,462 to Rs 94,566. The growth in per capita income was led by better job opportunities, propped up by overall GDP growth. Moreover, population growth has remained fairly stable at ~1% CAGR. India's per capita income declined by 9.1% in fiscal 2021 to Rs 85,929 due to disruptions caused by the Covid-19 pandemic.

Per capita net national income at constant prices (in Rs)

	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20RE	FY21PE
Per capita net national income	63,462	65,538	68,572	72,805	77,659	82,931	87,828	92,085	94,566	85,929
On-year growth (%)	2.1	3.3	4.6	6.2	6.7	6.8	5.9	4.8	2.7	-9.1

RE: Revised estimates PE: Provisional estimates

Source: Provisional Estimates of Annual National Income, 2019-20, Central Statistics Office (CSO), Ministry of Statistics and Programme Implementation (MoSPI), CRISIL Research

As per the International Monetary Fund's (IMF) estimates, global GDP per capita logged a CAGR of 1.2% over 2015 to 2020. During the period, the year-on-year per capita global GDP growth rate consistently fell to 1.4-2.1%. India's per capita GDP clocked a 3.2% CAGR during the corresponding period, growing ~2.5 times faster than the global rate. Over the next five years until 2025, IMF forecasts India's GDP per capita will continue to outpace the global average, albeit at a slower pace. At the global level, GDP per capita is expected to clock a CAGR of ~5.2% during the corresponding period and India is expected to grow at a CAGR of ~4.5%. Higher income potential among individuals is expected to expand the individual taxpayer base, which drives growth in allotment of PAN cards.

Global and Indian per capita GDP (Current prices, in $)

	2015	2016	2017	2018	2019	2020P	2021P	2025P	CAGR (2015-20)	CAGR (2020-25)
Per capita GDP – Global (current prices)	10,321	10,365	10,881	11,431	11,557	10,954	11,773	14,107	1.2%	5.2%
Per capita GDP – India (current prices)	1,606	1,732	1,982	2,006	2,098	1,877	2,031	2,729	3.2%	7.8%

Source: IMF, CRISIL Research

3 Assessment of Tax Information Network (TIN) system

3.1 Introduction to system and infrastructure

TIN is a repository of nationwide Tax related information

The Income Tax Department (ITD) established the Tax Information Network (TIN) that has helped in modernization of the direct tax collection system, processing, monitoring and accounting of direct taxes. By leveraging technology, TIN enhances record keeping and return preparation by tax deductors and reduces the cost of compliance, thereby improving overall tax compliance. It is also expected to reduce revenue leakage, increase the tax base, improve process efficiency and transparency and enable speedy reconciliation. Protean eGov Technologies Ltd. launched TIN on behalf of ITD.

Before the launch of TIN, the Central Board of Direct Taxes (CBDT) was inundated with truckloads of documents. CBDT administers various direct taxes through the Commissioners of Income Tax in different parts of the country and a significant part of direct taxes is collected at the source by mandating the parties paying the income to deduct tax at source. Tax deducted at source (TDS) had to be paid through a select list of bank branches and the payers had to file tax returns by giving details of tax deductions, deduction certificates issued and payment details. All these transactions resulted in huge documentation needs and reconciliation in such an environment was almost impossible.

The mechanism for tax related activities got streamlined with introduction of TIN

TIN system
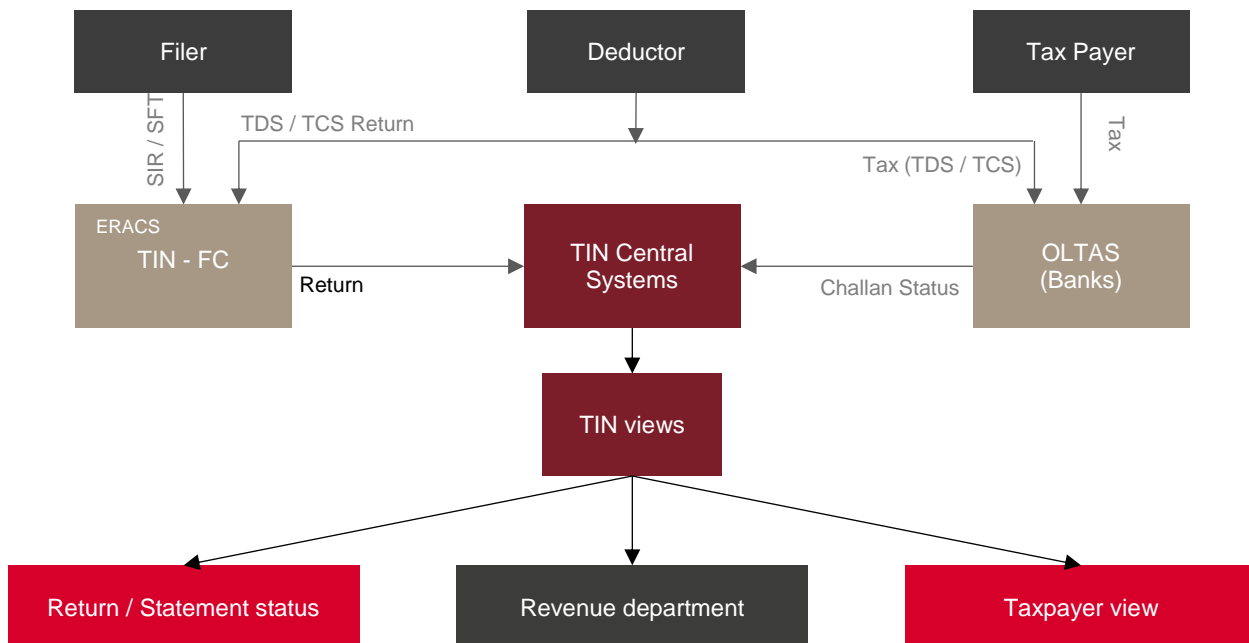
Source: CRISIL Research

TIN has two key sub-systems:

Electronic Return Acceptance and Consolidation System (ERACS): It consists of a nation-wide network of TIN facilitation centres (TIN-FC) for interface with taxpayers and a web-based utility for uploading electronic returns of

TDS and tax collection at source (TCS) and annual information return (AIR) / Statement of Financial Transactions (SFT) to the central system of TIN.

Online Tax Accounting System (OLTAS): It handles daily upload of the details of tax deposited in various collection branches across the country to the central system.

The functionality of each facility is elaborated below:

TIN-FCs

Through its network of TIN-FCs all over the country, TIN offers the following services:

● Acceptance of electronic and physical TDS/TCS returns

● Processing of new TAN and TAN change request applications

● Acceptance of AIR / Statement of Financial Transactions (SFT)

● Acceptance of Form 24G statement- Form 24G is a single monthly statement in which the accounting officer consolidates the payment details from each of the drawing and disbursement officer (DDO) for each type of deduction/collection (TDS-Salary/ TDS-Non Salary/ TDS- Non Salary Non Residents/ TCS) in a single form known as Form 24G.

Tax deduction at source

Entities (both corporate and non-corporate deductors) making payments (specified under Income Tax Act) to third parties (deductees) have to deduct TDS from these payments and deposit the deducted amount at any of the designated branches of banks authorised to collect taxes on behalf of the Indian government. They should also furnish TDS returns containing details of deductee(s) and challan details related to the deposit of tax to ITD.

To automate collection, compilation and processing of TDS returns, ITD issued an "Electronic Filing of Returns of Tax Deducted at Source Scheme, 2003" notification. The notification is applicable to all deductors furnishing their TDS returns in electronic form. As per this scheme:

● It is mandatory (w.e.f. June 1, 2003) for corporate deductors to furnish their TDS returns in electronic form (e-TDS return)

● From fiscal year 2004-05 onwards, furnishing TDS returns in electronic form is also mandatory for government deductors in addition to corporate deductors

● Deductors (other than government and corporates) may file TDS returns in electronic or physical form

● As the intermediary appointed by ITD, Protean eGov Technologies Ltd. receives e-TDS returns from the deductors on behalf of the department

Tax collection at source

Collection of tax at source by the seller (collector) from the buyer (collectee / payee) for goods specified under Section 206C of Income-tax Act, 1961 such as timber obtained under forest lease, scrap, any other forest produce not being timber or tendu leaves comes under TCS. For example, if the purchase value of goods is Rs.10,000, the buyer will pay an amount of Rs.10,000 + X (X being the value of TCS as prescribed under Income-tax Act, 1961) to the seller. The seller will deposit TCS) at any of the designated branches of the authorised banks.

Following the automation of TDS returns in 2003, ITD has notified an "Electronic Filing of Returns of Tax Collected at Source Scheme, 2005". As per this scheme:

- It is mandatory for corporate and government deductors to furnish their TCS returns in electronic form (e-TCS return) from fiscal year 2004-2005 onwards

- Deductors (other than government and corporates) may file TCS returns in electronic or physical form

- As the intermediary appointed by ITD, Protean receives e-TCS returns from the deductors on behalf of ITD

Annual Information Return (AIR)

AIR is a tool for collecting 'high value financial transaction' information in a structured manner, with the Permanent Account Nnumber (PAN) number as a unique identifier for ensuring tax compliance, widening and deepening of the tax base, creating a tax-payer profile and enabling data warehousing/business intelligence. The scheme for filing of AIR by the main nerve centres of financial activities such as banks, credit card companies or institutions, companies (issuing public/rights issue of shares and bonds/debentures), registrars of immovable property, mutual funds and the Reserve Bank of India (RBI), the central bank issues bonds, has been in operation since August 2005 for specified financial transactions registered or recorded by them during the financial year (beginning on or after April 1, 2004).

As the intermediary appointed by ITD, Protean receives AIR from the filer on behalf of the department through the network of TIN Facilitation centes. Details on return preparation and validation utilities are available on the TIN website. Further, AIR Information Booklet and FAQs are also provided on the TIN website.

Online Tax Accounting System (OLTAS)

OLTAS is an online system for collection, accounting and reporting of the receipts and payments of direct taxes from all kinds of taxpayers through a network of bank branches. OLTAS has been among the key e-governance initiatives undertaken by the Income Tax Department. The taxpayers' data flows from banks directly to TIN to do away with the paper trail for tax credit and the paper validation system. The system is uniquely placed to reduce taxpayer grievances and has been one of the landmark e-governance initiatives undertaken by the department. A separate OLTAS dashboard facility has also been introduced through TIN website for the Finance Minister, senior functionaries of CBDT, Chief Commissioners/Director Generals of Income Tax, Commissioners of Income Tax (TDS) and Commissioners of Income Tax (Computer Operations) for monitoring direct tax collections on a daily basis. Along with the details of direct tax collection, the OLTAS dashboard also cover the detail of paid refund under Income Tax and TDS refund.

eTDS/TCS market share of Protean
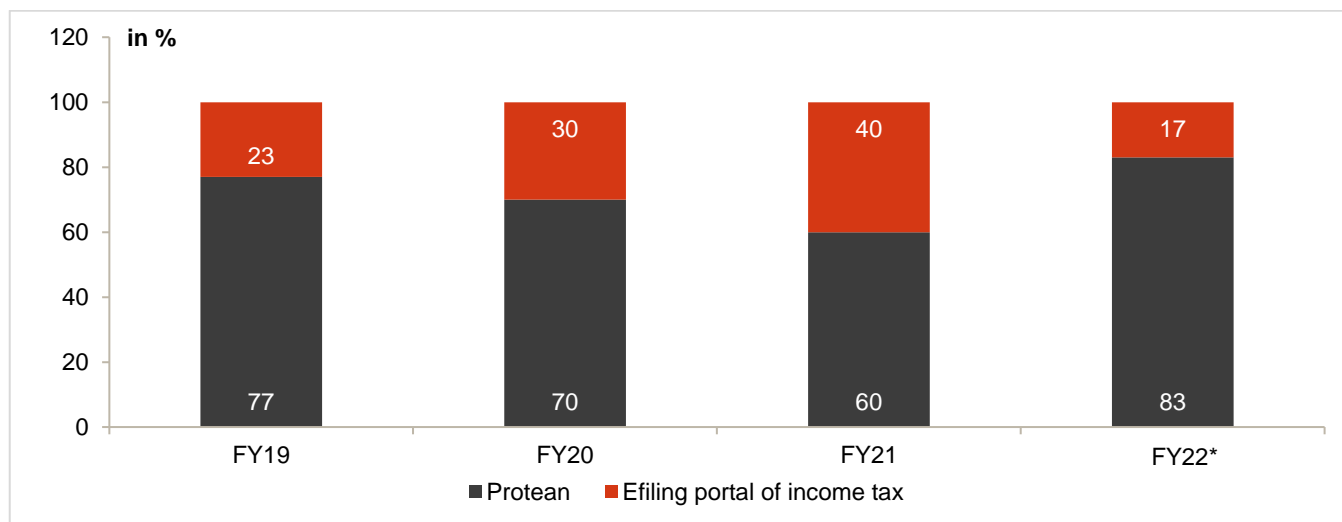
*As on 5th August, 2021

Source: Company document

3.2 Overview of software providers

Deductors/collectors/filers furnishing returns in electronic form (e-TDS/TCS returns and AIR) are required to prepare their return file in accordance with the electronic data structure (file formats) prescribed by the ITD. The electronic returns can be prepared using in-house facilities, any other third-party software or the Protean eGov Technologies Ltd. Return Preparation Utility, which is freely downloadable from Protean TIN website. The list of entities who developed a software for preparing e-TDS/TCS returns and AIR is given below:

e-TDS/TCS

Name of the company	Name of the product
Protean eGov Technologies Ltd.	NSDL e-TDS/TCSRPU (based on former name of Protean)
Adept Infoways Private Limited	AdeptTDS
BizSol Technologies Private Limited	XL e-TDS
Big Byte Solutions Private Limited	WEBPAY
Busy Infotech Private Limited	BUSY
CCH Prosystem India Private Limited	Prosystem
Chartered Information Systems Private Limited	TaxPro e-TDS
Clearsharp Technology Private Limited	TaxCloud India
Comptaax e Software Private Limited	IITRETeTDS
Cynosure Technologies Private Limited	SureTDS Enterprise
Defmacro Software Private Limited	ClearTDS
Electrocom Software Private Limited	EASYOFFICE
Farsight IT Solutions Private Limited	Payroll Insights

Name of the company	Name of the product
Fast Facts (A Thomson Reuters Business)	e-Tds Wizard
Figment Global Solutions Private Limited	TAXCPC
Greytip Software Private Limited	greytHR
Hostbooks Limited	HB-TDS
HRMantra Software Private Limited	HRMantra
Husys Consulting Limited	ApHusys
Innoart Technologies Private Limited.	Simplico
Intense Technologies Limited	eTaxfile
Jaya Softwares	JS@eTDS
KDK Softwares India Private Limited	Express TDS
K. D. K. Softwares (India) Private Limited	Zen TDS
KEYPRO PLUS	KeTDS
Kredence Digital Resources Private Limited	Protact
Logictech Solutions Private Limited	TDS-PLUS
MCS Computer Services Private Limited	E–TDS (2015)
MONARCH Computers.Com	I-TAX (The Taxomatic)
MYD Labs Private Limited	EZTDS
OPEL Systems and Consultants Private Limited	PAYSOFT
PCSOFT ERP Solutions Private Limited	Int-E-View ERP Solution
PDS Infotech Private Limited	TDSMAN
Prayag Infosoft	Prayag E-TDS
Prime Software Solution	Prime e-TDS
Prism Cybersoft Private Limited	SOHAM
Prodigy Technologies	Intelli Payroll(2015)
PS Softech Private Limited	PSS E-TDS
Relyon Softech Limited	Saral TDS - Electronic TDS Management Software
SAG Infotech Private Limited	Gen e-TDS
Sage Software Solutions Private Limited	Pocket HRMS
Saibex Network	eTDS SQL
Sensys Technologies Private Limited	eTDS @nalyst
Sinewave Computer Services Private Limited	TDSXpress
Skorydov Systems Private Limited	TDS Suite™

Name of the company	Name of the product
SmartBiz Technologies	Smart e-TDS
Spine Technologies India Private Limited	SpinePayroll
Stratus Management Technologies	TDSMAN Online
Tally Solutions Private Limited.	Tally.ERP 9
Taxeon Software Solutions	TAXEON
Taxmann Publications Private Limited	Taxmann's TDS Excel Module of E-TDS Return
Tax-o-smart LLP	TDS-O-Smart
Udyog Software India Limited	Taxilla – Tax Compliance on the Cloud
Webtel Electrosoft Private Limited	Web e-TDS
Wing e-tax Solutions Private Limited	WATS (Wings Application for TDS Solutions)
Winman Software Private Limited	Win TDS

Source: Company website, CRISIL Research

Annual Information Returns (AIR)

Name of the company	Name of the product
Protean eGov Technologies Ltd.	AIR Return Preparation Utility (AIR RPU)
Chartered Information Systems Private Limited	TaxPro AIR
Intense Technologies Limited	eTaxfile
K. D. K. Softwares (India) Private Limited	e-Corporate AIR
Perv Software Private Limited	AIR Return Generator
Professional Softec Private Limited	CompuTax
Pulsar InfoTech Private Limited	Pulsar EasyTDS
Relyon Softech Limited	Saral AIR - Annual Information Return Software
Rushabh Infosoft Limited	Rushabh's AIR
SAG Infotech	AIR - e-corporate
Skorydov MyTaxAssistant	Skorydov MyTaxAssistant (AIR)
Tarun Softwares Limited	XPERTAX AIR
Taxmann Publications Private Limited	Taxmann's e-TDS Returns (Free Download of AIR Software)

Source: Company website, CRISIL Research

3.3 Trend in tax collection

Direct tax collection has shown a strong uptrend in last two decades

A direct tax is paid directly to the government by an individual. The direct tax rules ensure redistribution of money in the country. Companies and individuals are solely responsible for paying their direct taxes. CBDT oversees matters related to the levy and collection of all direct taxes.

Some of the important components under direct tax include personal income tax, corporate tax, wealth tax, gift tax, property tax, and expenditure tax. Tax collection through corporate tax and personal income tax form a major chunk of total direct tax collection which has increased at a compound annual growth rate (CAGR) of 17% from fiscal 2001 till fiscal 2019. Both corporate tax and personal income tax have evenly contributed to overall growth in collections.

Direct tax collection (in Rs trillion)
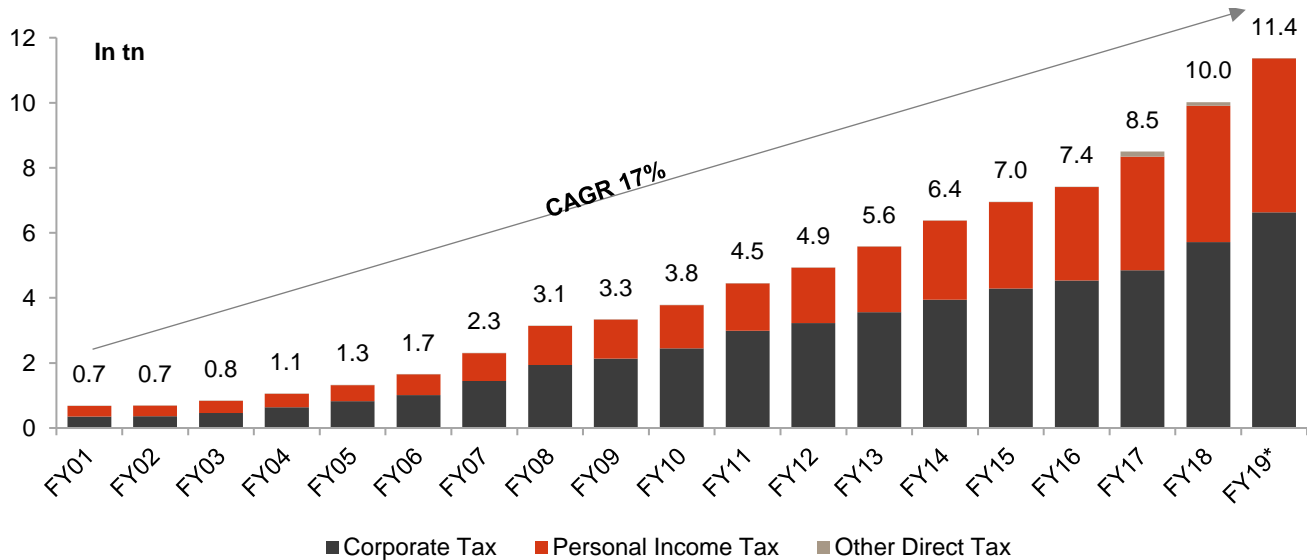
*Provisional

Source: www.incometaxindiaefiling.gov.in, CRISIL Research

Category wise split of direct tax collection

Number of taxpayers in India

Individuals form ~95% of taxpayer base

A taxpayer is an individual or corporation who pay taxes annually on earnings as per the provisions of the Income Tax Act. The act applies different tax rates depending on the category of taxpayers. It categorises taxpayers as individuals, Hindu undivided family (HUF), association of persons (AOP), body of individuals (BOI), firms, companies, government, local authorities, AOP (Trust), and artificial juridical person (AJP). Individuals account for ~95% of the tax base. The number of individuals joining the tax base has surged at a CAGR of 10.2% in the past five fiscal years, contributing the most to the overall taxpayer base.

Number of taxpayers (in million)
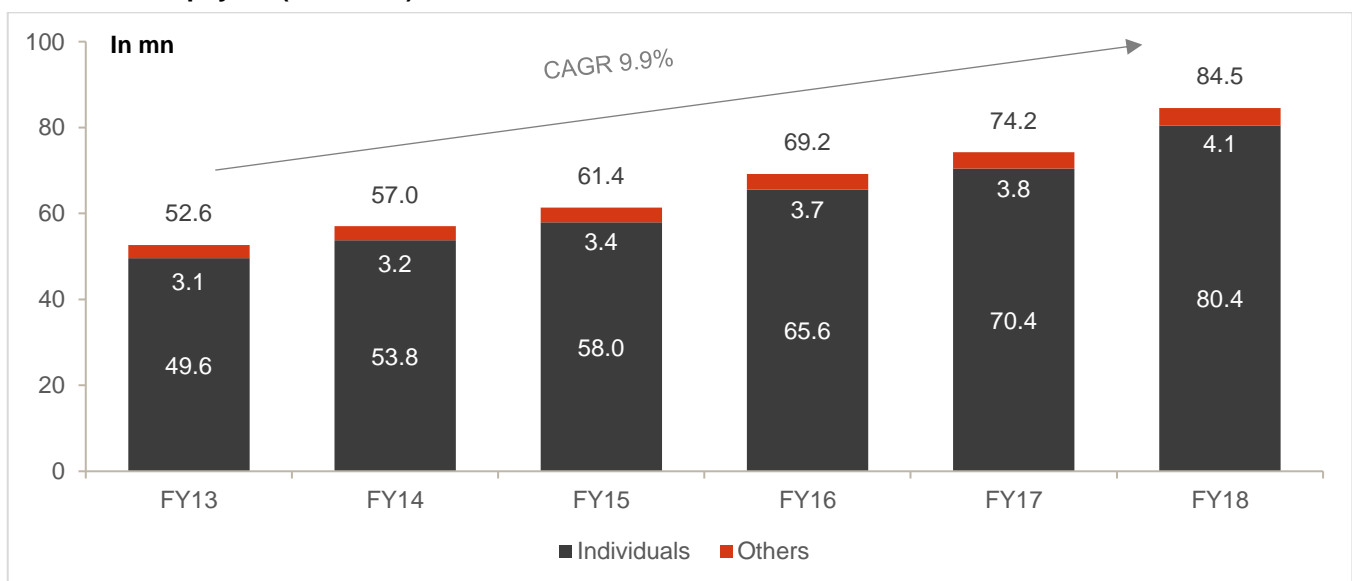
The taxpayer base is expected to be driven by growth in working age population, GDP growth, increasing per capita income and an increasing contribution of the formal economy. Considering the past growth trend in the taxpayer base and the demographic and economic scenario of India, the base is expected to expand at a CAGR of 9-10% to reach 150-160 million level by fiscal 2025.

Expected number of taxpayers (in million)

In mn

	FY13	FY18	FY25P
Total	52.6	84.5	150-160

CAGR 9.9%

CAGR 9%-10%
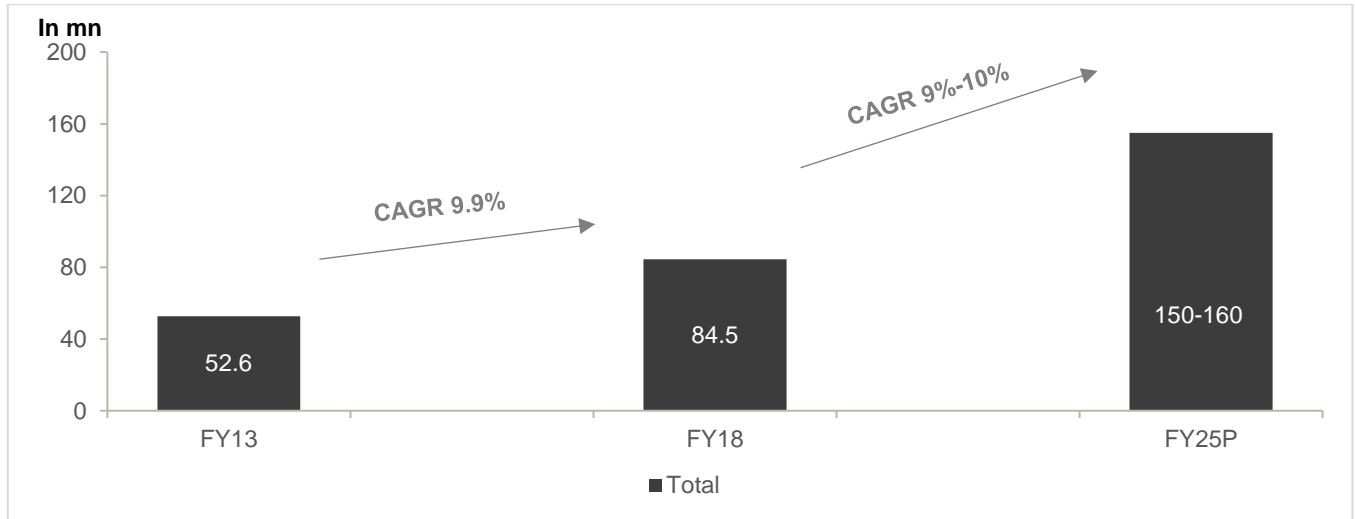
Source: www.incometaxindiaefiling.gov.in, CRISIL Research

Number of IT returns filed (in million)

In mn

CAGR 12.1%

	FY14	FY15	FY16	FY17	FY18	FY19
Total	38.0	40.4	46.3	55.8	68.7	67.4

■ Individuals ■ Others
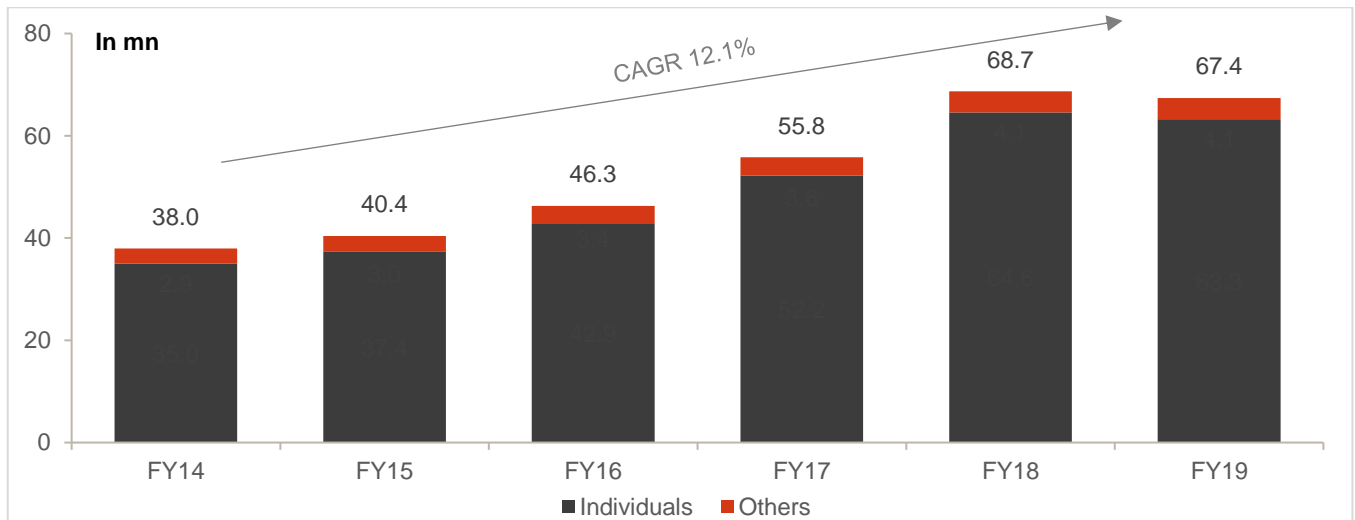
Source: ITD, CRISIL Research

3.4 Digital initiatives in income tax department

Launch of TIN 2.0 expected to further modernize the tax related processes

CBDT is implementing a new payment system, i.e., Tax Information Network (TIN 2.0), while subsuming the existing process of collection of direct taxes through the erstwhile Online Tax Accounting System (OLTAS) in the new system. TIN 2.0 is hosted by ITD and the Office of the Principal Chief Controller of Accounts (Pr. CCA), CBDT.

With introduction of TIN 2.0, accounting of government transactions will be facilitated through Pratayaksh Kar Lekhankan Pranali (PRAKALP). PRAKALP is an application of the Public Financial Management System (PFMS)

under the Office of the Controller General of Accounts (CGA). Besides CBDT and CGA, authorised banks and the RBI are also part of the TIN 2.0 ecosystem. The RBI will work as a collecting bank as well as an aggregator for accounting and settlement of direct taxes through e-Kuber, the core banking solution of the central bank. The solution provides commercial banks and other institutions access to their current account with the RBI.

TIN 2.0, broadly based on the Goods and Services Tax (GST) structure, requires taxpayers to generate online challans from a centralised system, thereby doing away with preparation and handling of physical challans. It enables taxpayers to use various payment options such as internet banking of authorised banks, over-the-counter (OTC) payment through branches of authorised banks including designated offices of the RBI, payment through national electronic funds transfer (NEFT) or real-time gross settlement (RTGS) through any bank directly to the central bank and payment through approved instruments such as internet banking, debit card, unified payment interface (UPI)/BHIM of any bank.

With the introduction of TIN 2.0, the challan generation information and confirmation of taxes received will be shared in real-time with all concerned stakeholders. As in the case of GST, all tax payments received by agency banks will be aggregated by the RBI and credited to the respective government accounts, along with OTC/NEFT collections by the central bank, as per prescribed timelines. The RBI will also provide necessary accounting and settlement related reports to the government systems. Listed below are some of the initiatives by ITD:

Initiatives by ITD

Initiative	Description
Central Processing center 2.0	The new e-filing portal, which became operational in June of 2021, provides improved features such as user-friendly dashboard, Simplified ITR preparation software, Free real-time assistance, etc. will provide taxpayers convenience as well as a modern and seamless experience.
E-Sahyog	This initiative establishes a paperless system in which the Internal Revenue Service (IRS) notifies taxpayers online. This eliminates the need to engage with tax authorities in person and saves time. Instead of inspecting taxpayers in person, the online system corrects any problems or inconsistencies in IT returns..
Expansion of Pan Card Administration	The initiative mandates qtinge one's Permanent Account Number (PAN) for any purchase or sale exceeding US$ 1496 (Rs 100,000). Extending the PAN's scope will allow tax authorities to combat the unlawful circulation of "black" money and maintain track of the taxable base in order to manage budgets more efficiently.
Tax Return Preparer Scheme (TRPS)	The IT department launched this tax filing service in 2006 whereby trained and certified professionals file returns on behalf of taxpayers at free of cost or for a marginal fee. The TRP scheme targets small taxpayers, and reduces costs while encouraging greater compliance with tax laws.
Faster Tax Refund	Since 2015, the IT department has dedicated itself to speedier tax refund processing and distribution using an automated ecosystem enabled by the Aadhaar card-based income tax return (ITR) authentication, which removes the need for human interaction in taxpayer services. The current capacity indicates a peak of 500,000 returns per day processed, with an average processing time of 55 days (from 12 to 14 moths).
Simplified IT Forms	In May of 2015, the finance ministry launched a new and simplified three-page ITR format — forms ITR 2 and ITR 2A. The income tax return form used to be 14 pages long. The tax department recently repealed a contentious reporting provision that required taxpayers to reveal foreign vacations and dormant bank accounts (for up to a period of three years).
Clarification on the Applicability of Minimal	The CBDT has clarified that MAT is inapplicable for foreign institutional investors (FIIs) and foreign portfolio investors (FPIs) in India.

Initiative	Description
Alternative Tax (MAT)	
E-Verification of ITR	The use of Aadhaar card linkage and net banking to verify income tax return forms online eliminates the need to transmit a printed copy of the ITR-V form to the IT department. This reduces the amount of time it takes to process and issue refunds.
SMS Alerts on Tax Deducted at Source (TDS)	Directly targeting the salaried professional class in the country, the finance ministry launched an SMS alert service on October 24, 2016. Every month, the service would send SMSes (text messages) to salaried taxpayers about their TDS deductions. This makes it much easier for assessees to match their office wage slip with the SMS notification sent out at the end of the fiscal year to stay up to date on any tax dues and/or avoid paying taxes twice.
Faster Grievance Redressal	According to the tax department, the disposal rate of grievances received in the previous fiscal through the centralised public grievance redress and monitoring system increased considerably. In 2016, a 'e-nirvaran' option for online resolution of taxpayer issues pertaining to refunds, ITRs, TDS, and PAN was created to further strengthen the system.

Source: CRISIL Research

CBDT initiatives for litigation management

The Direct Tax Vivad se Vishwas Bill, 2020 passed to settle pending tax litigations

In the past few years, CBDT has taken several policy steps to improve litigation management. These step include a steep hike in the monetary limit for filing appeals before ITAT/Courts, constitution of a committee for minimising and strengthening litigation management, constitution of a committee to study appellate orders to examine filing of appeals by the department before various forums, and introduction of the Central Tax Committee and Regional Tax Committees.

The government introduced The Direct Tax Vivad se Vishwas Bill, 2020 in February last year to settle pending tax litigations and enable it to collect revenues locked up in litigation. The bill provides a mechanism for resolution of pending disputes related to income tax and corporation tax. The scheme provides taxpayers an option to end litigation and achieve finality merely by paying the tax component of the dispute. The government shall waive penalty and interest, and offer a 50% discount to settle revenue appeals and appeals where the taxpayer has a favourable precedent by a higher court. The scheme explicitly clarifies that it is not an amnesty scheme and thus taxpayers can decide to settle their appeals based on an objective comparison of future litigation costs with the cost of availing the settlement option. The government expects the bill to clear the backlog of appeals.

National Judicial Reference System (NJRS) has been developed to improve litigation management

NJRS is a platform that contains accumulated reference of all judgments and orders of the Income Tax Appellate Tribunal, Authority for Advance Rulings, high courts and the Supreme Court of India from the year 2009 and all important earlier judgments. It enables easy identification of the judicial view on an issue. Committees setup to study improvement in litigation management have stressed on the use of NJRS as a primary step towards such improvement. The platform also includes search and analysis capabilities.

NJRS provides a mechanism to manage appeals through the Appeals Repository and Management system and a ready reference of judgments to provide all the information relevant to the subject (appeal) under consideration. The system enables users in ITD to analyse appeals based on outcomes of related appeals and judgments passed

in the past, related acts, circulars, etc. The system also assists in operational matters such as tracking the status of appeals and setting reminders and facilitate speedy appeal disposal to enable ITD to increase tax revenue.

The need for launching an e-Journal on legal matters relating to taxation had long been felt. Accordingly, a facility for an e Journal has been created on the National Judicial Reference System (NJRS) portal under the title 'Taxalogue'. NJRS is a platform which contains accumulated reference of all judgments and orders of the Income Tax Appellate Tribunal, Authority for Advance Rulings, High Courts & the Supreme Court of India from the year 2009 and all important earlier judgments. It enables easy identification of the judicial view on an issue. Committees setup to study improvement in litigation management have stressed on the use of NJRS as a primary step towards such improvement. The platform also includes search and analysis capabilities.

National Judicial Reference System (NJRS) comprises of two main components:

- Appeals Repository & Management System (ARMS): An online repository of all pending appeals at the ITAT, AAR, High Court and the Supreme Court with relevant documents.

- Judicial Research & Reference System (JRRS): A repository of judicial orders as a single, indexed, searchable , cross linked database of Judgments of ITAT, AAR, High Court and Supreme Court

Objectives of NJRS

- Ensure Expeditious Disposal of Appeals.

- Facilitate Tax Recovery by quick identification, prioritization and disposal of High Tax cases.

- Avoid Frivolous Appeals on Decided Issues.

- Bring Uniformity in the stand taken by Income Tax Dept. on Contentious legal Issues.

- Consolidation of Appeals by bunching similar cases.

- Develop expertise to defend cases on specific issues.

Appeals Repository & Management System (ARMS)

- Consolidate database of pending litigation.

- Ensuring monitoring of Appeals at each stage.

- Ensure Granularity of Data for Decision making by CBDT.

- Identification of law prone to litigation.

- Analysis of trends in outcome of Appeals.

- Quick movement of information on litigation to judicial officers.

- Reliable storage and ready retrieval of appeals documents.

Judicial Research and Reference System (JRRS)

- Centralized, indexed and searchable electronic repository of Judgments for efficient tax litigation management.

- Link decisions in decided matters with pending appeals to Income Tax officers.

- Intelligent search capabilities to identify issues across cases for improved decision making.

- Issue wise summary of Judgments for quick reference.

The Department has selected Protean eGov as NJRS' implementation agency for five years i.e. from fiscal 2017 to fiscal 2022.

Status - 2,83,249 judgments and data of 8,28,646 appeals have been made available in the NJRS as of June 2021. 11,576 officers of ITD have been registered on the NJRS portal.

Number of appeals on NJRS portal

Parameters	FY2018	As of June 2021 on website
Judgement	2,24,266	2,83,249
Appeals	6,52,681	8,28,646

Source: CRISIL Research

3.5   Growth drivers for income tax filings and tax collection

India's large young population expected to expand the taxpayer base

Over 60% of India's population is the working age bracket of 15-59 years and this bracket is expected to grow to above 60% in the next decade. According to UN World Population Prospects, in 2020, ~879 million people were in the working age range and the number is expected to cross 930 million by 2025 adding more individuals to the taxpayer base. The individual taxpayer base in fiscal 2018 stood at 80.4 million. With increasing working age population and the overall economic growth in the country, the individual taxpayer base is expected to expand at a CAGR of 9%-10% till fiscal 2025.

Working age population (in million)
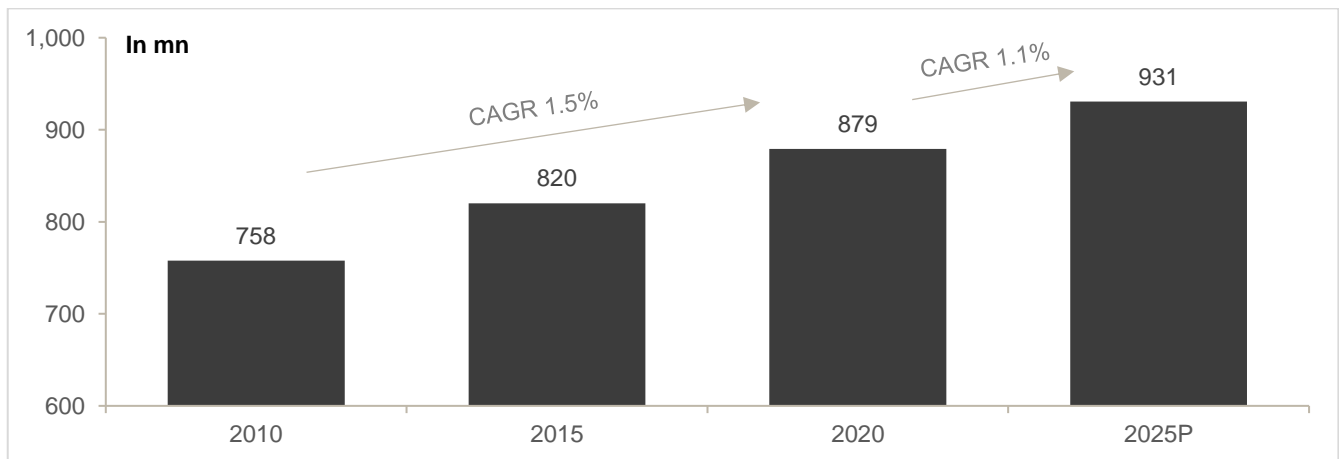
Source: UN Population, CRISIL Research

India per capita GDP expected to grow faster than global average

India's per capita income, a broad indicator of living standards, clocked ~5% CAGR from fiscals 2012-20, rising from Rs 63,462 to Rs 94,566. The growth in per capita income was led by better job opportunities, propped up by overall GDP growth. Moreover, population growth has remained fairly stable at ~1% CAGR. India's per capita income declined by 9.1% in FY21 to Rs 85,929 due to disruptions caused by the Covid-19 pandemic.

Per capita net national income at constant prices (in Rs)

	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20RE	FY21PE

Per capita net national income	63,462	65,538	68,572	72,805	77,659	82,931	87,828	92,085	94,566	85,929
Year-on-year growth (%)	2.1	3.3	4.6	6.2	6.7	6.8	5.9	4.8	2.7	-9.1

RE: Revised estimates PE: Provisional estimates

Source: Provisional Estimates of Annual National Income, 2019-20, CSO, MoSPI, CRISIL Research

As per the International Monetary Fund (IMF) estimates, global GDP per capita grew at a 1.2% CAGR over 2015-20. During the period, the year-on-year per capita global GDP growth rate consistently fell to 1.4-2.1%. India's per capita GDP clocked a 3.2% CAGR during the corresponding period, growing ~2.5 times faster than the global rate. Over the next five years until 2025, IMF forecasts India's GDP per capita will continue to outpace the global average, albeit at a slower pace. GDP per capita at the global level is expected to grow at ~5.2% CAGR during the corresponding period and India is expected to grow at ~4.5% CAGR. Higher income potential among the individuals expected to drive the personal income tax collection.

Per-capita GDP – Global and India (current prices, in USD)

	2015	2016	2017	2018	2019	2020P	2021P	2025P	CAGR (2015-20)	CAGR (2020-25)
Per capita GDP – Global (current prices)	10,321	10,365	10,881	11,431	11,557	10,954	11,773	14,107	1.2%	5.2%
Per capita GDP – India (current prices)	1,606	1,732	1,982	2,006	2,098	1,877	2,031	2,729	3.2%	7.8%

Source: IMF, CRISIL Research

Scope of improvement in tax compliance methods

Tax to GDP ratio refers to the ratio of the tax revenue of the country with respect to the country's Gross domestic product (GDP). While the ratio determines the extent to which the government is able to finance its expenditure from tax collections, it is also an indicator of tax compliance. Developed countries have a higher contribution of tax to their GDP. A higher tax-to-GDP ratio also indicates the tax base is increasing along with growth in the GDP. The government has taken a slew of measures to improve compliance, which include the introduction of GST and electronic assessment by tax officers. With improvement in tax compliance methods along with the expanding taxpayer base, the Indian tax to GDP ratio might see follow an upward trajectory from current levels.

Tax to GDP ratio
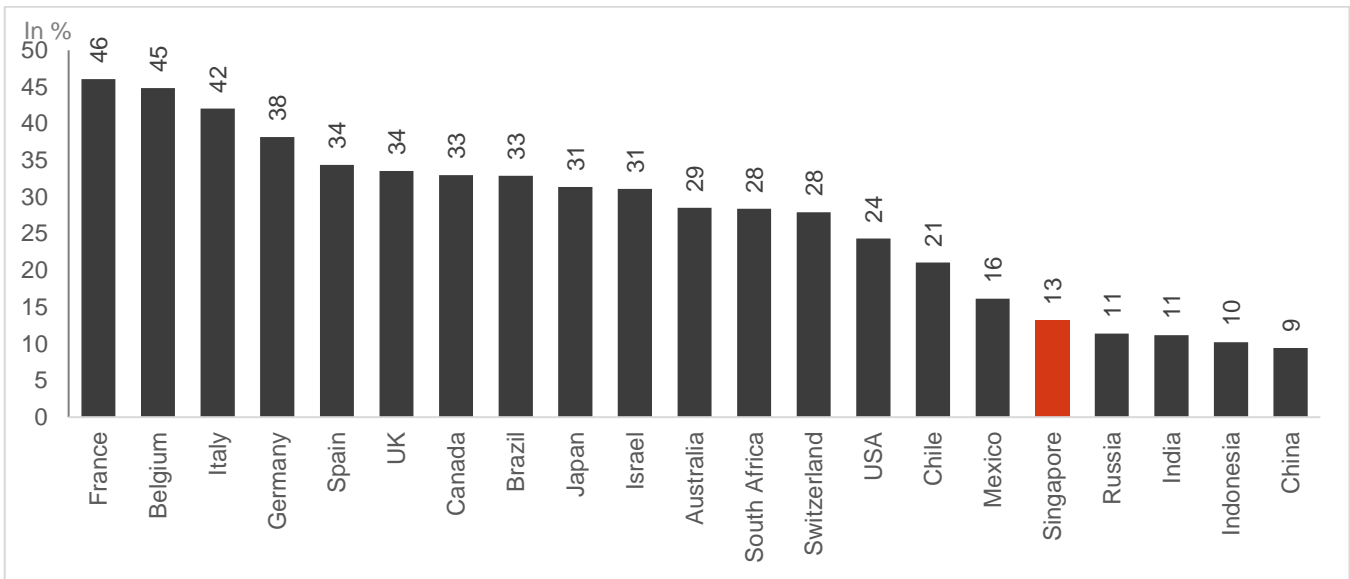
Source: Heritage 2021 Index of Economic Freedom, CRISIL Research

Growth in investments and other income sources for individuals

In India, the household sector contributes around 60% of gross savings in the Indian economy, and thus remains the major supplier of financial resources for gross investment. Households allocate their financial assets and liabilities among various instruments involving varying degrees of liquidity and risk. With increasing GDP and per capita income, India's domestic investment and household financial savings have been on an uptrend. Household financial savings clocked a CAGR of 8.1% from fiscal 2016 till fiscal 2020 to reach Rs 15.6 trillion.

Household financial saving (in Rs trillion)
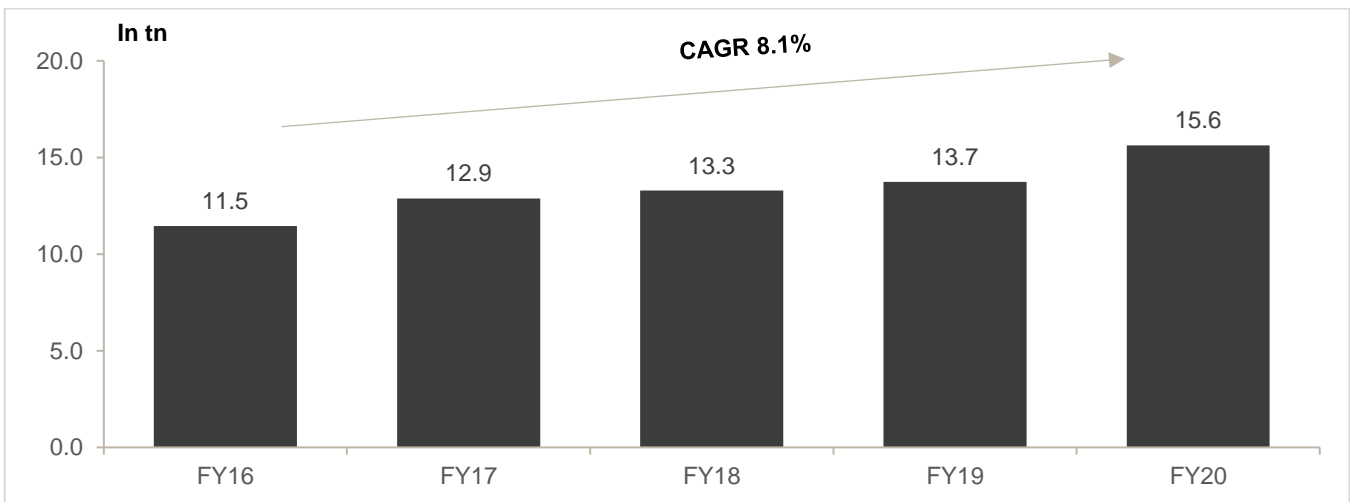
Source: RBI, CRISIL Research

Returns from financial investments attract TDS and capital gain tax. Fixed deposit (FD) is one of the most preferred investment options that enables investors to earn assured returns over a specific tenor. The interest income earned from FDs is fully taxable, with banks charging TDS on the income. With effect from May 2020, TDS shall be deducted at 7.5% if the interest income exceeds Rs 5,000 for fiscal 2021. However, if PAN details are not shared with the financial institution, TDS deducted for Indian residents is 20%.

Investment in FD/term deposits with scheduled commercial banks (in Rs trillion)

In tn

	FY16	FY17	FY18	FY19	FY20
	62.8	64.9	68.1	75.4	81.8

CAGR 6.8%
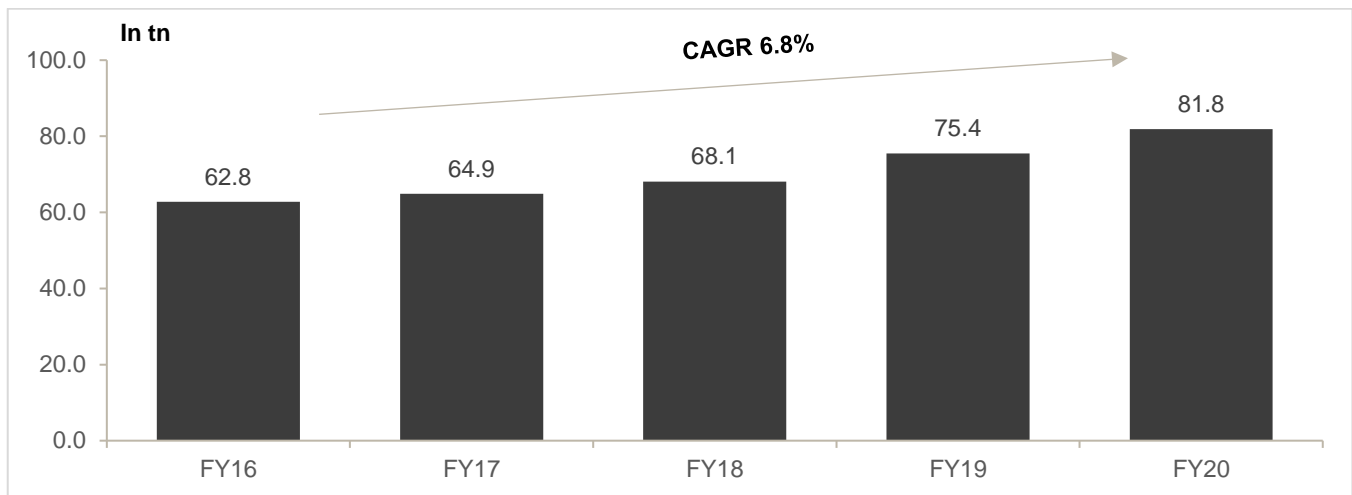
Source: RBI, CRISIL Research

For individual investors, equity linked savings scheme (ELSS) is another preferred investment avenue. With effect from April 1, 2018, long-term capital gains (LTCG) exceeding Rs 1 lakh a year on equity-oriented funds are taxable at 10%, with no indexation benefit. ELSS investors account for LTCG tax before redeeming their investments. Direct investment in equity market and investment in mutual funds are other prominent ways of investments. The inflow in mutual funds and capital markets from individual investors has also been on uptrend since last few fiscals. Increasing financial muscle among individuals is expected to further augment direct tax collection.

Investment in ELSS (in Rs billion)

In bn

	FY16	FY17	FY18	FY19	FY20	FY21
	417.0	614.0	805.8	960.2	747.9	1,299.5

CAGR 25.5%
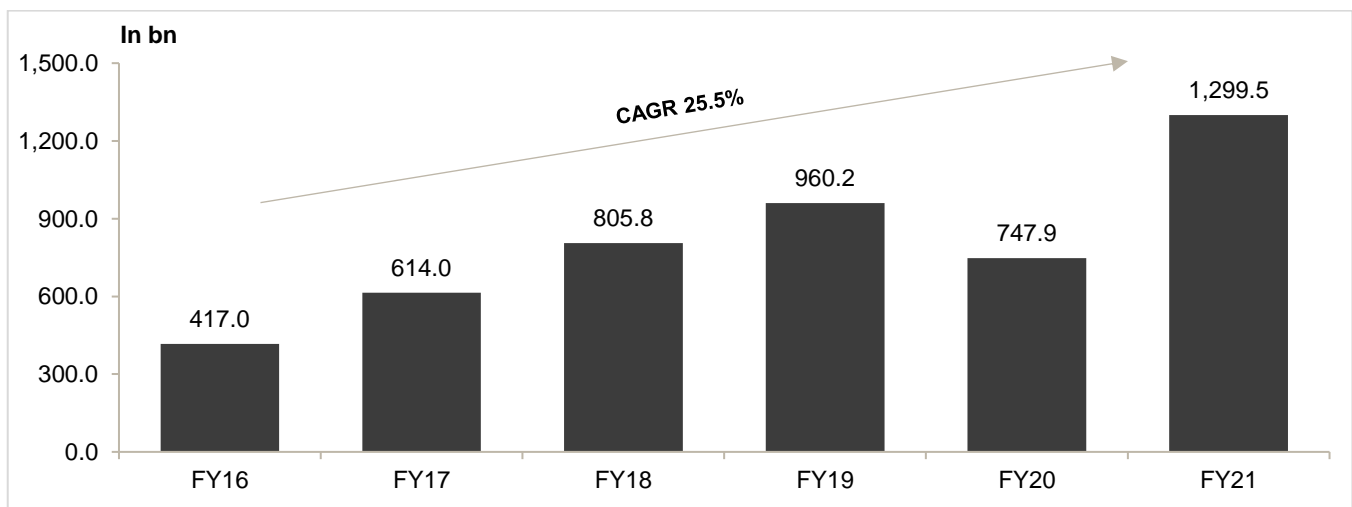
Source: SEBI, CRISIL Research

4   National pension system central recordkeeping

4.1   Overview of national pension system

Pension plans serve as a means of financial stability and security after retirement.

Pension plans are investment plans in which individuals can invest a part of their income and accumulate savings over a specific period of time. The purpose of the plan is to provide people with financial security after retirement. With the increase in private sector jobs, and a steady rise in inflation and average lifespan, demand of pension plans has risen over the past few years.

Pension plans have two stages – the accumulation stage and the vesting stage. In the accumulation stage, investors pay regular premiums until they reach the age of retirement. On reaching the retirement age, the second stage – vesting stage – begins and retirees start receiving annuities. They get the returns until their death or the death of their nominee, depending on the plan.

Based on the scheme structure and benefits, pension plans can be divided into eight major categories:

- **Deferred annuity:** This is the most basic retirement plan, which helps investors build a substantial retirement corpus through regular premium or single premium payment over a policy term. Investors also get tax benefits the scheme offers. Retirees start receiving regular annuities at the end of the accumulation phase.

- **Immediate annuity:** In an immediate annuity plan, the pension starts immediately after the subscriber pays the premium. There is no accumulation stage. It is useful for retirees who receive a lump sum amount on retirement. They can invest the amount in this plan to receive regular pension. If the policyholder dies, the policy allows their nominee to receive the money.

- **Annuity certain:** In this scheme, annuitants are paid the annuity for a certain number of years. They can pick this period, and in case of their death, their nominees can claim the pension.

- **With cover and without cover pension plans:** Pension plans with cover means the life of the policyholder is covered and upon his death, a lump sum amount is paid to his immediate family members, also known as nominees. The without-cover plan as the name suggests does not have life cover. If the policyholder passes away, then the nominee gets the corpus so built during the lifetime.

- **Guaranteed period annuity:** Guaranteed period annuity offers guaranteed return and ensures that immediate family members of annuitants get the benefits even after the death of the policyholder as along as the annuity is guaranteed.

- **Life annuity:** In the life annuity plan, the pension amount is paid to policyholder until their death. Policyholders can opt for with-spouse scheme, under which the spouse will get the pension amount in case the policyholder dies.

- **Pension funds:** Pension funds are regulated by the Pension Fund Regulatory and Development Authority (PFRDA) of India. These plans offer comparatively better returns at the time of maturity and remain in force for a substantial amount of time.

- **National pension system:** The National Pension System (NPS) is a pension programme the central government started in January 2004. Employees from public, private and even unorganised sectors, except armed forces,

can invest in this scheme. Under this scheme, people can invest in a pension account at particular intervals while they are employed. Post-retirement, they can withdraw a certain percentage of the accumulated amount, while the balance amount can be availed as a monthly pension.

4.2   Overview of NPS and intermediaries involved

NPS is an important milestone in the development voluntary defined contribution pension system

The NPS started with the government's decision to shift its employees who joined after April 1, 2004, from defined benefit pension to defined contribution pension. NPS is a voluntary and long-term contributory pension program the central government introduced under the PFRDA to ensure income security in the old age. It is aimed at inculcating among citizens a habit of saving for retirement and is an attempt to provide sustainable and adequate retirement income to each and every citizen. The scheme is portable across jobs and locations and enjoys tax benefits under Section 80C and Section 80CCD of the Income Tax Act.

Under the NPS, individual savings are pooled in to a pension fund. Professional fund managers regulated by the PFRDA invest this corpus in diversified portfolios comprising government bonds, bills, corporate debentures and shares, as per the approved investment guidelines. These contributions would grow and accumulate over the years, depending on the returns earned on the investments made. At the time of normal exit from the NPS, subscribers may either use the accumulated wealth to purchase a life annuity from a PFRDA-empanelled life insurance company or also withdraw a part of the amount as lump-sum, if they choose so.

NPS has unbundled Architecture, where each function is performed by different entity

The PFRDA is an authority set up by the Centre through an Act of Parliament in 2013 to ensure old-age income security by establishing, regulating and developing pension funds to protect the interest of subscribers to schemes of pension funds and for matters connected therewith or incidental thereto. It is the regulator for the NPS.

The NPS architecture consists of an NPS Trust, which is entrusted with safeguarding subscribers' interests; central record keeping agencies (CRAs), which maintain the data and records; point of presence (POP) and aggregators as collection and distribution arms; competing pension fund managers for generating and maximising returns on investments of subscribers; and custodian to take care of the assets purchased by fund managers and trustee banks to manage the banking operations. The entities involved in NPS are as follows:

NPS Trust: The National Pension System Trust (NPS Trust) was established by the PFRDA on February 27, 2008, by executing an NPS Trust Deed. The trust has been set up for taking care of the assets and funds under the NPS in the interest of the beneficiaries (subscribers). Individual NPS subscribers shall be beneficiaries of the trust. The NPS fund is managed by the Board of Trustees to realise and fulfil the objectives of the NPS Trust in the exclusive interest of subscribers.

CRA: The PFRDA has appointed the Protean eGov Technologies Limited and KFin Technologies (KFintech) Private Limited as CRAs (abbreviated Protean-CRA and KCRA, respectively) for the NPS. Both of them carry out the functions of record keeping, administration and customer service for all subscribers under NPS. They issue a permanent retirement account number (PRAN) to each subscriber and maintain data base of each PRA and record transactions under each PRAN. PFRDA granted Certificate of Registration (CoR) to Computer Age Management Services Ltd. (CAMS) in March 2021 to act as Central Record keeping Agency (CRA) for NPS.

Pension fund managers: Pension fund managers (PFMs) are intermediaries who are granted a certificate of registration as a pension fund by the PFRDA. They can receive contributions, accumulate them and make payments to subscribers in the manner as may be specified by the authority.

Trustee bank: The PFRDA has appointed Axis Bank Ltd. as the trustee bank for the NPS effective from July 1, 2013. As an intermediary, the trustee bank is responsible for the day-to-day flow of funds and providing banking facilities in accordance with the guidelines/ directions issued by the authority under the NPS. It receives NPS funds from all nodal offices and transfers them to the pension funds / annuity service providers/ other intermediaries as per the operational guidelines.

Annuity service providers: Annuity service providers (ASPs) would be responsible for delivering a regular monthly pension to subscribers after they exit from the NPS. The PFRDA appoints ASPs.

Point of presence: POPs are financial institutions who act as the first points of interaction for NPS subscribers within the NPS architecture. The authorised branches of a POP, called point of presence service providers (POP-SPs), act as collection points and extend a number of customer services to NPS subscribers.

Corporate head office: A corporate wishing to offer the NPS to its employees can join the scheme by registering as a corporate head office (CHO) through a POP. The various branches of the corporate can be registered as corporate branch offices (CBOs).

The Stock Holding Corporation of India Ltd. functions as the custodian for the NPS.

NPS architecture (for all citizens)

Source: PFRDA, CRISIL Research

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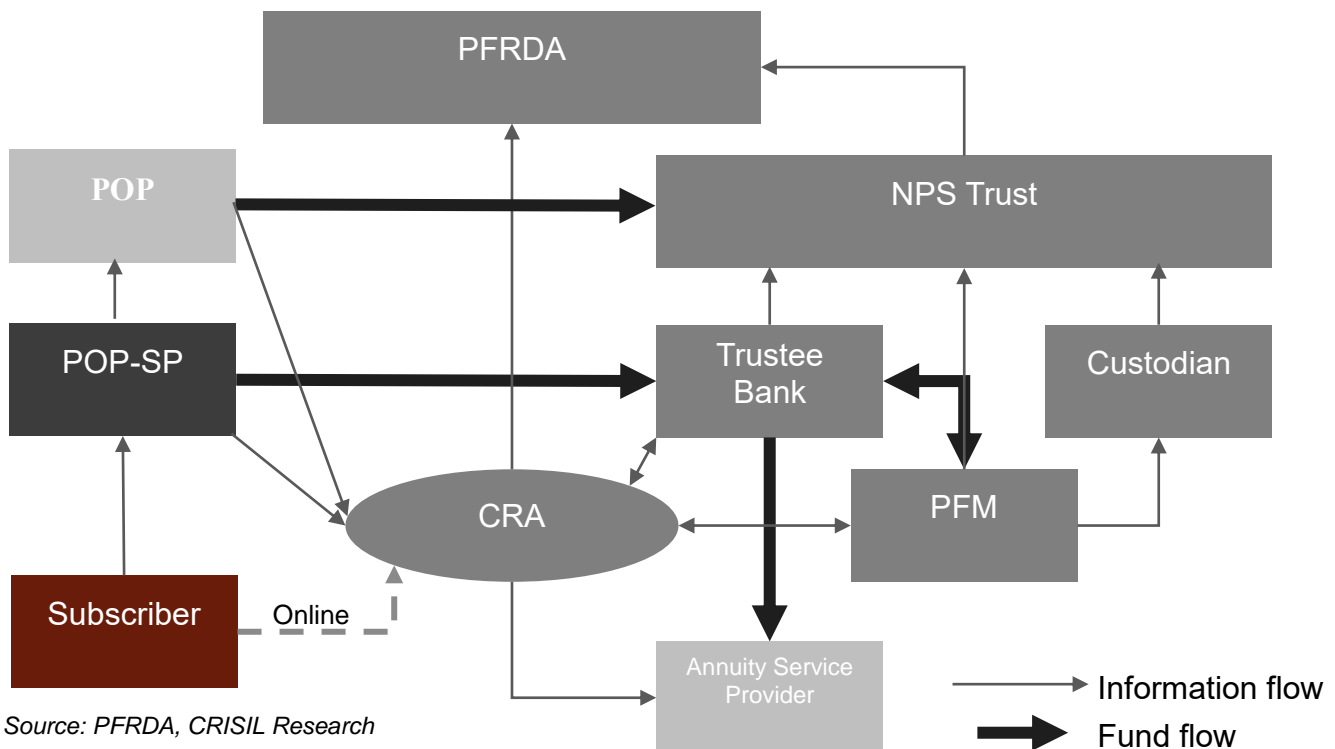
Central record keeping agency facilitation centre (CRA-FC) also play a role in NPS value chain. The CRAFC is the entity appointed by Protean to accept forms for subscriber registration. The entities appointed as CRA-FCs set up multiple branches across the country to provide services to POPs, POP-SPs, and nodal offices.

4.3 Overview of Central Record keeping Agencies (CRAs)

CRA acts as an operational interface between PFRDA and other NPS intermediaries

The CRAs are required to establish an internal system that complies with standards of internal organisation and operational conduct, with the aim of protecting the interests of NPS subscribers and their assets. It acts as an operational interface between the PFRDA and other NPS intermediaries such as pension funds, annuity service providers, the trustee bank, etc. Currently, Protean eGov Technologies Ltd. and M/s KFin Technologies Private Limited are carrying out activities of the CRA. From February 15, 2017, subscribers have an option to choose between the two entities. Interoperability functionality allows existing subscribers of NPS to shift from one CRA to the other from April 1, 2017, onwards. PFRDA granted Certificate of Registration (CoR) to Computer Age Management Services Ltd. (CAMS) in March 2021 to act as Central Record keeping Agency (CRA) for NPS. Following are the services the CRAs offer to subscribers:

● They register subscribers and allot unique PRAN.

● They issue PRAN card and user ID, I-PIN and T-PIN to access their websites and call centres.

● They maintain subscribers' permanent retirement account and facilitates creation of units in subscribers account as per contribution details and funds received from the nodal offices.

● At the end of every financial year, the CRAs send a physical transaction statement to subscribers with details of transactions in their permanent accounts. The statement as on March 31 of every year will be sent within two months, i.e. before May 31.

● They register grievances through Central Grievance Management System (CGSM, received through CRA system or through G1 form) and send the resolution details to subscribers via e-mails.

● They provide I-PIN-based login to their websites for subscribers to view their account details.

Steps taken by CRAs to increase accessibility and awareness of NPS

NPS subscribers can access their account through the NPS mobile application, which can be from the App store /Play store on the mobile phone and is offered by both the CRAs- Protean and KFintech. After downloading, the subscriber must key in the Permanent Retirement Account Number (PRAN) and PIN received with the PRAN welcome kit. Upon successful login, users can access their NPS account to use the basic services such as checking the total NPS holding value as on date (Tier I account and Tier II account holdings), last five transaction details, profile details such as registered mobile number, email id etc.

Protean conducts Subscriber Awareness Programs (SAPs) across India to increase awareness about NPS. Existing as well as prospective subscribers can attend these awareness Programs. Detailed information on NPS and its importance are explained to the attendees. The proposed schedule of such SAPs is available on the CRA's website. Protean also actively runs a YouTube channel with the name "NPS ki Pathshala" which has over 120 thousand subscribers and has video library of over 110 videos. Protean CRA also actively educate people on NPS through other social media platforms such as Facebook, Twitter, and Quora

CRAs' charges

The CRAs' charges include those levied for opening NPS account, annual maintenance of the account, processing contribution, change requests, withdrawal requests, sending statement of account and other requests such as re-print of PRAN card etc. Charges applicable for various services are given in the following table.

Charges levied by CRAs (in Rs)

Charge head*	Protean-CRA	KCRA
Account opening: Physical PRAN card- NPS	40.00	39.36
Account opening: ePRAN card - welcome kit in physical format- NPS	35.00	39.36
Account opening: ePRAN card - welcome kit via email only- NPS	18.00	4.00
Account opening- NPS Lite or APY^	15.00	15.00
Annual PRA maintenance- NPS	84.00#	57.63
Annual PRA maintenance- NPS Lite or APY	20.00	14.40
Charge per transaction- NPS	3.75	3.36
Charge per transaction- NPS Lite or APY	Free	Free

^APY- Atal Pension Yojna
* The charges are collected through redemption of units
#Annual PRA maintenance for Protean-CRA will change to Rs 69.00 from 1st October 2021
Source: NPS Trust, CRISIL Research

In case of government employees, CRA charges are paid by the respective governments. In case of subscribers from the private sector, Tier-I account opening charges can be borne either by Corporate or Subscriber, at the discretion of Corporate. Tier-II transaction charges are same as Tier-I, however it will be borne by subscriber only.

Number of transactions settled (in million)

Month	NPS Regular	NPS Lite	APY	Total
Dec-20	8.4	0.2	16.1	24.7
Jan-21	9.0	0.2	16.8	26.0
Feb-21	8.7	0.2	17.4	26.3
Mar-21	11.8	0.3	19.4	31.6
Apr-21	7.7	0.2	16.4	24.2
May-21	9.2	0.2	18.2	27.6
Total	54.9	1.3	104.2	160.4

Source: Company document

Assuming 110 million NPS regular transaction settled annually, the revenue generated by CRAs through transaction charges would amount ~Rs 400 million Revenue generated through annual maintenance charges and PRAN generation charges directly correlates to the number of existing and new subscribers. Considering number of subscribers under NPS regular and NPS Lite/APY by end of FY21 and number of subscribers with each CRA, expected revenue generated through annual maintenance charges for both CRAs combined would be ~Rs 1.7 billion.

4.4 Services offered through NPS portal

Range of online services offered by NPS portal has widened over the years

eNPS websites of both the CRAs offer wide range of online services. From opening a new account to exiting the NPS, almost all of activities can be performed online. Below are the key services that can be availed through the eNPS portals:

Registration: Users can open pension accounts under the NPS through the eNPS portal. Any Indian citizen of 18-70 years can open Tier-I or a combination of Tier-I and Tier-II account. Non-resident Indians (NRIs)/ overseas citizens of India (OCIs) can open only Tier-I account. To open a pension account through eNPS portal, the user has two options: i) The applicant must have an 'Aadhaar number' with a mobile number registered to it.; KYC in NPS will be done using Aadhaar through One Time Password (OTP) authentication. The user will be allotted a PRAN number on completion of OTP authentication. ii) Applicant must have a 'Permanent Account Number' (PAN), bank account with the empanelled bank for KYC verification for subscriber registration through eNPS. KYC verification will be done by the bank selected by the applicant during the registration process. In case the user has already submitted his/her registration request, the user may take a printout of the form or may eSign registration form.

Contribution: Contributions to Tier-I and Tier-II accounts can be done through the portal. Swavalamban accountholders can also make contribution through the website. CRA charges are applicable on such transactions and will be recovered separately by way of units deduction from subscribers' NPS accounts. The investment will made on the T+2 working days basis (subject to receipt of clear funds from PGSP).

Tier-II activation: Tier-II account is a voluntary savings facility. Subscribers can activate this account through the eNPS portal. All existing subscribers with an active Tier-I account can activate their Tier-II account through the site free of charge.

Same-day NAV (direct remittance or d-remit): Users can get same-day NAV (d-remit) for registration of virtual account number for making investment directly through their bank accounts. The same-day NPS investment (T+0) facility can be availed through the d-remit process (as per pre-defined cut-off time for receipt of funds at the trustee bank).

Change personal details: Subscribers can update their personal details such as mobile number, email address, and other personal details through the CRA portal by logging into to their account by using the user ID and password provided by the CRAs in their PRAN kit.

Change investment pattern: Eligible subscribers can modify their investment pattern (allocation of funds in various available asset classes) online. To avail the facility, users need to log in into their account.

Change pension fund: Eligible subscribers can change their pension fund (which manages the pension corpus) through the CRA portal. To avail this facility, users need to log in into their accounts.

Statement of transaction: The CRAs dispatch the statements of transaction (SOTs) in physical form to users' registered address once a year. A soft copy is also sent periodically to users' registered email addresses. However, subscribers can download their SoTs from the CRA portal.

Print ePRAN: The CRAs generate and dispatch the physical PRAN card to subscribers on the registered address once the registration formalities are completed. Users can download the ePRAN from the CRA portal. They can download the soft version of their PRAN in PDF and print it.

Online exit or withdrawal from NPS: In order to ensure timely exit/ withdrawal from the NPS, the CRAs send communication to the subscriber and nodal office six months before the date of superannuation/ reaching 60 years of age. The communication will initiate the withdrawal claim in the CRA system and generate a claim ID for each claim request. Subscribers can apply for withdrawal through the CRA portal using their user ID and I-PIN in the CRA system during the six months until the age of superannuation/ vesting date they have opted. While initiating the request in the system, subscribers should provide details such as percent of corpus they wish to withdraw, share of annuity in percentage terms, details of the annuity service provider, bank, and the nominee, etc.

Grievance redressal: As per the provisions of the PFRDA (Redressal of Subscriber Grievance) Regulations 2015, subscribers can raise their grievances for resolution through the Central Grievance Management System (CGMS). The grievances are directed to the concerned intermediary/ office for necessary action to be taken. The remarks provided by the entity concerned is intimated to subscribers over email. Subscribers can also view it online.

4.5   Trend in subscribers addition and asset under management (AUM)

AUM of NPS has advanced at a CAGR of 36.6% in last five fiscals

To address the longevity risks of workers in the unorganised sector and to encourage them to voluntarily save for their retirement, the Indian government announced a new scheme called Atal Pension Yojana (APY) in the Union Budget 2015-16. All unorganized sector workers can avail the APY, which is administered by the PFRDA through the NPS architecture. Protean eGov Technologies Ltd. is the only CRA managing the infrastructure of the APY in India.

Number of NPS, APY subscribers (in million)
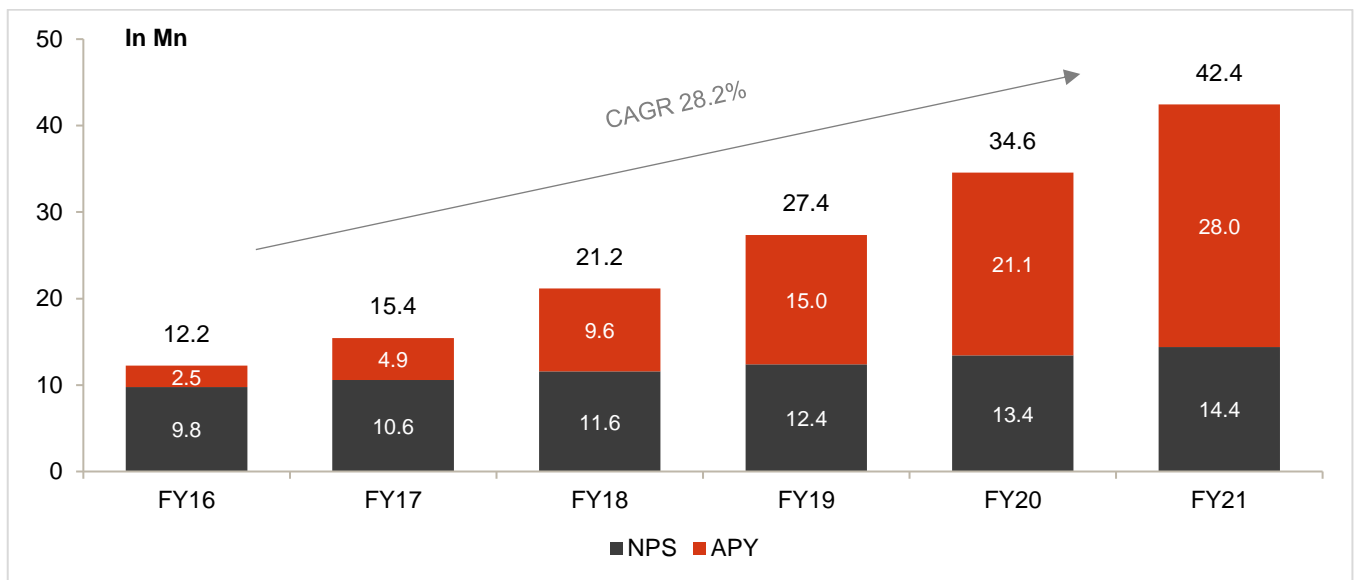
Source: PFRDA, CRISIL Research

The NPS has been made available to every citizen from May 1, 2009, on voluntary basis. More than 14 million have enrolled for the scheme ever since. In the past five fiscals, NPS subscriber base has grown at a CAGR of 8%. The APY has found traction right from the beginning. As the unorganised sector has a huge workforce, the number of APY subscribers is now double that of the NPS. However, given the country's huge population (the second largest after China) both the pension schemes stand grossly underpenetrated.

Assets under management of the NPS, APY (in Rs billion)

Rs bn

	FY16	FY17	FY18	FY19	FY20	FY21
Total	1,188.1	1,745.6	2,345.8	3,182.1	4,174.8	5,780.3
APY	5.1	18.9	38.2	68.6	105.3	156.9
NPS	1,183.0	1,726.7	2,307.6	3,113.5	4,069.5	5,623.4

CAGR 37.2%

■ NPS ■ APY
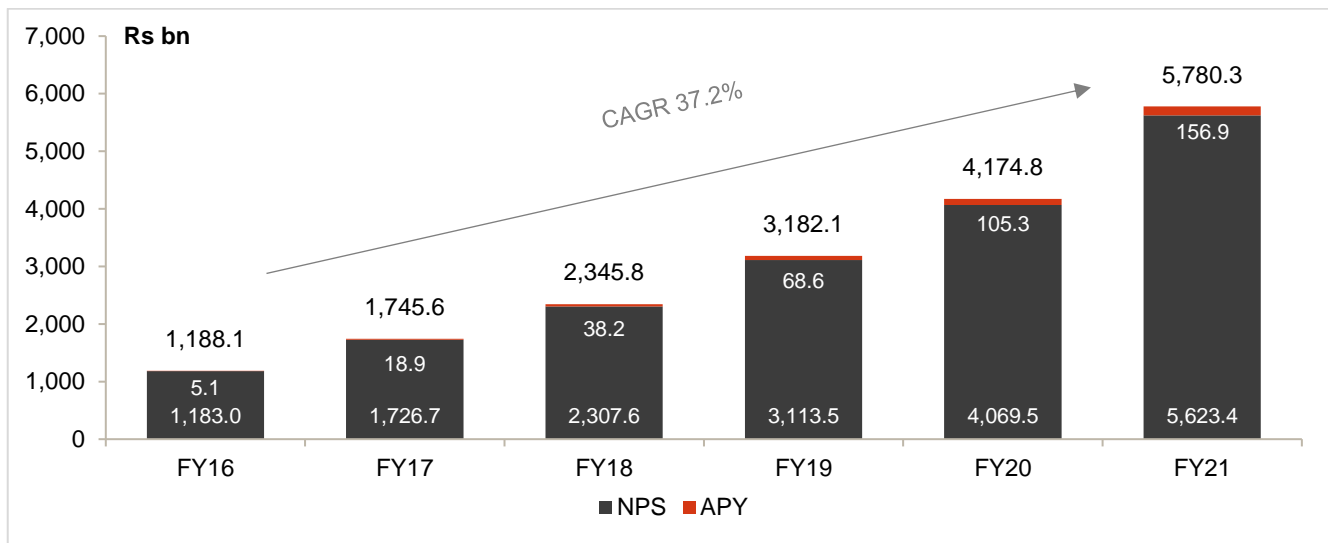
Source: PFRDA, CRISIL Research

Asset under management (AUM) of the NPS has been growing robustly. Over the past five fiscals, its AUM base clocked a CAGR 36.6%. The PFMs authorised by the PFRDA manage these assets. Although the number of subscribers under the APY is double that of the NPS, the ticket size in under it is very small. Hence, the AUM of APY is minuscule in comparison with that of the NPS.

Protean-CRA enjoys the lion's share under the NPS

Protean eGov Technologies Ltd. and KFin Technologies Private Ltd. abbreviated as Protean-CRA and KCRA respectively, act as central record keeping agencies (CRA) for NPS in India. As of May 21, Protean eGov Technologies Ltd. CRA (Protean-CRA) had a market share of 97% in terms of NPS subscribers and 99% in terms of NPS AUM in fiscal 2021. Protean-CRA dominates the NPS CRA market for both government and private sectors.

Number of subscribers, NPS (as of May 2021, in million)

In mn

	Central Government	State Government	Corporate Sector	All Citizen	NPS Lite/Swavalamban	Total
Total	2.2	5.2	1.2	1.7	4.3	14.6
KCRA			0.1	0.3		0.4
Protean-CRA	2.2	5.2	1.1	1.4	4.3	14.2

■ Protean-CRA ■ KCRA
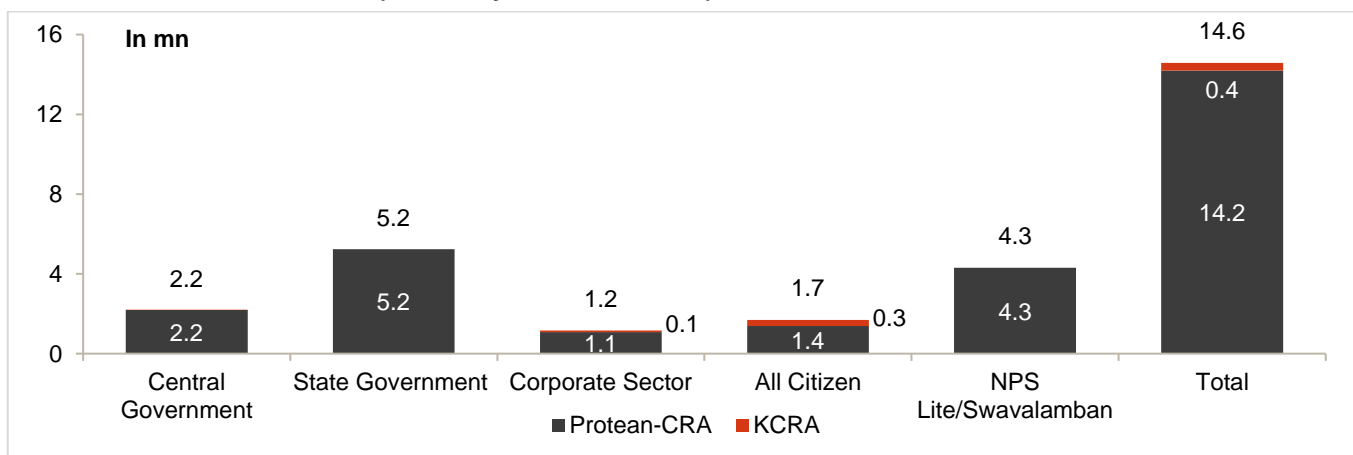
Source: Company document, CRISIL Research

Asset under management, NPS (as of May 2021, in million)
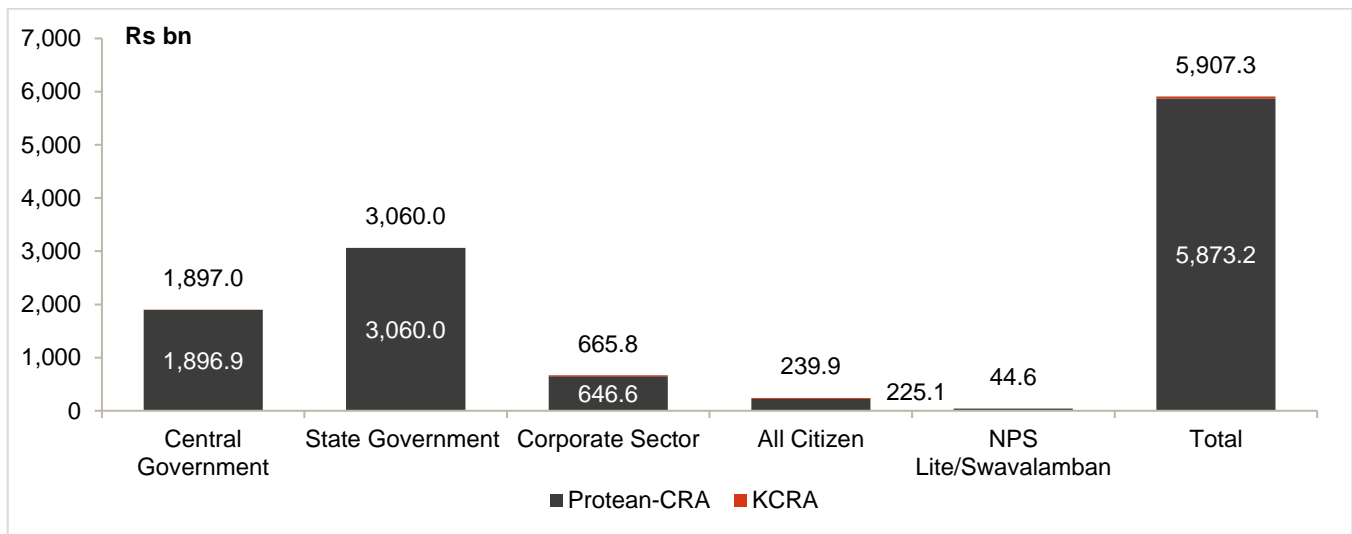
Source: Company document, CRISIL Research

4.6 Retirement plans in India

Industry has a diverse and complex variety of existing schemes

Apart from the government-instituted NPS and APY, there are other retirement plans available in the Indian market. This section briefly discusses these schemes.

Schemes by Employees' Provident Fund Organisation (EPFO)

The EPFO offers three retirement solutions – Employees' Provident Fund Scheme 1952 (EPF), Employees' Pension Scheme 1995 (EPS) and Employees' Deposit-linked Insurance Scheme 1976 (EDLIS).

The EPF scheme offers advances for various exigencies during the employment tenure and provides an accumulated corpus at superannuation. EPS offers lifelong pension to the accountholder and family. All employees eligible for the EPF scheme will also be eligible for EPS. EDILS provides insurance cover to family members in case of an unfortunate demise of the subscribed member.

The EPFO has witnessed tremendous growth in subscriber base, with more and more industries and establishments join in. As of fiscal 2019, its combined corpus of all three schemes stood at Rs 11,140 billion charting a growth of 12% CAGR from fiscal 2015. Membership count by end of fiscal 2019 was 229 million expanding from a membership base of 158 million in fiscal 2015. However, not all of these members were active members (contributing universal account numbers or UANs of past three wage months). In November 2019, the number of active members was ~45 million and the number of pensioners ~6.6 million. Net addition to total EPFO membership in fiscal 2020 was 7.8 million and fiscal 2021 was 7.7 million.

Public Provident Fund (PPF)

The PPF is a savings-cum-tax-saving instrument in India, introduced by the National Savings Institute. The aim of the scheme is to mobilise small savings by offering an investment with reasonable returns combined with income tax benefits. The investment duration in the scheme is 15 years. Thereafter, it can either be closed and the entire amount can be withdrawn or, if subscriber so wishes, extended for one or more blocks of 5 years each, with or

without making further contributions. The PPF is not pension- or retirement-specific vehicle as the amount parked in this account can also be used for other purposes, too. However, given the long investment duration, it is one of the preferred retirement investment choices. The scheme is fully guaranteed by the central government. The net savings under PPF accounts in fiscal 2018 was Rs 694 billion which grew from Rs 467 billion in fiscal 2015 logging a CAGR of 14%.

Private pension funds, and life insurance/ annuity plans

Private pension funds, and life insurance/ annuity plans are other available options for retirement planning. Private pension fund managers contributing to the retirement fund corpus include Max Life, Bajaj Allianz, HDFC Life, Reliance, and ICICI Prudential, among others. Ease of usage, application of innovative technology, better reach and increased industry competitiveness are significant growth drivers for this segment.

Comparison between NPS and other retirement options available

Features	NPS	PPF	New age retirement products (whole life ULIP)	Regular retirement product
Choice of multiple investment strategies to maximize the growth of fund value	Yes	No	Yes	No
Tax exemption on amount invested	Section 80 CCD (1B) up to 0.5 lacs and Section 80 up to 1.5 lacs	Section 80C up to 1.5 lacs	Section 80C up to 1.5 lacs	Section 80C up to 1.5 lacs
100% tax-free income on retirement for life	No	No	Yes	No
Flexibility to withdraw 100% fund value	No, partially withdraw up to 25% of self-contribution after 3 years	No, partially withdraw up to 50% of fund value	Yes, withdraw up to 100% of fund value any time after 5 years	No, withdraw up to 33% of fund value upon retirement
Tax-free fund value withdraw	No, withdraw up to 60% of fund value tax-free upon retirement	Yes, withdraw 100% of fund value tax-free	Yes, withdraw 100% of fund value tax-free	No, withdraw up to 33% of fund value tax-free upon retirement
Flexibility to increase/decrease income	No	No	Yes	No

Source: CRISIL Research

4.7 Outlook for NPS and APY

Growth prospects of both the pension plans continue to remain strong

India woke up to the issue of old-age income security much later than developed countries. The NPS started with the government's decision to shift its employees who joined after April 1, 2004, from defined benefit pension to defined contribution pension. While the scheme was initially designed only for government employees, it was opened up for all citizens in 2009. NPS enabled development of a sustainable and efficient voluntary defined contribution pension system in India. The government launched the APY in fiscal 2016 to provide pension facility to workers in the unorganised sector.

Apart from the APY and NPS, the other government-backed pension scheme available in India is the EPS, which can be availed by EPFO subscribers. Employees enrolled for the EPF will automatically be the subscriber of the

EPS, too. As of November 2019, the number of pensioners under the EPS was ~6.6 million, translating to ~6% penetration rate for the scheme among working age population (15-59 years of age).

As of fiscal 2016, combined penetration of the NPS and APY among the working age population stood at ~1.5%. With subscriber base of both the pension plans growing robustly, the combined penetration level as of fiscal 2021 crossed 5% mark. However, this is a gross under-penetration as just 1 out of 20 people has opted for the pension plan. Total number of subscribers for both the plans combined logged a CAGR of 28% over fiscals 2016-2021. AUM during the period clocked 37% CAGR. Given the under penetrated state of pension market combined with favourable demographic trend and overall economic growth, the outlook for acceptance of NPS and APY remain strong.

NPS, APY penetration (combined)
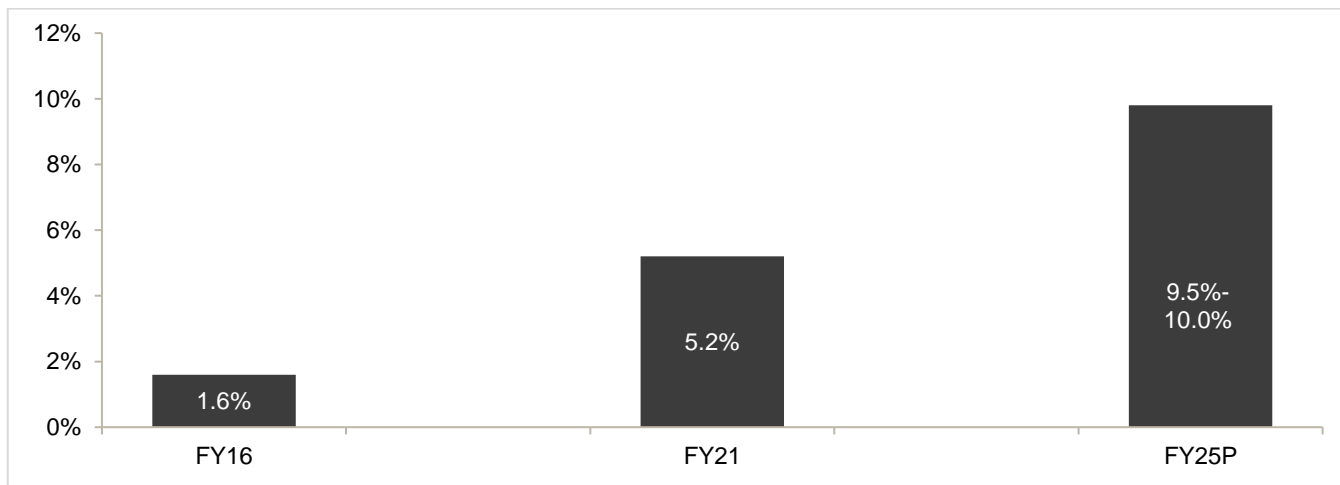
Source: CRISIL Research

If the combined penetration rate becomes twice from the current level by fiscal 2025, the number of subscribers and AUM expected to register a CAGR of approximately 18-20% and 33-36%, respectively

Number of subscribers for NPS and APY (in million)
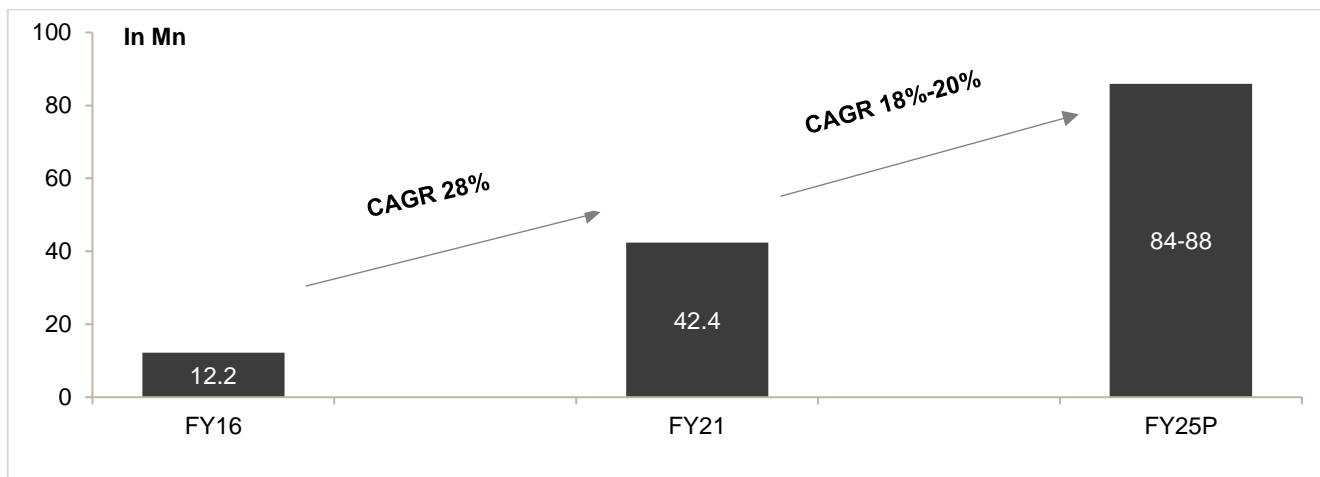
Source: CRISIL Research

Aggregate NPS, APY assets (in Rs billion)
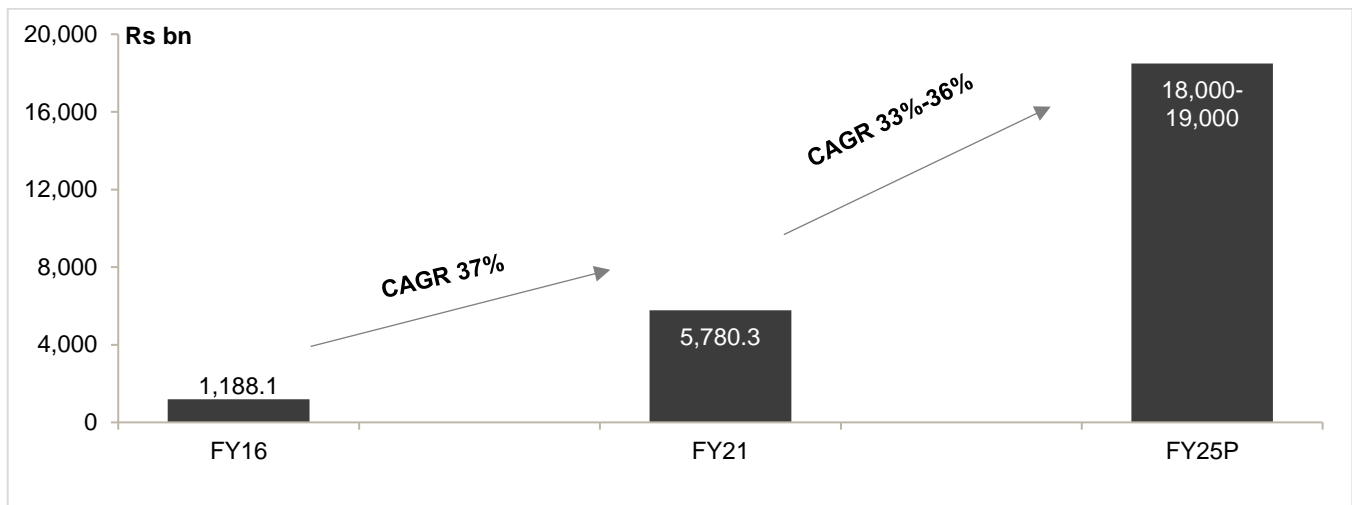
Source: CRISIL Research

4.8 Growth drivers for national pension system initiative

Government's push for widespread acceptance of NPS

The NPS has crossed some key milestones in the past few fiscals as its number of subscribers and AUM saw robust growth. However, these numbers are still minuscule given India's huge workforce. Considering the lack of social security net for most of the employed and the looming risk of under-funded retirement, the government tweaked the product several times to make it more attractive.

From a complex and heavily taxed product, the scheme has transformed into a more investor friendly one over the years. Relaxation in early withdrawal rules, flexibility to subscribers to stay on after 60 years of age and increase in tax exemption limit are some useful changes made by the government. Earlier NPS subscribers could withdraw only 40% of the corpus tax free. This government increased this to 60%. To make the on-boarding and transaction process hassle-free, the government introduced electronic account opening and direct remittance of contributions.

To make the scheme more competitive than PPF, NPS allows an additional deduction of Rs 50,000 under Section 80CCD (1B), over and above Rs 1.50 lakh that can be claimed under Section 80C. Additional tax benefit is available to subscribers under corporate sector, under section 80CCD (2) of Income Tax Act. Employer's NPS contribution (for the benefit of employee) up to 10% of salary (Basic + DA), is deductible from taxable income, without any monetary limit. Corporates can claim deduction on their contribution towards NPS up to 10% of salary (basic + dearness allowance) as business expense from their profit and loss account. Along with that, with certain limitations, the subscribers get the option to strategically allocate funds between equity and debt unlike PPF making the NPS investment option more attractive.

India's large young population base favourable for NPS penetration

Demographically, India is in a sweet spot today. With the median age of its population at 28 years, it is a young country (for China, this is 38). Of India's population, more than 60% is in the working age group. It is expected to remain so over the next decade as well. That's a formidable number, considering the country is the second-most populous in the world with ~1.38 billion people as of 2020 (as per the United Nations' World Population Prospects 2019). With increasing awareness of retirement products among the youth, NPS poses strong potential to penetrate further from current level.

Median age of South and Southeast Asian countries (2020)

Country	Median Age
Pakistan	23
India	28
Sri Lanka	34
China	38
Japan	48
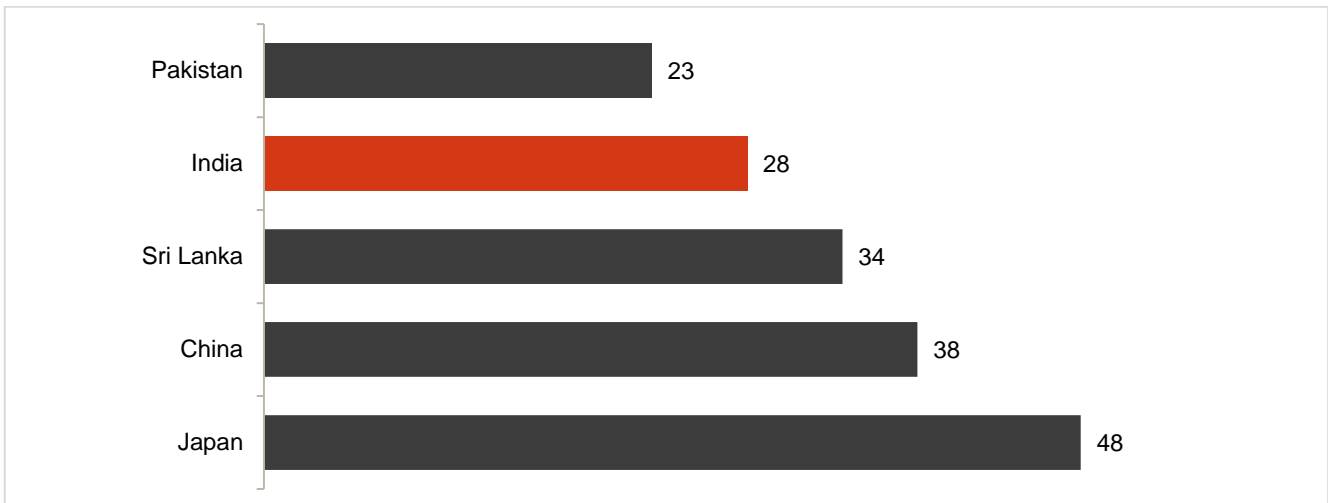
Source: United Nations' World Population Prospects 2019, CRISIL Research

India's age group wise population distribution

Age group	2010	2020	2030P	2040P	2050P
60+ years	7.8%	10.1%	12.6%	15.6%	19.5%
15-59 years	61.4%	63.7%	64.4%	63.7%	62.0%
0-14 years	30.8%	26.2%	23.0%	20.8%	18.5%
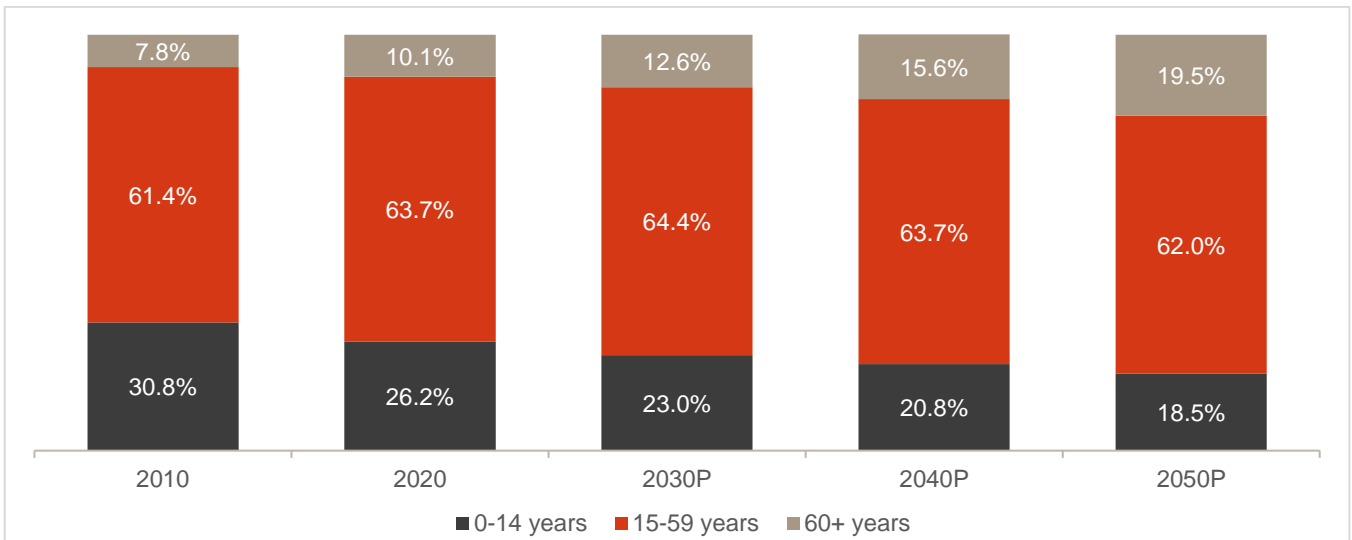
Source: United Nations' World Population Prospects 2019, CRISIL Research

In the next three decades, share of elderly will double

Buoyant as India's demographic profile appears today, the median age of its population is expected to increase to 38 by 2050 from 28 as of 2020. The population of the elderly – or those aged 60 and above – is expected to increase by ~180 million by 2050, logging a CAGR of 2.8%.

India's population above 60 years (in million)
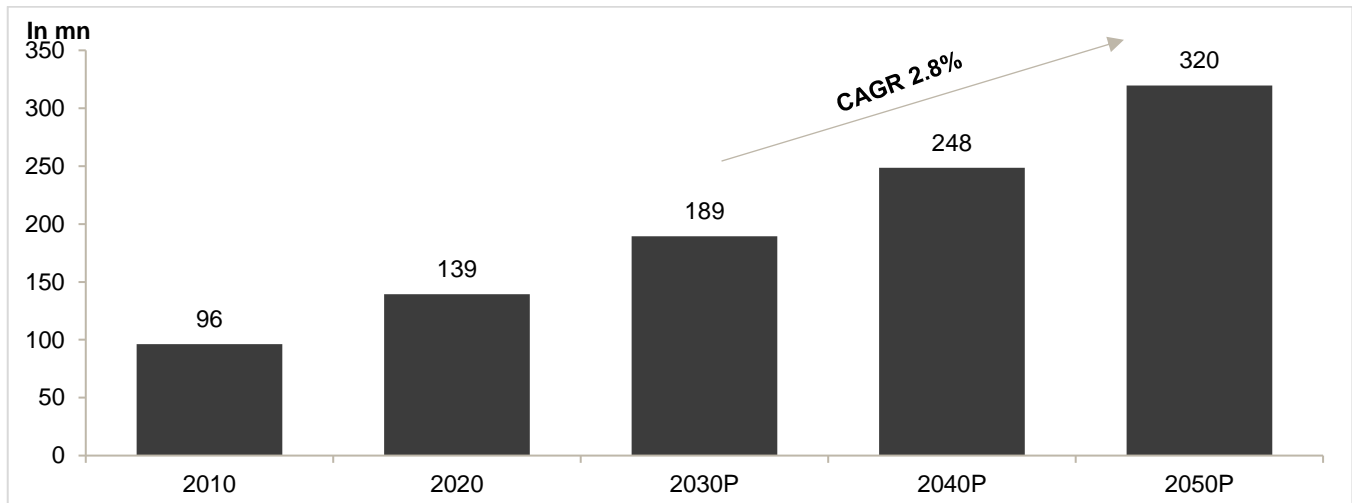
Source: United Nations' World Population Prospects 2019, CRISIL Research

With increasing elderly population, the old-age dependency ratio is expected to increase to over 30% by 2050 from 15% in 2020.

Old-age dependency ratio
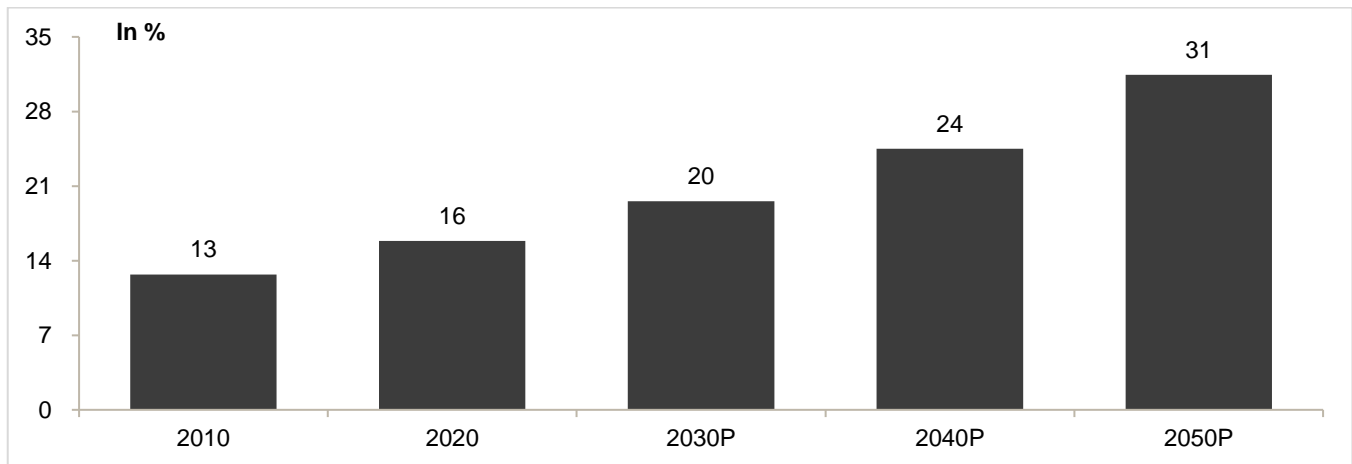
Source: United Nations' World Population Prospects 2019, CRISIL Research

Traditionally, Indians rely on family support in post-retirement years – a phenomenon termed as pillar zero in the World Bank's five-pillar pension framework. But this cushion is withering away as families go nuclear. Though life expectancy is lower compared with most Asian peers, a low retirement age in India lengthens the sunset period, bolstering calls for better pension planning.

Retirement age and life expectancy at 60 years

Country	Retirement age (men)	Retirement age (women)	Life expectancy at 60 years, 2020-2025	Life expectancy at 60 years, 2045-2050
Bangladesh	59	59	19.9	22.9
China	60	55	20.8	23.8
India	**58**	**58**	18.3	20.1
Indonesia	65	65	18.7	21.1
Japan	65	65	27.2	29.5

Country	Retirement age (men)	Retirement age (women)	Life expectancy at 60 years, 2020-2025	Life expectancy at 60 years, 2045-2050
Pakistan	60	55	17.8	18.4
Philippines	65	65	19.7	21.3
Republic of Korea	65	65	25.7	28.3

Source: United Nations' World Population Prospects 2019, CRISIL Research

India's pension market remains grossly underpenetrated at the moment. In 2003, the PFRDA was established with aim to promote, develop and regulate the pension sector in the country. The NPS introduced in 2004 was initially the default retirement scheme for central government employees but was extended to all citizens in 2009. As mentioned earlier, the government has amended the scheme many times to make it more lucrative for the masses. Demographically India's working age population base is expected to remain above 60% for one more decade. Given the government's push to pension products and favourable demography, the NPS is expected to gain more subscribers going forward.

Awareness of retirement planning among investors

One of the key mandates of securities markets regulators, which extend beyond their supervisory function, is to inspire confidence, strengthen infrastructure and improve participation rates in the securities markets. To examine, the ground realities, Securities and Exchange Board of India (SEBI) conducts investor survey. SEBI investor survey (SIS) 2015 was and potentially bridge this gap, SEBI Investor Survey 2015 (SIS 2015) was fourth iteration of a periodic SEBI investor survey. The survey was developed to identify and understand investor perceptions regarding investment choices and savings instruments and to probe further into the decision-making processes of non-investors, particularly by attempting to understand their non-participation in market instruments and their approaches to saving. Among many subsets for data collection, one group was subset of market participants (MPs). The MP survey included responses from a total of 1,016 respondents, 100 brokers, 311 Sub-Brokers, 305 Authorized Persons (AP), 90 Depository Participants (DP) and 210 Mutual Fund Agents (MFA) from across the country.

According to MPs, those engaging their services use it primarily for retirement. This might be an effect of the average age of investors using the services of financial intermediaries, that is, younger groups do not engage intermediaries and invest on their own, while those who do engage these intermediaries are older and this have a retirement focus. But this data shows a strong interest for retirement planning among people with above average age. With growing financial literacy, a large proportion of the population is expected to opt for beneficial pension programs such as NPS.

Reasons for clients to invest in securities markets*

Bar chart showing reasons for investing:
- Retirement: 293
- Capital Preservation: 279
- Capital Gains: 228
- Interest/ Dividend: 101
- Regular Income: 99
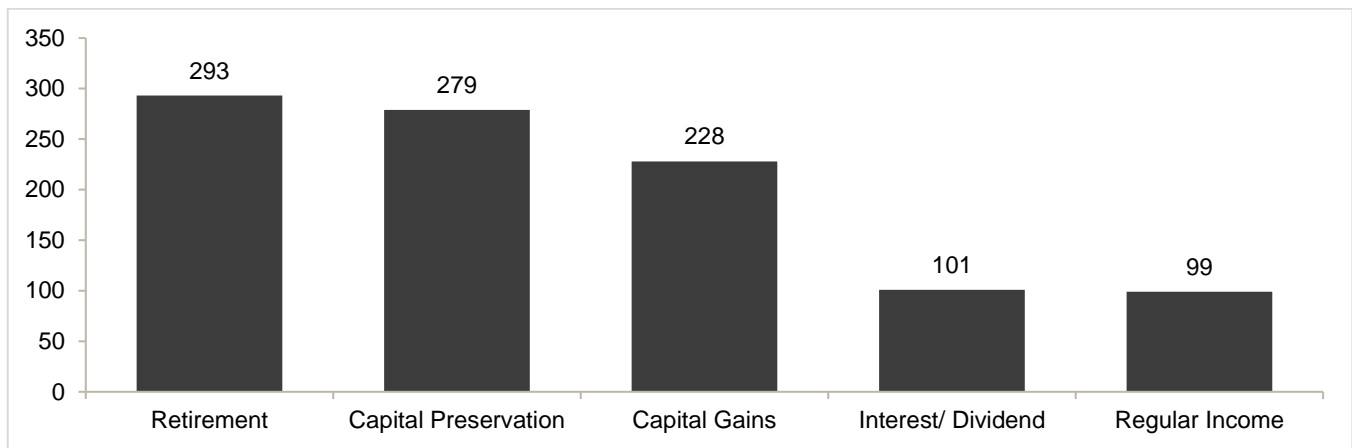
N = 1,016 (Market Participants)

Source: SEBI Investor Survey (SIS) 2015

Strong growth prospects for APY

Typically, pension systems across the world cover the formal or organised sector of the economy, while the informal sector is largely ignored. In developing countries, this is a bigger concern than the developed peers as workforce in the sector is much larger.

As the following chart shows, income of a regular formal worker is nearly four times that of a regular informal worker. Hence, formal workers get both higher pay and better social security benefits such as contribution towards pension. Informal workers usually have no buffer for retirement as their low pay doesn't allow them to keep any.

Organised, unorganised segment workers in India

In Rs

Grouped bar chart (2004-05 vs 2011-12):

Organised sector:
- All organised workers: 430 / 513
- Regular formal workers: 545 / 750
- Regular informal workers: 315 / 411
- Casual workers: 113 / 138

Unorganised sector:
- All unorganized workers: 109 / 166
- Regular informal workers: 144 / 205
- Casual workers: 90 / 143

Legend: ■ 2004-05 ■ 2011-12
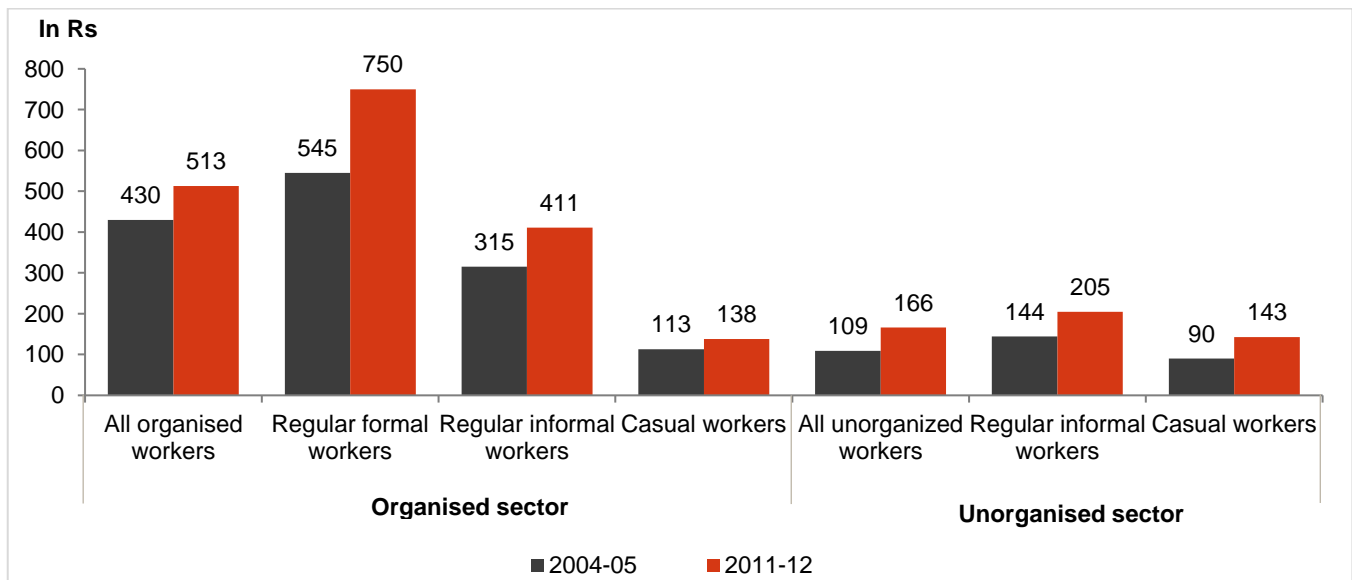
Source: ILO- India wage report

The finance minister in his budget speech in February 2019 had estimated unorganised sector workers at around 420 million workers. This includes street vendors, rickshaw pullers, construction workers, rag-pickers, agricultural workers, beedi workers, etc.

The APY was launched (announced in Union Budget 2015-16) to address their longevity risks and to encourage them to voluntarily save for their retirement. As of May 2021, the scheme has over 28 million subscribers, which forms of a small proportion of the workforce in the sector.

The APY has a simple structure, which makes it easy to understand for anyone who wants to open an account under the scheme. All major banks offer the product to their customers, making it accessible to anyone. The scheme offers guaranteed pension depending on the subscriber contribution and offers tax benefits too. Due to the benefits the scheme offers and the huge market to tap into, the APY has strong growth prospects.

5 Assessment of Aadhar authentication, e-KYC and e-sign in India

5.1 Overview of e-KYC and e-sign

E-KYC

Know Your Customer abbreviated as KYC is process under taken for the purpose of authenticating the identity and credentials of a beneficiary or a customer. e-KYC process often referred to a paperless KYC, is the process through which verification of customer credentials are done electronically. In India, e-KYC norms are laid down by Reserve Bank of India.

e-KYC services are majorly used in situations where service providers need to verify the authenticity of details provided by the customer. Following are the list services (non-exhaustive) where e-KYC is used for better delivery:

- Authentication for account opening at banks

- Authentication for new telecom connection

- Authentication for opening of investment account

- Authentication for credit disbursal by financial institutions

- Authentication for e-sign

E-sign

Electronic signature (E-sign) is a service through which electronic signing of documents can be done in easy, efficient and secured manner. E-sign is provided by authenticating signer using e-KYC services. Using this service any e-sign user can sign the documents electronically without the requirement for physical documents. This process would reduce turn around required for processing requests.

These e-sign would be effectively applicable in situations where requirement for signed copies to be submitted exists. Agencies who are obtain major benefit from e-sign services are those who accept large number of signed documents from their users. Following are services where E-sign service can create efficiency:

- Self-attestation for Digi locker

- Application for e-tax filing

- Application for account opening at banks

- Application for issue and reissue of passport

- Application for new telecom connection

- Application for various certificates such as birth, caste, marriage, income etc.

- Application for driving license renewal, vehicle registration

- Application for enrolment in exam or courses

- Submission of parliament questions by member of parliament

Note: Some of these use-cases may be under implementation or to be implemented in future.

5.2 Overview of e-KYC Authentication eco-system

Unique ID or electronic ID places a key role in e-KYC authentication system as it enables to verify data provided by the individual against existing data stored in repository maintained by public or private entity. Initially, in the e-KYC authentication process individuals provide ones Unique ID to the requesting entity through Authentication devices. The requesting entity then sends the Unique ID provided by the Individual to the service entities in an encrypted format. These service entities act as intermediaries between requesting entity and repository by providing infrastructure and secured connection to access repository database. Data received from services entities is cross-verified against existing data at the repository. Later, repository sends a authentication response or details for the unique ID provided based on service requested back to service entities which in turn flows to requesting entities.

Aadhaar based Authentication

In India, Unique Identification Authority of India (UIDAI) facilities the authentication through online using demographic and biometric data. The unique identification number (UIN) or Aadhaar which is assigned on an individual level helps in establishing the identity of individual to public or private enterprises. The implementation of the Aadhaar has led to a revolution in authentication and consequently in monitoring & security, credit ecosystems, payment systems, and direct benefit transfers (DBT).

Aadhaar Authentication services

Aadhaar authentication services which are used to validate user identity are divided into two types

- Yes/ No Authentication

- e-KYC authentication

Yes/ No authentication: UIDAI has started this service as of February 2012. Under these services the requesting entity would send demographic or biometric or One Time Password (OTP) of the Aadhaar holder to UIDAI in an encrypted format. UIDAI through its Central Identities Data Repository (CIDR) validates the details against data stored with it and returns a yes or no response

e-KYC based authentication: In this service, requesting entity would send the Aadhaar card holders demographic or biometric or One Time Password (OTP) to UIDAI in an encrypted format. After validation of the details against CIDR, UIDAI would send signed e-KYC authentication response which contains Aadhaar card holder e-KYC data in an encrypted format

Key stake holders involved in Aadhaar Authentication

Aadhaar number holder: It refers to an individual to whom Aadhaar has been under Aadhaar Act

Aadhaar service agencies (ASA)/ KYC service agencies (KSA): ASA/KSA are agencies that have established a secured connection with CIDR in compliance with standards set by UIDAI. These agencies offer UIDAI-connectivity network as a service to AUA / KUA. Entities that are appointed or to be appointed as ASA/KSA should comply with conditions under schedule B of Aadhaar act 2016. KSAs are ASAs using their network can provide access to e-KYC service.

Aadhaar user agencies (AUA)/ KYC user agencies (KUA): AUA/ KUA are requesting entities that use authentication to provide services to their customers. They interact with CIDR through ASA/KSA. (Either by

becoming ASA/KSA on its own or through entering into contract with other ASA/ KSA). KUAs are AUAs that provide access to e-KYC service to the end user.

Central Identity Data repository (CIDR): It is a centralised database by UIDAI in one or more locations and contains all the demographic and biometric information along with Aadhaar numbers of Aadhaar holders.

Overview of process flow for Aadhaar authentication
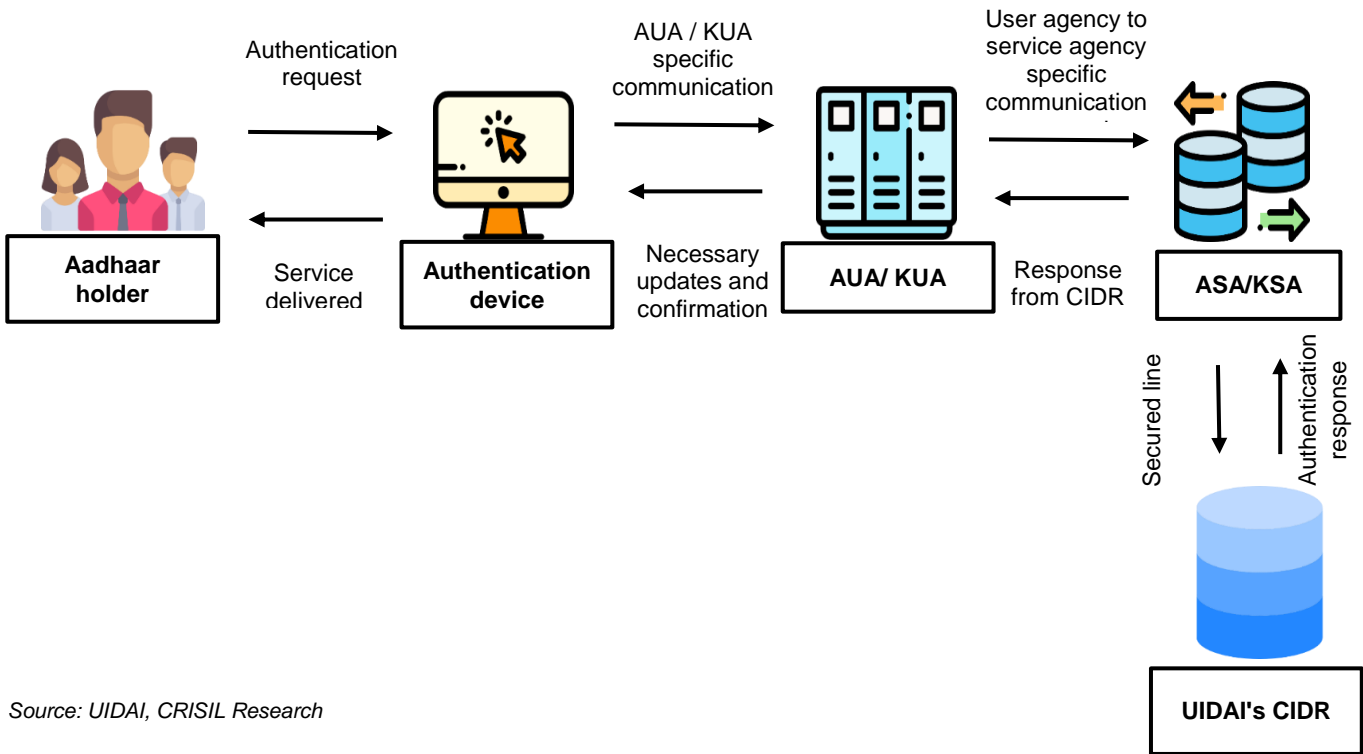
Source: UIDAI, CRISIL Research

Trends in authentication eco-system

Total cumulative authentications based on Aadhaar have reached from 56,139 million as of 3rd July 2021 with cumulative OTP mode authentications amounting to 160 million. Average daily authentication transactions reached 38 million in June 2021. Between the period August'20 and June'21 (both inclusive), average authentication transactions reached 1,087 million per month. During same period, average OTP mode of authentications have accounted for an average of 48 million per month

Trend of authentication transactions

Total number of ASAs / KSAs	Total number of AUAs	Daily average authentications (June 2021) in million	Monthly average authentications (Aug'20 to Jun'21) in million	Cumulative total authentications (In million)	Monthly average OTP authentications (Aug'20 to Jun'21) in million	Cumulative OTP authentications (In million)
29	235	38	1,087	56,139	48	160

Note:

AUAs are agencies that are requesting entities that provide service to the customer

ASAs/ KSAs are service entities providing secure connection between KUAs and UIDAI database

OTP is one of the modes of authentication (others include biometric, demographic)

Data is as of 3rd July 2021

Source: Aadhaar Dashboard, CRISIL Research

Top 3 ASAs/KSAs in terms of cumulative authentication as of 3rd July 2021

ASAs/ KSAs	Cumulative transactions (In Million)	% share
National Payments Corporation of India (NPCI)	18,060	33%
National Informatics Centre (NIC)	14,210	26%
Bharat sanchar nigam limited (BSNL)	4,613	8%

Note:

ASAs/ KSAs are service entities providing secure connection between KUAs and UIDAI database

Data is as of 3rd July 2021

Source: Aadhaar Dashboard, CRISIL Research

Monthly trend of authentication transactions in India
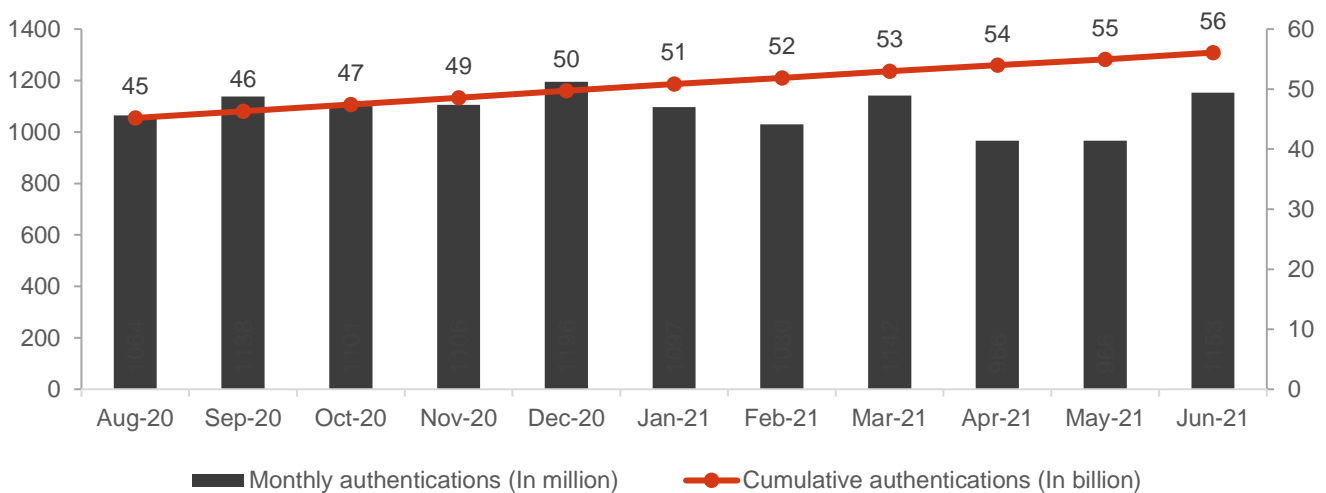
Note: Data is as on 3rd July 2021

Source: Aadhaar Dashboard, CRISIL Research

Number of cumulative e-KYC transactions in India have reached from 9,415 million as of June 2021 with average daily transactions amounting to 4 million in June 2021. Between the period August'20 and June'21 (both inclusive), average monthly e-KYC authentication transactions reached 97 million per month

Trend of e-KYC transactions

Total number of ASAs / KSAs	Total number of KUAs	Daily average e-KYC transactions (June 2021) in million	Monthly average e-KYC transactions (Aug'20 to Jun'21) in million	Cumulative total e-KYC transactions (In million)
29	205	4	97	9,415

Note:

KUAs are agencies that are requesting entities that provide service to the customer

ASAs/ KSAs are service entities providing secure connection between KUAs and UIDAI database

Data is as of 3rd July 2021

Source: Aadhaar Dashboard, CRISIL Research

Monthly trend of e-KYC transactions in India
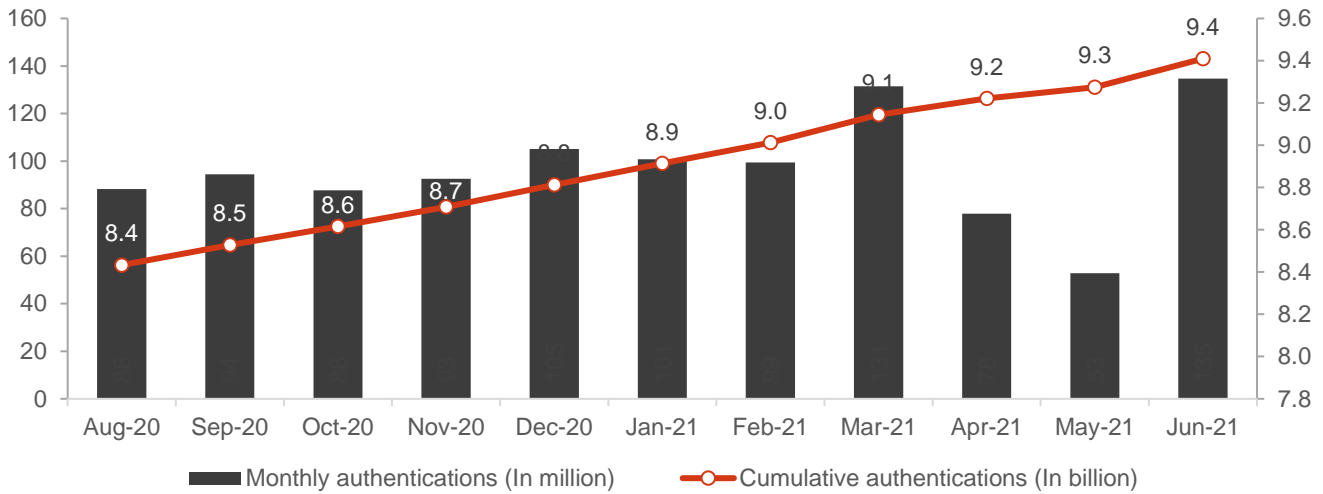
Note: Data is as on 3rd July 2021
Source: Aadhaar Dashboard, CRISIL Research

Benefits of e-KYC

Cost reduction

e-KYC being an electronic based authentication system, reduce the necessity of managing documents as in paper based authentication system. Also, e-KYC requires less man power when compared to older ways authentication. Being electronic based and requiring lesser man power would in turn reduce the cost generated by the company.

Instantaneous

The process of e-KYC is completely done online which enables real time the transfer of data during the KYC process. This means manual intervention that is required is minimal. Due to this, e-KYC process would be completed in minutes whereas the manual KYC process would take weeks to be done.

Prevention of fraud

During the E-KYC, UIDAI shares the demographic and biometric details of the individual for whom the request is raised. These data is shared through secured channels eliminating the chances of data manipulation thereby reducing malpractices such as fraud, identity fraud etc.

Improved operational efficiency

In this age of digital technology, Institutions under the necessity to go digital in order to better customer experience and improve regulatory compliance. Integration of e-KYC into businesses would reduce the turnaround required for on-boarding a customer and provide customer support easy and accurate manner. This in turn would improve operational efficiency of the company.

5.3 Overview of authentication service agencies (ASA) / KYC Service Agency (KSA)

ASA/KSA generate revenue from rendering of services for AUA/KUA

ASA/KSA is an entity that provides connectivity through a secure network to UIDAI data centers which helps in transmitting requests from one or more AUA/KUA to the data centers. ASA/KSA generate revenue from providing following services:

- Software for AUA or KUA on application service provider basis

- Charges for per record AUA services at a nominal fee (ASA/ KSA fee + UIDAI charges+ taxes)

- Charges for per record KUA services at a nominal fee (ASA/ KSA fee + UIDAI charges+ taxes)

- Auditing of AUA/ KUA systems and providing certificate for the same

- Annual fee charged on AUA/ KUA

List of ASAs and their presence across Aadhaar based services

List of ASAs	AUA	KUA	E-sign
A.P food and supplies department	✘	✘	✘
Bharat Sanchar Nigam Llimited (BSNL)	✔	✔	✘
Bharti Airtel	✔	✔	✘
CDAC	✔	✔	✔
CeG Governemnt of Karnataka	✔	✔	✘
Central depository services Ltd.	✘	✘	✘
Computer Age Management services Ltd.	✔	✔	✘
CSC e-governance India	✔	✔	✔
Department of IT Govt of Bihar	✔	✔	✘
Department of Science and technology	✔	✔	✘
DIT Government Of Maharastra	✔	✔	✘
DoIT&C government of rajasthan	✔	✔	✘
Fino paytech limited	✔	✔	✘
I.T.I Limited	✔	✔	✘
Idea cellular limited	✔	✔	✘
Karvy data management serives Ltd.	✘	✘	✘
M.P. Madhya Kshetra Vidyut Vitaran Co. Ltd.	✔	✔	✘
Mastercard India Services Pvt. Ltd.	✔	✘	✘
National Informatics Centre (NIC)	✔	✔	✘
National Payments Corporation of India (NPCI)	✘	✔	✘
Protean eGov Technologies Ltd.*	✔	✔	✔
Railtel Corporation of India Ltd.	✔	✔	✘
Reliance Corporate IT Park Ltd.	✘	✘	✘

List of ASAs	AUA	KUA	E-sign
Softcell Technologies Limited	✘	✘	✘
Telenor (India) Communication Pvt. Ltd.	✔	✔	✘
UIDAI	✘	✘	✘
UIDAI internal system monitoring	✘	✘	✘
Videocon Telecommunications Ltd.	✘	✘	✘

Protean eGov Technologies Ltd. was also appointed as a registrar by the Unique Identification Authority of India (UIDAI) to facilitate registration of residents for Aadhaar

Source: Aadhaar dashboard, CRISIL Research

List of cumulative number of authentication transactions by ASA

Entity name	Cumulative number of transactions (In mIllion)	% share
National Payments Corporation of India (NPCI)	18,060	32.6%
National Informatics Centre (NIC)	14,210	25.6%
Bharat Sanchar Nigam Limited (BSNL)	4,613	8.3%
CSC e-governance India	3,151	5.7%
Bharti Airtel	2,342	4.2%
Protean eGov Technologies Ltd.*	2,335	4.2%
DoIT&C government of Rajasthan	1,867	3.4%
UIDAI internal system monitoring	1,549	2.8%
Idea cellular limited	1,332	2.4%
Reliance Corporate IT Park Ltd.	1,322	2.4%
A.P food and supplies department	1,260	2.3%
Mastercard India Services Pvt. Ltd.	1,245	2.2%
Department of Science and technology	627	1.1%
Railtel Corporation of India Ltd.	284	0.5%
CeG Government of Karnataka	227	0.4%
DIT Government Of Maharashtra	180	0.3%
Department of IT Govt of Bihar	172	0.3%
Computer Age Management services Ltd.	152	0.3%
Telenor (India) Communication Pvt. Ltd.	148	0.3%
CDAC	98	0.2%
Central depository services Ltd.	77	0.1%
Karvy data management serives Ltd.	59	0.1%
UIDAI	57	0.1%
M.P. Madhya Kshetra Vidyut Vitaran Co. Ltd.	50	0.1%
Fino paytech limited	31	0.1%
Videocon Telecommunications Ltd.	19	0.03%
Softcell Technologies Limited	10	0.02%

Entity name	Cumulative number of transactions (In mIllion)	% share
I.T.I Limited	0.2	0.0004%

Note: Data is as of 3rd July 2021

Protean eGov Technologies Ltd. was also appointed as a registrar by the Unique Identification Authority of India (UIDAI) to facilitate registration of residents for Aadhaar

Source: Aadhaar dashboard, CRISIL Research

5.4 Overview of e-sign eco-system

Integration of E-sign can be done with various service delivery applications to ease digital signing of documents by obtaining verification through e-KYC of e-sign user. Authenticated responses received against e-KYC services with respect to e-sign users is used to apply the digital signature.

In the e-sign process, Application service provider (ASP) which provides e-sign as a service would send the request raised by the end user to the e-sign provider (ESP). Upon receiving the request from ASP, e-sign provider invokes the request for e-KYC of the end user through e-KYC service provider. Authentication of end-user details are done through biometric or One Time Password (OTP) received on mobile. On authentication, ESP sends the end user request along with e-KYC verification details to Certifying authority for obtaining certification. Based on e-KYC details received, certifying authority issues Digital Signature Certificate (DSC) which is then sent to ESP. Once received, ESP forwards the certificate to the end user for acceptance. After the acceptance, electronic signature is created and is attached to the document electronically.

Key stake holders in e-sign eco-system

End user: Individual request for e-sign procedure and under scope of IT act an end user shall also be 'applicant/e-Sign User for digital certificate'

Application service provider (ASP): Uses e-sign as a service to digitally the sign documents. These providers get into contract/ agreement/ undertaking with e-sign providers

E-sign provider: It provides e-sign service and is a "trusted entity" as per schedule two of Information technology act. An e-sign provider must be either a certifying authority or must be in agreement with the certifying authority to provide digital certificates for the end user

Certifying authority: For creating an electronic signatures, end user needs to obtain Digital Signature Certificate (DSC) from the certifying authority (CA). These certifying authorities are licensed by the Controller of Certifying Authorities (CCA) under the Information Technology (IT) Act, 2000. Before a CA issues a DSC, the end user must be verified through E-KYC.

e-KYC service provider: e-KYC service provider would validate the details of the end user against already existing details in UIDAI's CIDR repository.

Control of certifying authorities (CCA): Issues licenses and regulates the Certifying Authorities (CA).

Overview of process flow for E-sign
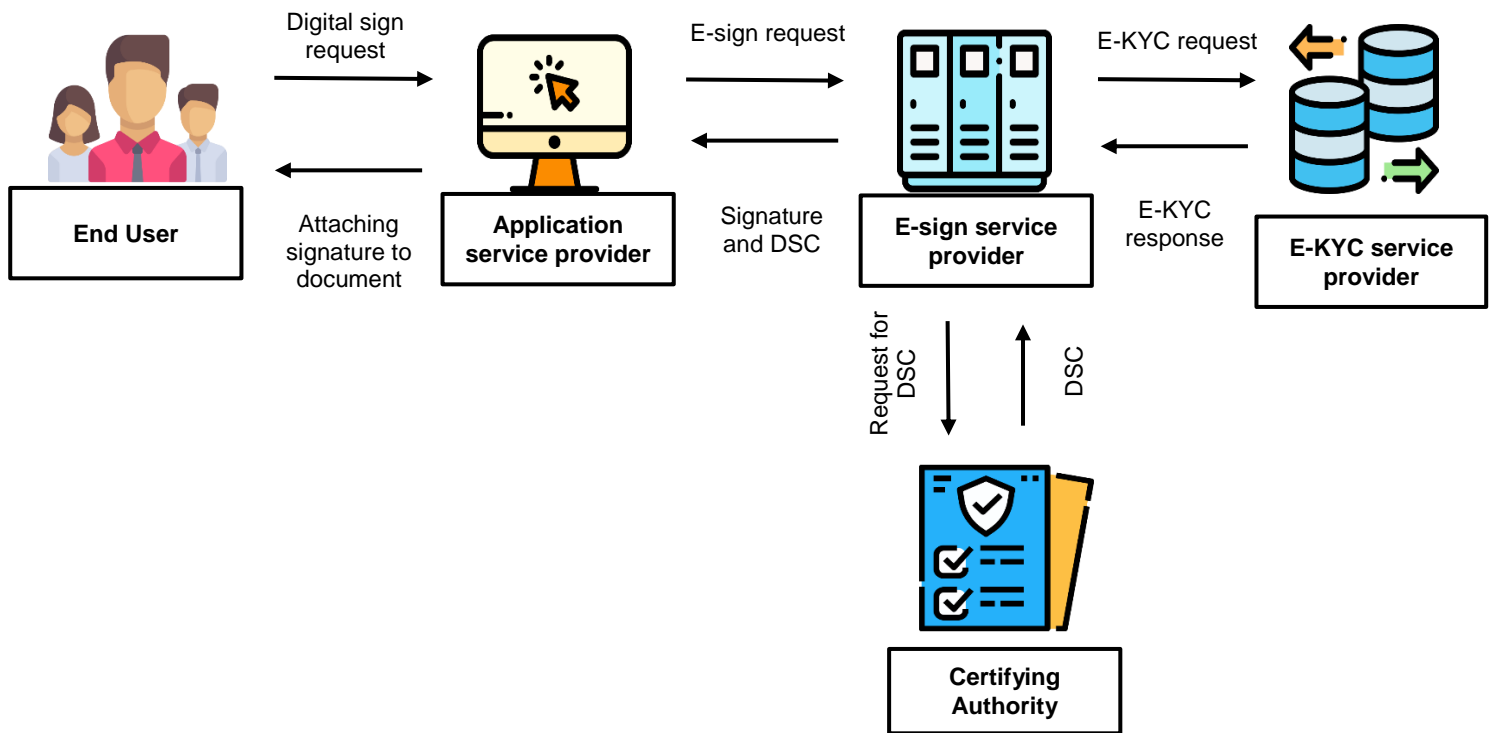
Source: Controller of Certifying Authorities, CRISIL Research

List of e-Sign providers in India

List of empanelled services providers
Protean eGov Technologies Ltd.
Safescrypt, Sify Technologies Ltd.
(n) code solutions
eMudhra Limited
Centre for Development of Advanced Computing (C-DAC)
V-sign, Verasys Technologies Private Limited
IDsign, QCID Technologies Pvt Ltd.
Panata sign, Pantagon Sign Securities Pvt Ltd.
CSC e-Governance Services India Limited
CDSL ventures Ltd.
Capricorn Identity Services Pvt. Ltd.
RajCOMP Info Services Ltd.

Source: Controller of Certifying Authorities, CRISIL Research

Potential of E-sign

The major value proposition of e-sign is to enable an Aadhaar or PAN card holder to sign a document at any time, from anywhere and through any device. Users can affix their electronic signature on a digital document by authenticating through E-KYC services or biometrics. The advantage of E-sign is extended not only to individual customers but also businesses and enterprises. In Indian context, e-sign forms a key element in Government of India's, Digital India Program.

E-sign facilitates its providers a means to move from paper based signature by integrating e-sign service within their applications and thus forming a key component in paperless environment. Financial Institutions are currently using e-sign to in order process various services such as account opening, credit disbursal and on-boarding new employees etc. From an organisation standpoint, e-sign can enhance the ease of doing business. It can improve the customer and vendor on-boarding process and perform online transactions with an ease. This can reduce cost involved and fasten the turnaround thus improving the overall experience.

In India, E-sign services are provided by third party service provides licensed under the IT act and are governed by e-authentication guidelines making them secure, advantageous and cost-effective method.

E-sign also acts a viable option for development of E-governance infrastructure and its penetration. E-governance is a platform where various services offered by the government are conducted through online channel. In such online transaction and services, E-sign is used to authenticate and authorise transactions with end users, while maintaining security and confidentiality. In addition to that, current systems, where physical presence is required for authentication, are not completely suitable for mass adoption. However, with growing internet penetration, a service such as e-sign can be scalable for a large set of population in providing fully paperless E-governance services and increasing efficiency of government services. Financial institutions can also provide various services online by using e-sign for authentication in turn increasing number of digital transactions.

Overview of Digital signature certificate (DSC)

Digital signature certificates are equivalent form of physical or paper certificates in a digital format. These certificates contain user information such as demographic details, data of issuance of certificate and name of issuing authority. Digital certificates presented in an electronic formed can be further used to prove ones identity while availing services over internet or to sign documents digitally (e-sign). In India, Certifying Authorities (CA) have been granted license to issue digital certificates under section-24 of Indian IT,2000. The validity of digital certificate can one year to two year and can be renewed further on expiry.

List of Digital signature certificate providing agencies

List of empanelled services providers
IDRBT certifying authority
Safescrypt, Sify Technologies Ltd.
(n) code solutions
eMudhra Limited
Centre for Development of Advanced Computing (C-DAC)
IDsign, QCID Technologies Pvt Ltd.
Panata sign, Pantagon Sign Securities Pvt Ltd.
CDSL ventures Ltd.
CSC e-Governance Services India Limited
Capricorn Identity Services Pvt. Ltd.
Protean eGov Technologies Ltd.
RajCOMP Info Services Ltd.

List of empanelled services providers
Indian Air Force
Indian Army
V-sign, Verasys Technologies Private Limited

Source: Controller of Certifying Authorities, CRISIL Research

Classes of DSCs

Based on the type of applicant and purpose of application for DSC, one can obtain class of DSC suitable. Below are the list of DSC classes issued by the certifying authorities.

Class 1 Certificates: These certificates are issued to individuals and business personals. They are used to assure the authenticity of information provided by the subscriber in the application by validating it with authorized databases. Class 1 certificates are used for assurance where the risk level is low.

Class 3 Certificates: Class 3 certificates are high assurance certificates issued to both individuals and organisations. For these certificates to be issued individuals have to appear in person before the certifying authorities Relevance for these certificates is primary where risk is very high and security plays a vital role.

Note: As of 1st January 2021, Controller of certifying authorities (CCA) has discontinued the issuance of Class 2 certificates and Class 3 certificates are issued in place of Class 2.

5.5   Growth drivers for authentication transactions

Aadhaar enabled e-KYC to reduce the physical paper submissions required

Aadhaar verification lies at the center of availing many financial services in the country. These verification were time consuming and involved lot of paper based submissions earlier. However, UIDAI has launched electronic KYC mechanism to verify the Aadhaar card holder. This provides quick verification of Aadhaar holder credentials and majorly reducing the cost of paper based verifications. Seamless authentication and e-KYC services have led to a growth in the credit economy through simple and easy authentication processes based on Aadhaar.

In addition to this, UIDAI has introduced Aadhaar paperless offline e-KYC verification for areas where online e-KYC may not be possible. Same as online e-KYC, this process also enables users to establish their identity in paperless manner. e-KYC being an electronic based authentication system, reduces the necessity of managing documents as in paper based authentication system, leading to a reduction in carbon footprint

As these services are majorly based on usage of electronic devices such as mobile phones etc,, reduces the physical paper submissions and in turn reducing the cost involved.

Direct benefit transfer scheme to aid further growth in e-KYC requirement

The major aim of Direct Benefit Transfer (DBT) lies in transferring of subsidies provided by the government directly to bank accounts of the beneficiaries. Through this scheme, government envisages to reduce the delay in payments and accurately target beneficiaries. Aadhaar based services have ensured accurate targeting of the beneficiaries by reducing frauds, enabled portability, eliminated diversion of Public Distribution System benefits, reduced manual intervention, ensured faster delivery of LPG cylinders, and facilitated access to digital services of the government. In order to reduce the leakages and duplication, these targeted beneficiaries are authenticated using Aadhaar e-KYC as Aadhaar acts as unique identity for its holder. Jan Dhan account, Aadhaar and Mobile

(JAM) act as the major pillars for this program. With issuance of JAM, the government was able to improve its focus to provide easy access of banking facilities and enhance ability to digitize transactions. This expanded use of digital payments by the government for welfare and served as the launchpad for DBT.

As of FY21, government has transferred Rs. 4.3 trillion under 318 scheme which has grown at a CAGR of 47% from FY16. Going forward, increase in number of beneficiaries would further propel the requirement for e-KYC processes and e-KYC infrastructure.

Amount of DBT over the years
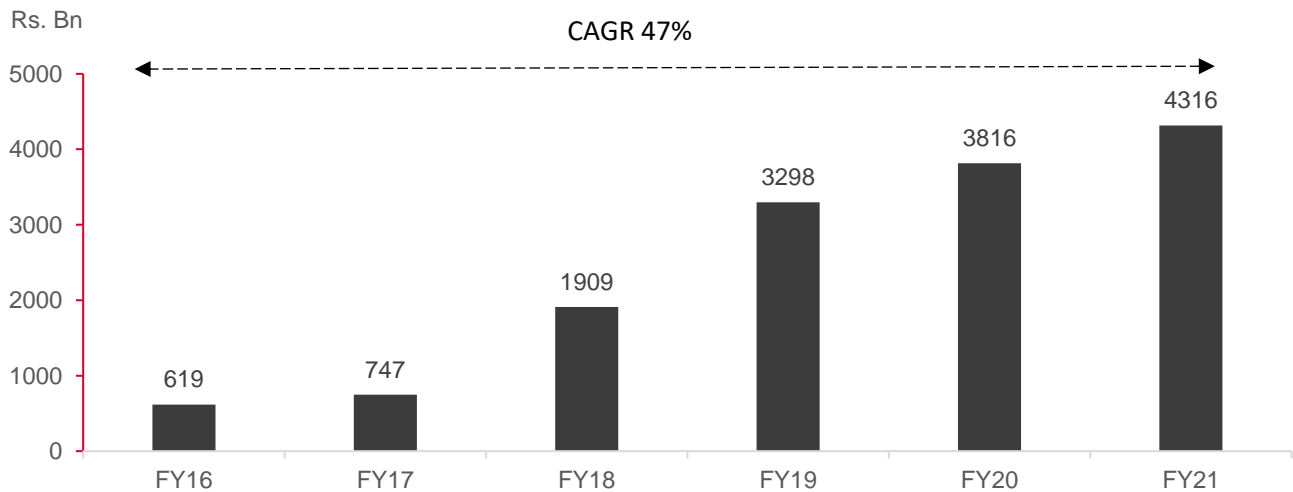
Source: DBT, CRISIL Research

Increasing digital transactions to drive the e-KYC infrastructure growth in the country

Lead by change in consumer behavior caused due to demonitisation in the country, the number of cash transactions as a % of total transactions have seen a gradual decline over the years. As of 2020, most of the transactions occur digitally due to ease of performance and convenience. Digital transactions have seen a rise from 36% of total transactions in FY16 to occupying a large pie of 92% in FY21. In volume terms, number of digital transactions have increased from 6.3 billion in FY16 to 40.9 billion transactions in FY21 at a CAGR of 45.0%. Moving forward, CRISIL research estimates digital transactions to grow at a CAGR of 22-24% between FY21-25 reaching 92.3 billion transactions by FY25

In addition, UPI transactions have grown at a tremendous pace of 122% CAGR from FY17 reaching 22.3 billion transactions by FY21. Other digital payments transactions such as NEFT and IMPS have also grown strongly at a CAGR of 10% and 27% from FY16 to FY21.

Aadhaar based services including e-KYC and e-Sign have assisted in shift from being a cash-dominated economy to a digital one. Most of digital payments such as UPI are linked to bank accounts which in turn require e-KYC process to be completed creation. In addition, to support digital payments and increase the financial inclusion in rural part of nation, Government of India has introduced Aadhaar enabled payment system (AePS) through which one can use Aadhaar linked bank account to process the transaction. For one to make payments through AePS, e-KYC is required. Financial inclusion in India is on rise. As per Reserve Bank of India's (RBI) Financial Inclusion (FI) Index survey, the annual FI-Index for fiscal 2021 is 53.9 as against 43.4 for fiscal 2017.

Financial Institutions are currently using e-KYC and e-sign in order to process various services such as account opening, credit disbursal and on-boarding new employees etc. This service, enhances the ease of doing business

as it improves the customer & vendor on-boarding process and perform online transactions with ease. It reduces cost involved and fastens the turnaround time for processing of services. Going beyond payments Aadhaar stands to play a central role in enabling the consent architecture for data sharing under the Account aggregator framework leading to democratisation of credit through Open Credit Enablement Network (OCEN).

In future, growth in digital transactions coupled with government efforts are likely to increase financial inclusion which would drive the demand in e-KYC space for processing of applications.

Percentage share of digital transactions over the years
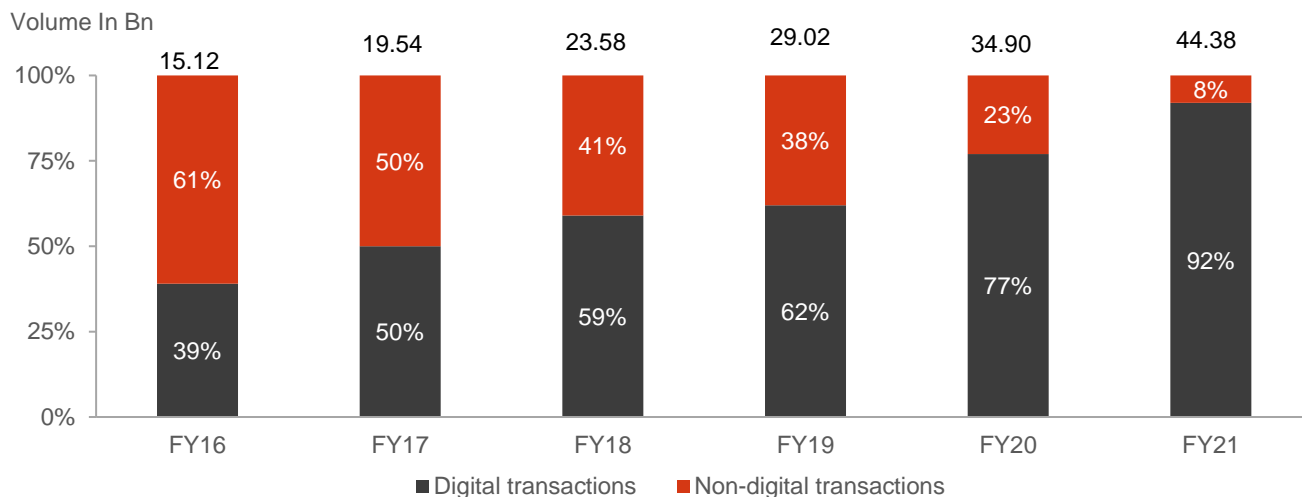
Note:
Digital transactions include RTGS – excluding interbank clearing, ECS, NEFT, IMPS, NACH, cards and prepaid instruments; Non-digital transactions include cheques/paper clearing and ATM transactions. Amount above each bar indicates volume of transactions in the year. Amount above each bar indicates total volume of transactions in that fiscal year.
Source: RBI, CRISIL Research

Digital transactions volume over the years
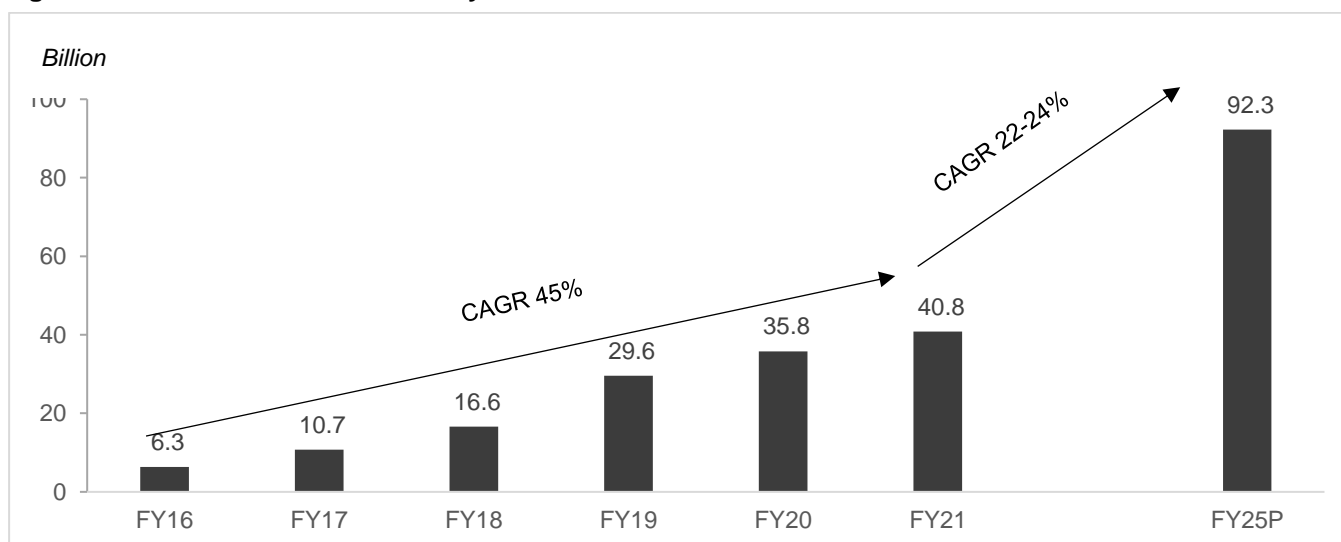
Note:
Digital transactions includes RTGS – excluding interbank clearing, ECS, NEFT, IMPS, NACH, cards and prepaid instruments
P: Projections
Source: RBI, CRISIL Research

Trend in volume of payments for NEFT, IMPS and UPI

In billion

CAGR 10%   CAGR 27%   CAGR 122%

NEFT: 1.3, 1.6, 1.9, 2.3, 2.7, 3.1

IMPS: 0.2, 0.5, 1.0, 1.8, 2.6, 3.3

UPI: 0.02, 1, 5, 13, 22

■FY16 ■FY17 ■FY18 ■FY19 ■FY20 ■FY21
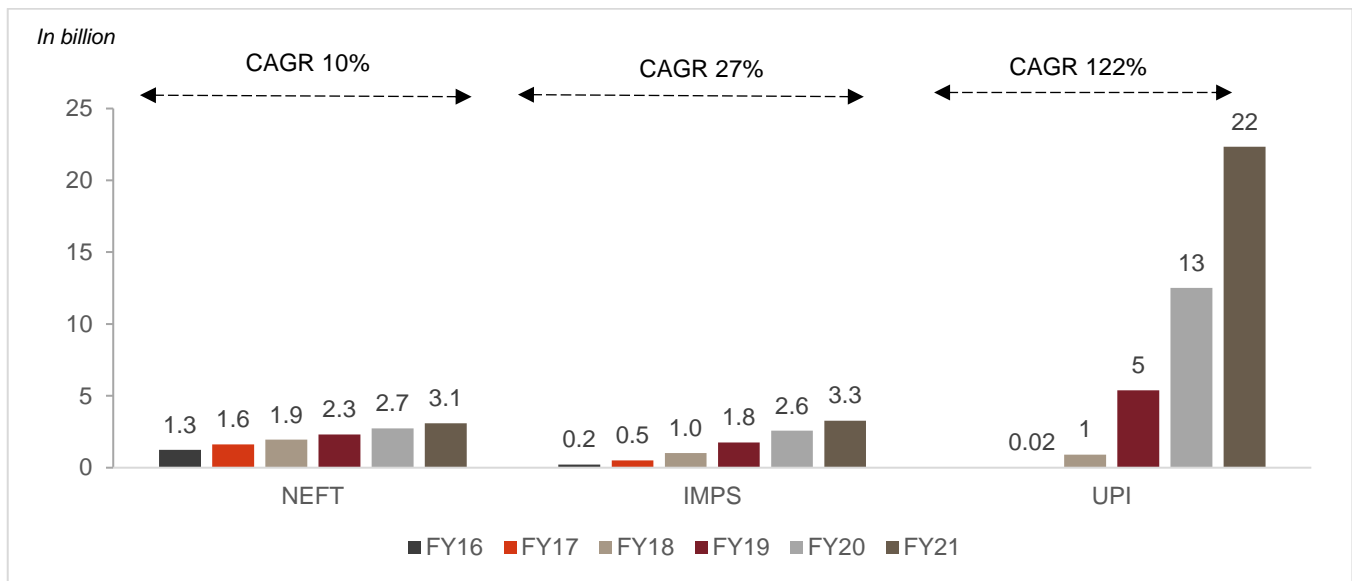
Note: CAGR mentioned for UPI is from FY17 to FY21 (4-year range) as UPI was introduced on 11th April 2016

Source: RBI, CRISIL Research

Growth in Digital economy to further push the need for e-KYC and E-sign infrastructure in the country

Technology plays a vital in the development of an economy and provides a cost effective solution for government solutions to untapped regions. Through Digital India Initiative, Government of India plans transform India into digitally empowered economy. As economy moves towards digitisation, necessity arises for higher security needs especially in banking and investments space.

e-KYC being a better way to authenticate an individual's identity playing a vital role in this process. In addition to this, E-sign can also be used to digitally sign the documents concerning to government bodies, banking and financial institutions, educational institutions etc which would reduce time and cost involved. Development of infrastructure facilities for these e-KYC and E-sign services would further support growing digitisation in the country.

Requirement for authentication by various institutions likely to drive the growth in future

Number of authentications transactions have seen a growth over the years as it plays a major role for financial institutions in verification of individual identity.

Aadhaar authentication helps the credit disbursal agencies to easily validate documents provide by the beneficiary. As Aadhaar is necessary document to be submitted for availing of loan, authentication helps checking if duplicate proofs have been submitted thus reduce the operational risk for the entity. It also reduces the turn-around time required to avail the loan. Similarly, asset management companies opt for Aadhaar authentication for investments such as mutual funds which would provide easy and secure on-boarding of investors in less time frame.

In addition to these, it also has vital importance government initiatives such as Direct Benefit Transfer (DBT) and National Mission on Financial Inclusion.

Going forward, further growth in these spaces would in turn lead to raise in requirement for development in authentication infrastructure in the nation.

Authentication transactions over the years
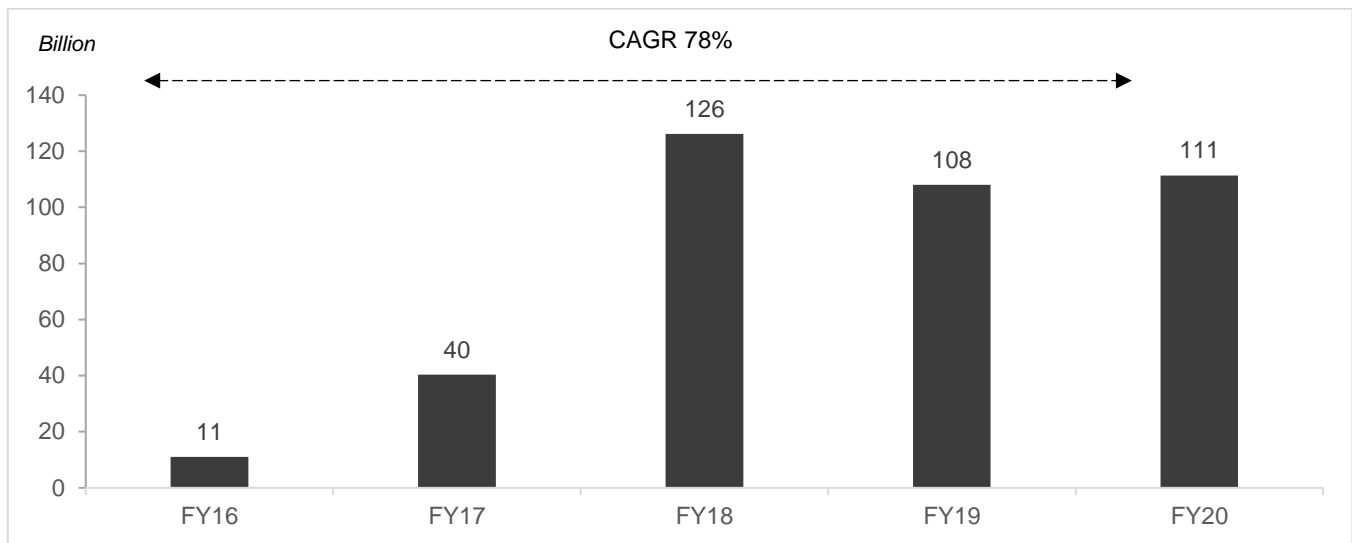
Note: Above values include transactions from both yes/no authentication as well as e-KYC authentication
Source: UIDAI annual report, CRISIL Research

Impact of pandemic on digital payments

Pandemic has increased the pace of digital transformation of payments ecosystem in India. It not only propelled the use of technology based but also increased the number of product offerings in digital mode. Though number of digital payments saw a dip during the lockdown (2.4 billion transactions/month in April 2020), increased preference for contactless transactions during rest of the period has pushed to look for cashless alternatives. In addition to this, fintech players increased adaption to end-user needs digital payments has propelled the growth in digital payments reaching 4.5 million transactions/month by April 2021 (91.4% Y-o-Y growth).

Further to enable, growth of digital transactions Reserve Bank of India (RBI) has also introduced 24*7 RTGS as of December 2020. Going forward, increase in digital payments is likely to create demand for e-KYC infrastructure.

Monthly trend in digital transactions volume (Jan'20 to Mar'21)
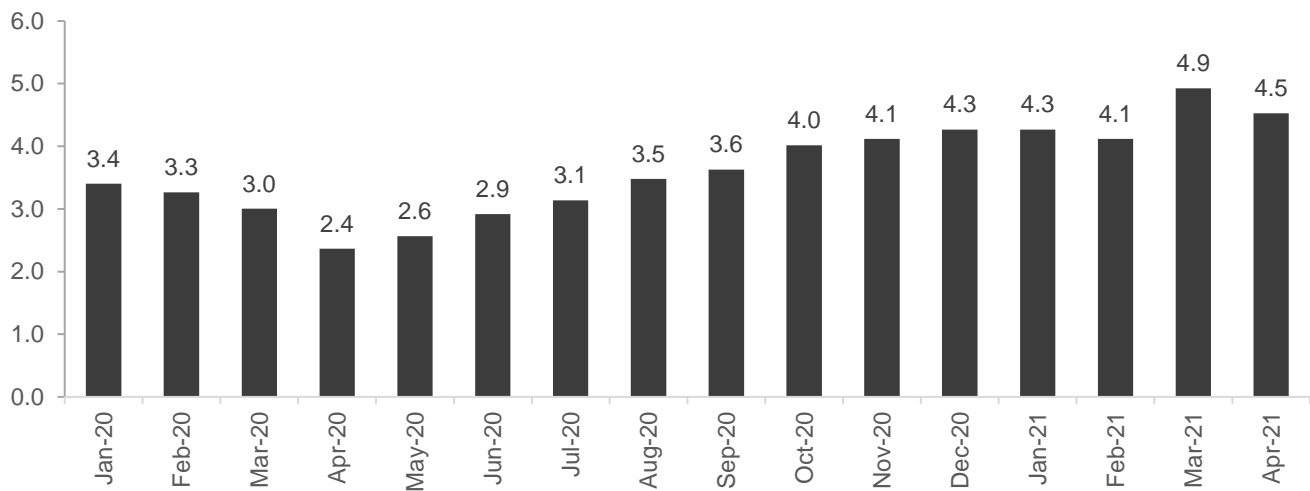
Source: RBI, CRISIL Research

Increasing digitals payments penetration to further boost requirement for authentication infrastructure

Digital payments lie at the core of digitalisation in the country, making it vital to understand its growth over the periods. In order to capture this, RBI has developed a Digital Payment Index (DPI) covering wide range of payment ecosystems in India. It helps in understanding the penetration of digital payments across the country. In development of DPI, RBI has assigned five parameters with each having sub-parameters and weights assigned to it signifying the importance in payments ecosystem. With March, 2018 as base period (=100), DPI has increased to 153.47 as of Mar 2019 and 207.84 as of Mar 2020 depicting the increasing penetration of digitals payments.

However, bank accounts linked to these payment interfaces require regular authentication done to reduce the occurrence of fraudulent activities creating necessity for better authentication facilities such as e-KYC to be in place.

Trend in Digital penetration Index (DPI)
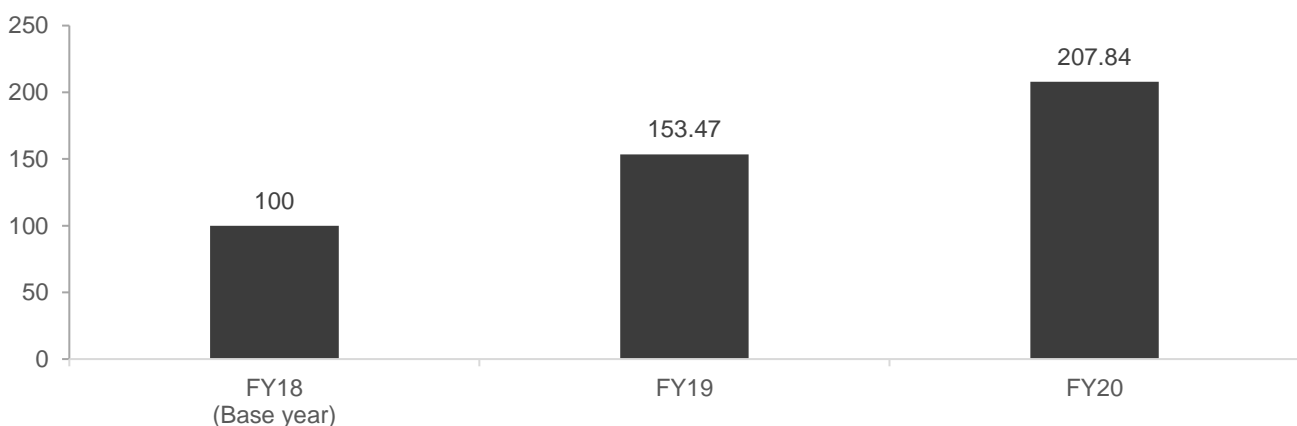
Source: RBI, CRISIL Research

Aadhaar based credit disbursal system to support the future growth in e-KYC infrastructure

Aadhaar Bridge Payment System (ABPS) is setup National Payments Corporation of India (NPCI). It is a unique payment system that uses Aadhaar or Unique Identity issued by UIDAI and IIN (Institution Identification Number)

issued by NPCI to provide government subsidies and benefits to Aadhaar Enables Bank Accounts (AEBA) of beneficiates.

ABPS also serves the goal of inclusion in rural economy of India. It further enables, transformation of large number of retail payments done into electronic mode thus serving the purpose of digital transformation. Number of credit transfer to beneficiaries through ABPS have grown at a CAGR of 61.9% from Rs. 61 billion in FY15 to Rs. 1,106 billion in FY21. In volume terms, ABPS transactions have grown at a CAGR of 42.9% from FY15 reaching 1,433 million transactions by FY21

Going forward, with increase in financial inclusion and government taking measure to provide subsidies and benefits, creates a further dependence on e-KYC process for eliminating duplication, identity theft etc and in turn creating a demand for e-KYC infrastructure.

Trend in ABPS transactions (In Rs. Billion)
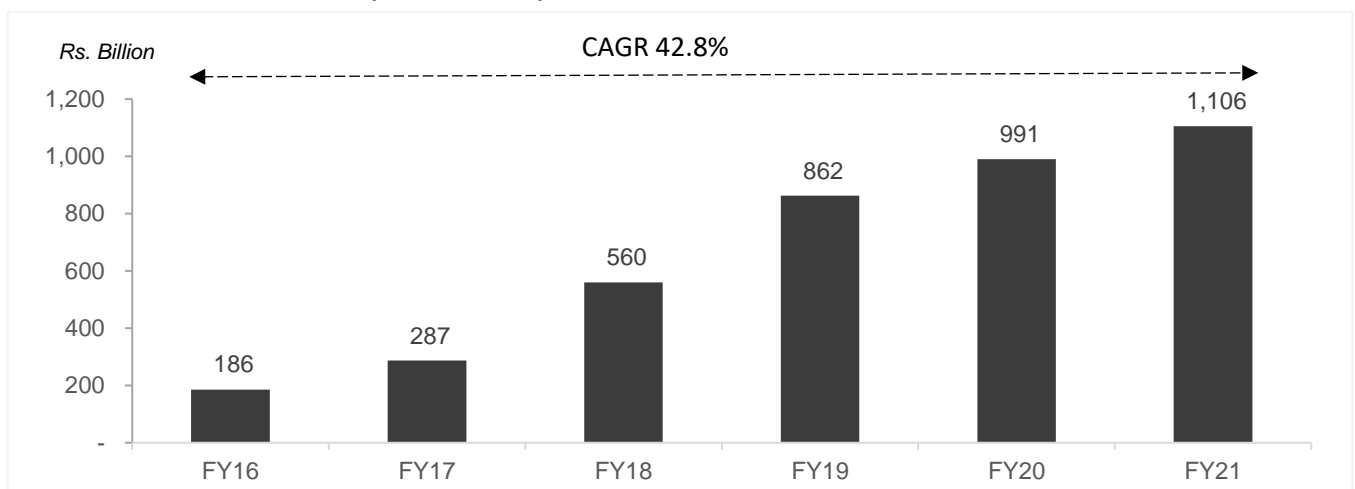
Source: National payments Corporation of India (NPCI), CRISIL Research

Trend in number of ABPS transactions (In millions)
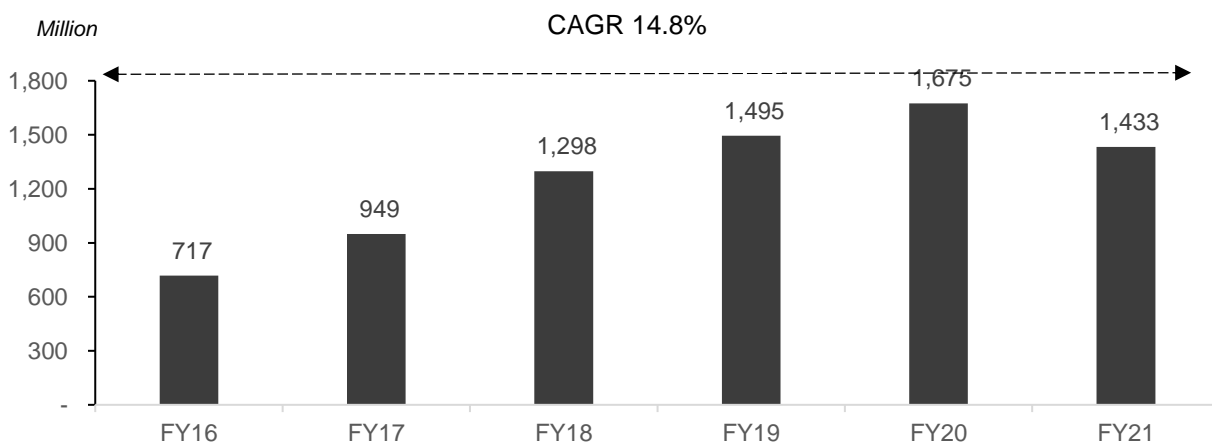
Source: National payments Corporation of India (NPCI), CRISIL Research

Umbrella Entity for Retail payments to pave growth in e-KYC segment

Growth of Fintech companies in India are dependent upon penetration of digital usage, which in turn depends upon the infrastructure required, financial literacy and awareness among the population from both supply and demand prospects and having security protocols in place for data privacy and protection. Recent initiative by reserve for

setting up of umbrella organization to look over the digital space is likely to increase the healthy competition among the players thus benefitting end users of the segment. As the competition intensifies leading to addition of new end users in the fintech space, e-KYC companies would also see demand increase lead by end-user authentication.

6 Overview of account aggregator and allied services

Consent-based data sharing ecosystem is crucial in leveraging large quantum of information

Data is a strategic asset driving value for companies. However, customer and/or enterprise data is often spread across banks, telcos, healthcare institutions, etc, and there is no standardised way to aggregate this divided data. If made available, the aggregated data can provide complete information on individuals/entities and help build customised products .

Paper-based data collection is inconvenient, time consuming and costly. With the growing digital adoption in India, the need for a digital model for sharing data is becoming increasingly evident. However, there is an issue with digital sharing: it typically involves transferring data through intermediaries that are not always secure, or through specialised agencies that offer little protection to customer data.

While companies benefit from data, individuals and small firms do not reap the same benefits. So, the aim of any data-sharing model needs to be to:

- Give users more control over how their personal data is used

- Make institutional data controllers more accountable

- Make personal data more accessible and affordable to access by breaking down data silos

- Create shared, open-technology infrastructure to enable decentralised management of personal data

- Share only the data which will be necessary for the purpose at hand

- Promote financial inclusion

In August 2020, the National Institution for Transforming India, or NITI Aayog, released a draft framework on Data Empowerment and Protection Architecture (DEPA or the draft) in consultation with five government regulators: the Reserve Bank of India (RBI), Securities and Exchange Board of India, Insurance Regulatory and Development Authority of India, Pension Fund Regulatory and Development Authority, and Ministry of Finance.

The DEPA framework is India's solution to aggregating and sharing personal data. DEPA enables individuals to easily and securely access their data and share it with third-party institutions. A new type of private institution, called consent manager, has been entrusted with the responsibility to ensure that individuals can provide consent, as per an innovative digital standard, for every granular piece of data shared securely.

Consent managers

The introduction of consent managers has also been suggested in the Personal Data Protection Bill, 2019. Consent managers deliver data from an information provider to a customer or an information user based on the user's authorised electronic/digital consent. Consent managers are also allowed to charge a small fee for data transfer. They are 'data blind', meaning they simply serve as a conduit for encrypted data flows. They will manage requests for personal data, facilitate consent for such requests, and once the appropriate consent has been procured, access the requested information and share it with the requester.

The RBI regulates consent managers in the financial industry as account aggregators (AAs), and a non-profit organisation or alliance of these actors called the DigiSahamati Foundation (or Sahamati) has been formed.

Sahamati is a collective of the AA ecosystem and is involved in the implementation of the DEPA and AA frameworks.

AAs

As mentioned earlier, AAs will act as consent managers in DEPA for the financial sector. AAs are a new class of non-banking financial companies (NBFCs) approved by the RBI in 2016. AAs are responsible for providing personal data transfer services based on the explicit consent of individual clients.

Three types of entities are involved in the consent process:

1. **AAs:** These are NBCs licensed exclusively to act as an intermediary for consent-based data exchange.

2. **Financial information providers (FIPs)**: These are financial institutions and non-financial institutions—as permitted by the RBI—holding customer data that can potentially be shared

3. **Financial information users (FIUs):** These are companies that seek access to customer data from FIPs, based on explicit customer consent.

AA ecosystem

FIPs		FIUs
Bank	Individuals	Flow-based credit
Mutual fund house	1. Consent to share data	Personal finance management
Insurance provider	2. Request for data (through open APIs)	Wealth management
Tax/GST platform	AA	Robo advisors
	3. Data flows to FIUs End-to-end encrypted	
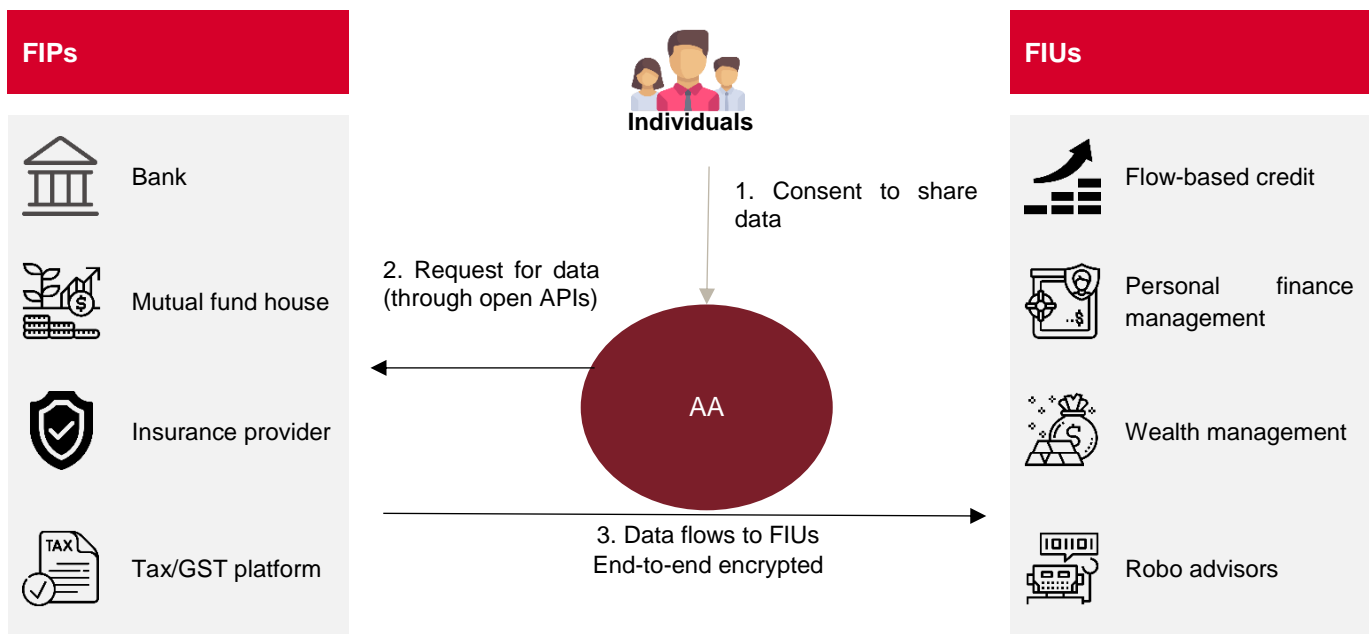
Source: NITI Aayog: DEPA, CRISIL Research

Operational model

The consent procedure begins when an FIU requests that an AA seek customer consent to share specified data (within standardised limits) from one or more sources for a specific purpose for a predetermined period. The AA requests pertinent data from multiple FIPs after receiving approval. Finally, the AA receives, aggregates and transmits the data to the requesting FIU in a machine-readable format.

The core principle of DEPA-based AA solutions is to provide users ultimate control over how their data is used. AAs are only allowed to collect and transfer data, not to see, stock or sell it. A user who registers with an AA will be able to offer or withdraw consent for data sharing in any of her or his FIP accounts. The user will have complete control over how much data can be shared. If a user has three banks and investment accounts, for example, he or she can

choose to give access to data from two or just one. The user will also be able to set a time limit for when the data can be shared with the FIU.

A user may register with an AA desktop or mobile application. The application shows all consents given, consents revoked and a history of all data requests made by FIUs. Users must link (open application programming interface or APIs) with their FIPs (accounts with banks, the government or other corporate bodies) in order to communicate data from FIPs to an FIU in the AA application. The linking procedure requires users to punch a unique identifier through which the FIP can find the account (e.g., an AA ID). The AAs in this ecosystem have a huge potential for profitable growth because they can either charge the FIU they are enabling to provide better services or, in some models, charge the end customer for facilitating information transfer in a digital and secure manner, thus reducing the customer's efforts to obtain financial services.

An Account Aggregator can charge the FIU or the end consumer (owner of data) for the data requested. However, An AA can't charge the FIP for the data. Also, each AA is free to fix the price it wishes to charge the FIU or consumer.

AA(s) in the context of regulators and financial institutions
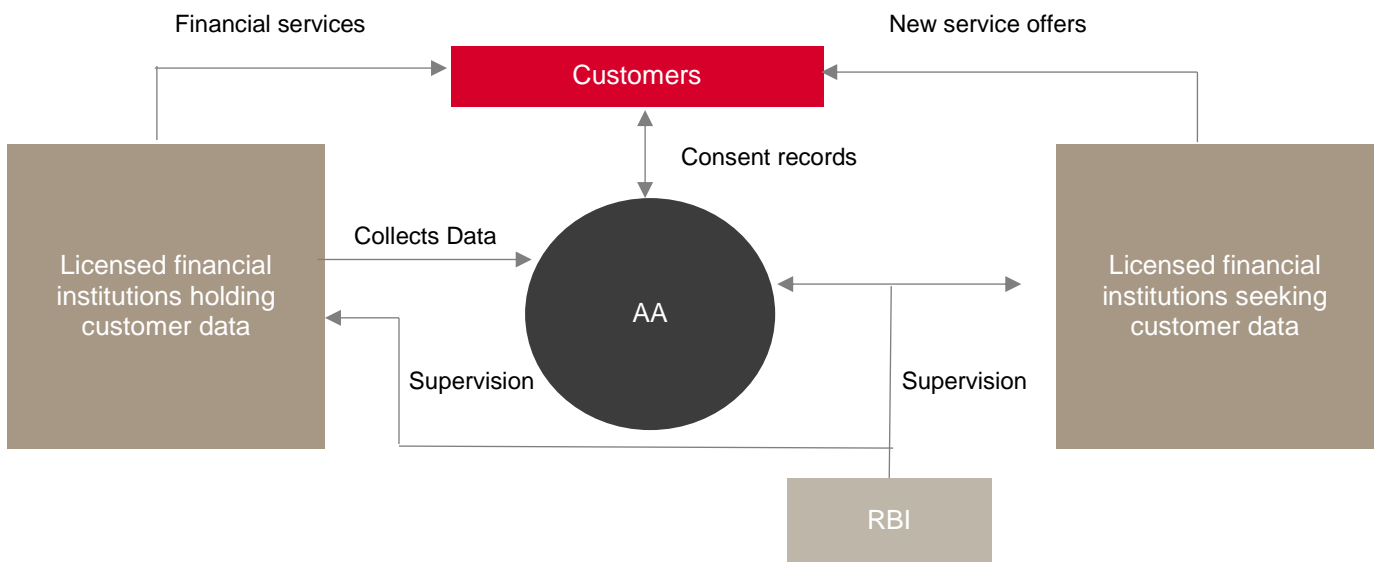
Source: NITI Aayog, CRSIL Research

The DigiSahamati Foundation (also referred to as Sahamati) is a membership-based collective, created as a nongovernment not-for-profit company to manage governance in the AA ecosystem.

Sahamati's responsibility includes assisting members in adhering to essential technological standards, such as the API specifications developed by the RBI's wholly owned technology subsidiary, Reserve Bank Information Technology (ReBIT). The RBI has also sent a notification to ecosystem participants, urging them to comply with the requirements. Sahamati also plans to use member working groups to help define data interchange standards that are applicable to all its members.

Bank credit grew at 5.0% in FY21 supported by MSME credit

The Gross Bank Credit has increased from Rs. 31 trillion in fiscal 2010 to Rs. 97 trillion in fiscal 2021, growing at a rate of ~11%CAGR. CRISIL expects India's gross domestic product (GDP) growth to rebound to 9.5% in fiscal 2022. With economic growth bouncing back in the next fiscal, banking credit growth is expected to grow at ~9-10%.

This would be mainly driven by retail loans and services segment which have already exhibited growth since second half of FY21. Credit to Industry which was broadly stable in fiscal 2020 and declined in fiscal 2021 would grow at ~5% in fiscal 2022 given government's infrastructure push and a likely revival in private investment and capex demand especially by large players. MSMEs in India received a lending of around Rs. 18.4 trillion in fiscal 2021. MSME Bank credit growth has been ~7% for fiscal 2021. For fiscal 2022, GDP growth is expected to be ~9.5% supported by a weak base and some benefit as the global economy fares better and provides a lift to India's exports. Therefore, CRISIL Research expects the overall MSME credit growth to be ~7-9% for fiscal 2022.

Gross bank credit

in Rs. trillion

CAGR 9-10%

CAGR ~11%

FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22P	FY23P
31	37	44	50	56	61	66	71	77	87	93	97	105-110	115-120
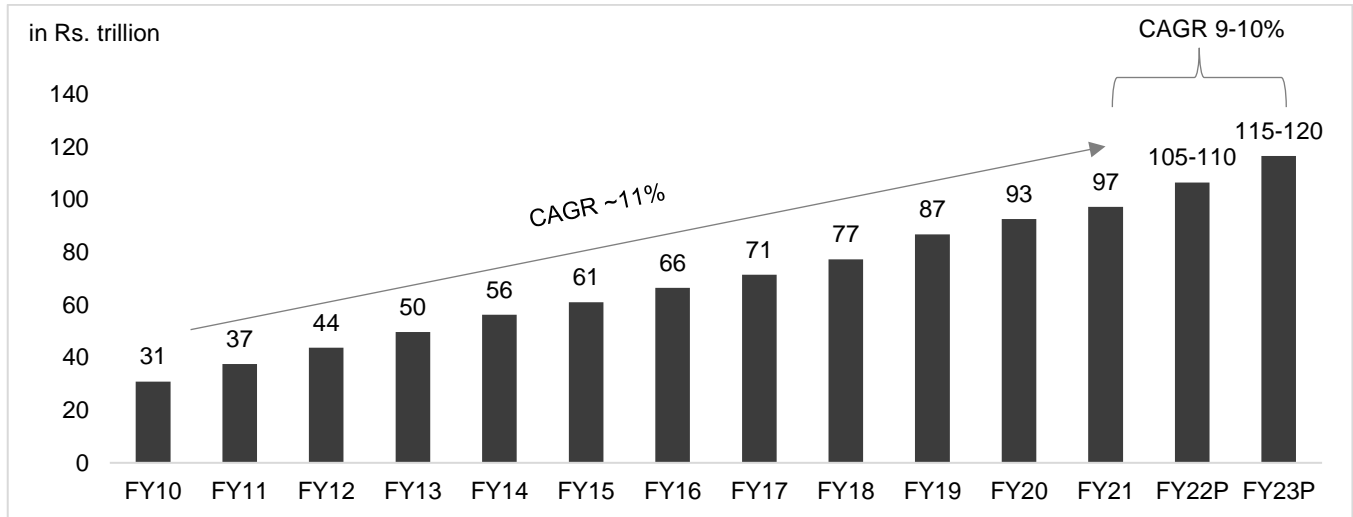
Source: RBI, CRISIL Research

In the long run, CRISIL Research expects bank credit to clock 9-10% CAGR and reach Rs. 115-120 trillion in fiscal 2023.

Gross bank credit growth

FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22P	FY23P
18.7%	21.4%	16.6%	13.6%	13.2%	8.6%	9.0%	7.5%	8.2%	12.2%	6.8%	5.0%	9-10%	9-10%
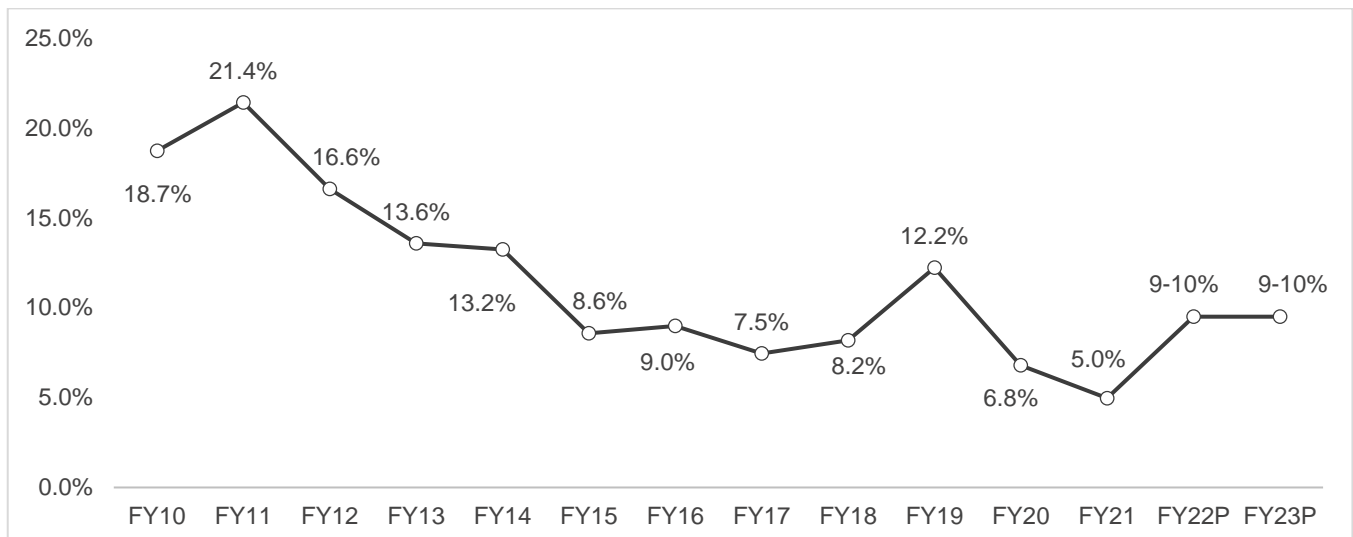
Source: RBI, CRISIL Research

Balance sheet based vs Cash-flow based lending (CFL):

In Balance sheet based lending, also called asset-based lending, lending institutions offer loan to companies based on the liquidation value of the assets on the company's balance sheet. On the other hand, in Cash flow based lending, loans are offered based on a company's past and future cash-flows. The loan requirement in CFL is determined by actual revenue creation and repayment capabilities. In addition, the payback timeline is also determined by the company's cash streams. The benefits of CFL include a loan amount and repayment schedule based on the company's actual cash flow, a reduction in credit risk, lower monitoring costs for banks, a shorter time to market, and the opportunity to serve organizations without suitable collateral. However, due to the difficulty involved in assessing a company's cash-flows, cash-flow based lending may typically command a higher fees (i.e. high interest rates). Besides, some lenders require automatic payments as a condition of the cash-flow based loan since for many businesses, their cash-flow keeps varying from month-to-month. Many of these disadvantages of cash-flow based lending are being solved by the Account aggregator network being set-up in India. AAs can assist in the transition from asset-based to cash-flow-based lending by empowering lenders to offer sachet sized loans based on cash flow predictions of the businesses. Asset-based loans are considerably better suited for firms with huge balance sheets, while they may also be a good idea for enterprises in industries that don't provide significant cash flow potential. Cash flow lending, on the other hand, is best suited to enterprises with large balance-sheet margins as well as those without the tangible assets needed to back an asset-based loan.

Different modes of CFL, as suggested by the RBI report on MSME, June 2019, are as under:

● Turnover ascertained by the bank based on the Goods and Services Tax (GST) data

● Trip finance for logistics companies (invoice-based lending to truckers for each trip)

● Lending to the hospitality industry through aggregator models

● E-commerce transactions (to provide financial assistance to sellers registered on e-tail platforms)

● Turnover ascertained from digital sales on POS machines

● Supply chain finance (dealer financing and vendor financing)

Growth in MSME sector driving demand for credit

In accordance with the new classification provided by Micro, Small & Medium Enterprises Development (MSMED) Act, which came into effect from 1st July 2020, MSMEs are classified as below:

(i)   A micro enterprise where the investment in plant and machinery or equipment does not exceed Rs 1 crore and turnover does not exceed Rs 5 crore

(ii) A small enterprise where the investment in plant and machinery or equipment does not exceed Rs 20 crore and turnover does not exceed Rs 20 crore

(iii) A medium enterprise where the investment in plant and machinery or equipment does not exceed Rs 50 crore and turnover does not exceed Rs 250 crore

The new classification came into effect from July 1, 2020. The earlier criteria for classification of MSMEs was based only on investment in plant and machinery or equipment. It was different for manufacturing and services units. It was also very low in terms of financial limits.

MSMEs are among the significant contributors to the socio-economic development of the country as they are directly involved in the development of the rural and backward classes. MSMEs have been contributing significantly to the expansion of entrepreneurial endeavours through business innovations. MSMEs are widening their domain across sectors and offering a diverse range of products and services to meet the demands of domestic as well as global markets.

As per the data available with the Central Statistics Office (CSO), Ministry of Statistics and Programme Implementation, the gross value added (GVA) from MSMEs increased to Rs 57,418 billion in fiscal 2019 from Rs 36,582 billion in fiscal 2015, at ~12% CAGR.

Total MSME GVA

in Rs. trillion

FY	GVA
FY15	37
FY16	41
FY17	45
FY18	51
FY19	57

CAGR ~12%
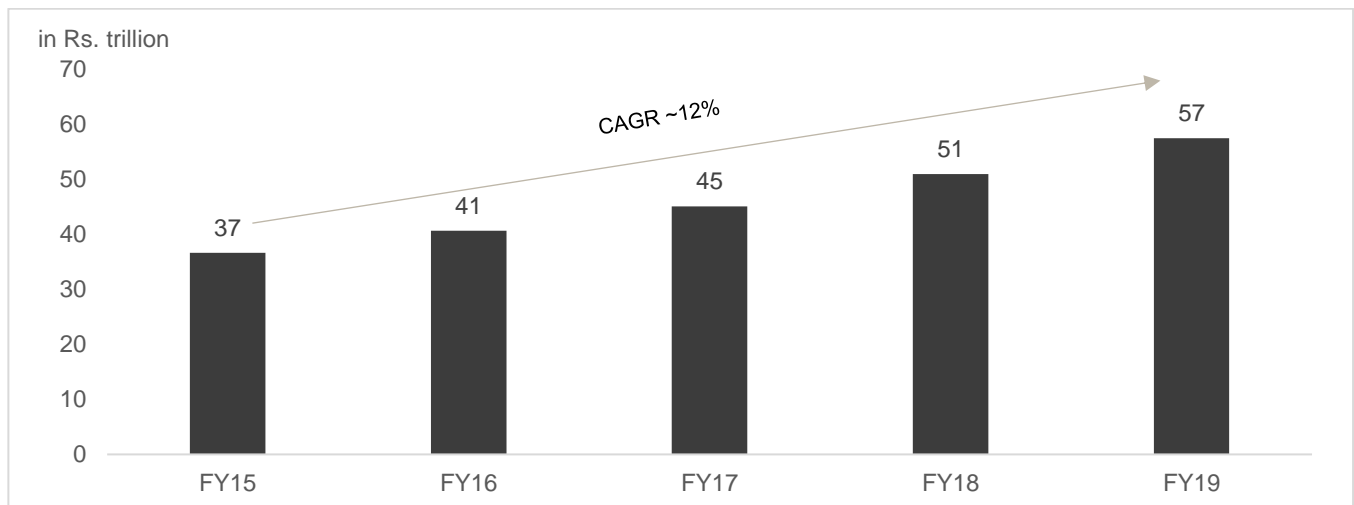
Source: CSO, CRISIL Research

As per the National Sample Survey 73rd round, conducted by the National Sample Survey Office, Ministry of Statistics and Programme Implementation, during 2015-2016, there were 633.88 lakh unincorporated non-agricultural MSMEs in the country engaged in different economic activities (196.65 lakh in manufacturing, 0.03 lakh in non-captive electricity generation and transmission, 230.35 lakh in trade and 206.85 lakh in other services). During the period, the MSME sector employed around 11.10 crore people across rural and urban regions in India.

MSMEs are also a major contributor to India's GDP. The share of MSMEs to total GDP of India has been continuously increasing. The sector contributed ~30% to the total GDP of India in fiscal 2019.

Share of MSME in GDP of India
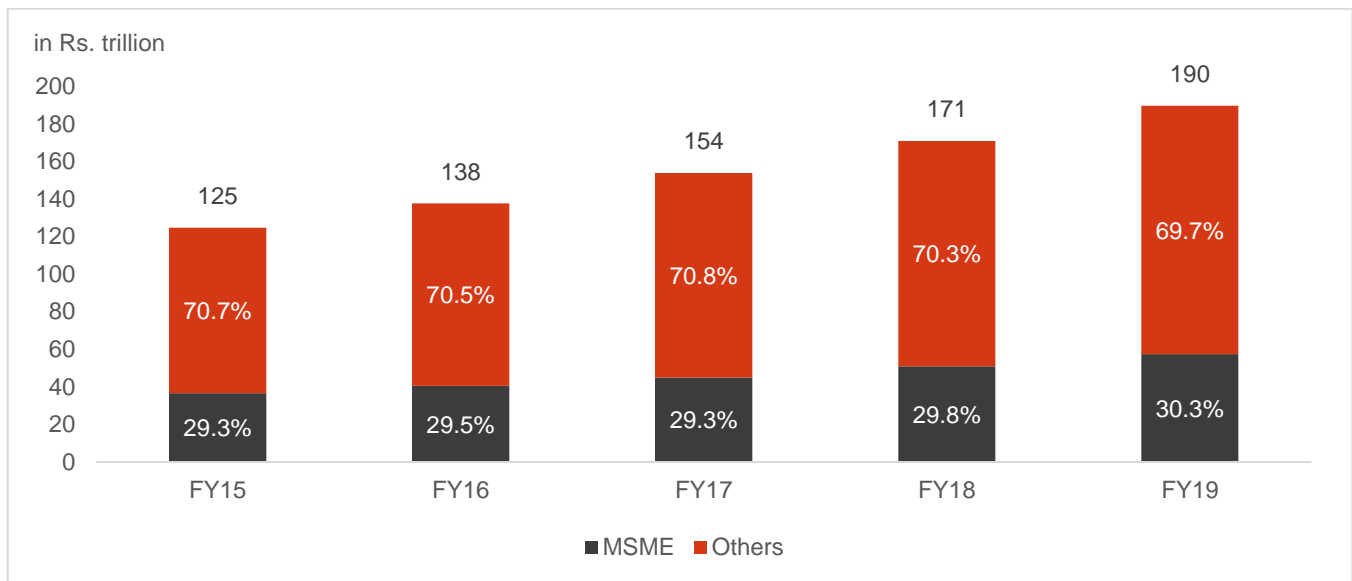
Note: Figures above bars represent total GDP of India in Rs billion
Source: CSO, CRISIL Research

COVID has impacted all sections of society, but MSMEs are impacted the most. FY22 is expected to witness the brunt of the pandemic as second wave of cases and lockdown hit the country. However, availability of vaccine and measures in place are expected to prevent a free fall in growth and still post positive numbers this fiscal 2022. An assessment of 11,500 CRISIL-rated SMEs reveal revenue growth of 7.8% during FY17-19. The MSME industry was already on low footing with revenue growth of a flat 0.8% in FY20. MSME industry de-grew 9-11% in fiscal 2021, thanks to the COVID-19 pandemic. Key verticals pulling down this growth are exports and consumption services sectors which are expected to register revenue de-growth of 20-25%. All verticals are expected to witness a recovery in fiscal 2022 by 12-16%.

MSME Revenue Growth
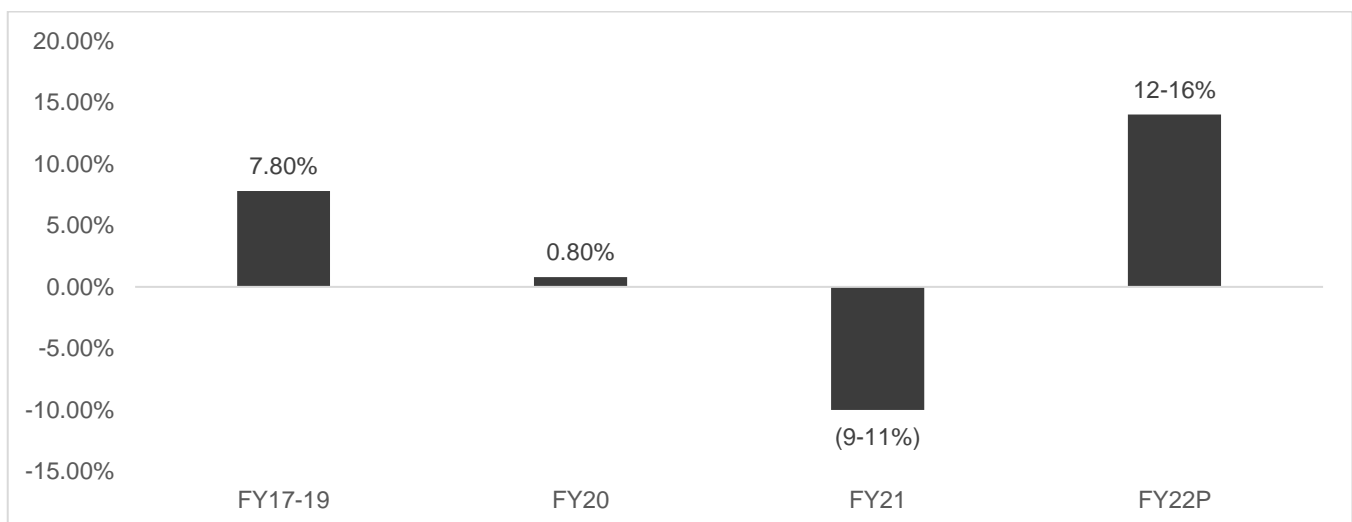
Source: CRISIL Research

MSME Bank credit growth has grown from Rs. 8.7 trillion in fiscal 2013 to Rs. 18.4 trillion in fiscal 2020, increasing at a rate of ~10% CAGR. Going ahead, driven by an improved global economy pushing India's exports, CRISIL Research expects the overall MSME credit growth to be ~7-9% CAGR for fiscal 2023.

MSME credit growth
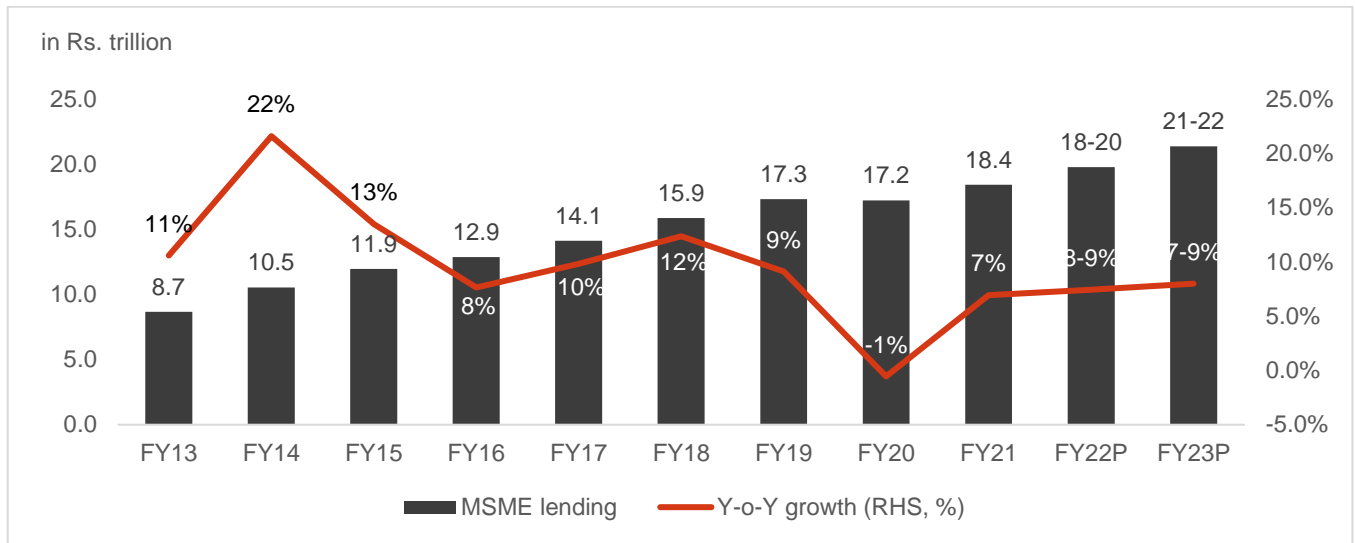
Source: CRISIL Research

According RBI's UK Sinha led MSME committee's report in 2019, only about 11% of the 63 million MSMEs in the country had access to capital from organised lenders. Due to their informal nature, MSMEs lack access to formal credit as banks face challenges in credit risk assessment of MSMEs. The proposed AA network is expected to solve these problems of MSME lending by enabling lenders to offer sachet-sized loans based on cash flow predictions of businesses.

Complete implementation of AA business and licenses under process

The journey of establishing AAs in India started with the government enlisting the support of iSPIRT, a consulting firm, to conduct a study on electronic consent. The central bank accredited a new category of NBFCs to act as AAs in 2016.

Below diagram lists the important events leading upto the creation of AAs:

Mar 2016
iSPIRT consultation on Electronic consent

→

Sept 2016
RBI releases Account Aggregator policy

→

Mar 2017
Electronic consent framework becomes a national standard (published by MeitY)

↓

Mar 2018
Draft Technical standards for Account Aggregators published by ReBIT

←

Aug 2017
Launch of Data empowerment and protection architecture

←

Jul 2017
Srikrishna committee of experts for Data protection setup by Government of India

↓

Jul 2018
Draft privacy bill and SriKrishna report released providing regulatory cover for DEPA

→

Jul 2019
Account Aggregator Sandboxes went live

→

Oct 2019
Launch of AA in other verticals- securities, insurance, pension funds, taxation, etc.

↓

Jul 2020
Public Launch of Open Credit Enablement network (OCEN)

←

Dec 2019
Privacy bill based on consent sent to select committee

Source: AA workshop for consultants and technology service providers by Sahamati, CRISIL Research

According to the RBI's master directive on AAs, every company seeking registration as an NBFC-AA should make an application for registration to the Department of Non-Banking Regulation, Mumbai.

The bank must ensure that the following conditions are fulfilled, before considering the application for registration:

1. The company has the necessary resources and wherewithal to offer such services to customers

2. The company has adequate capital structure to undertake the business of an AA

3. Promoters of the company are fit and proper

4. General character of the management or proposed management of the company is not prejudicial to the public interest

5. The company has a plan for a robust information technology system

6. The company does not have a leverage ratio of more than seven

7. Public interest will be served by the grant of certificate of registration to the AA to commence or to carry on the business in India

8. Any other condition that made be specified by the bank from time to time, the fulfilment of which, in the opinion of the bank, will be necessary to ensure that the commencement of or carrying on the business in India will not be prejudicial to the public interest

List of empanelled AAs

So far, seven AAs have received approval from the RBI to move ahead with establishing their business.

- AAs with operating license:

    1. CAMS FinServ (a subsidiary of CAMS)

    2. Cookiejar Technologies Pvt Ltd. (product titled Finvu)

    3. FinSec AA Solutions Pvt Ltd. (product titled OneMoney)

    4. NESL Asset Data Ltd. (51% of its shareholding with banks and public sector undertakings like State Bank of India and Life Insurance Corporation of India)

- AAs with in-principle approval:

    1. Perfios Account Aggregation Services Pvt Ltd.

    2. Yodlee Finsoft Pvt Ltd.

    3. Jio Information Solutions Ltd.

Besides, there are several other companies that are in the process of getting approval from the RBI for their AA licences. Protean eGov Technologies Ltd. has formed a separate company for the AA business, called NSDL e-Governance Account Aggregator Limited (based on former name of the company). Pasfar Financial Services, which is a subsidiary of the payment gateway Cashfree, is another such company that is focused on the emerging AA business. In June 2021, the State Bank of India announced making strategic investments in the payment gateway Cashfree at a valuation of $200 million.

Apart from these, several FIPs and FIUs (other elements of the AA ecosystem) have also been registered. The following institutions are in various stages of their FIP/ FIU implementation:

1. Axis Bank

2. Bajaj Finserv

3. DMI Finance

4. Federal Bank

5. ICICI Bank

6. IDFC FIRST Bank

7. HDFC Bank

8. Hero FinCorp

9. IndusInd Bank

10. LendingKart

11. NeoGrowth Credit

12. State Bank of India

Account aggregator will aid credit accessibility

Following are some of the benefits of the AA model:

- **Promotes financial inclusion:**

  - AAs have the potential to disrupt the digital lending industry by allowing more people and businesses to access formal credit.

  - By eliminating paperwork, AA enables lenders to have faster access to consented data from individual customers and small businesses, allowing them to assess credit risks and process more loan applications without jeopardising due diligence and security.

- **Benefits to MSMEs:**

  - According RBI's UK Sinha led MSME committee's report in 2019, only about 11% of the 63 million MSMEs in the country had access to capital from organised lenders. AAs can assist businesses in sharing alternate financial data with lenders, to verify their creditworthiness in the absence of a traditional credit record such as tax returns, bank statements, bill payments receipts, expenditure information and online purchase bills.

  - AA can also reduce the rate of dropouts by customers in the loan application process by reducing the need for physical paperwork and creating a more hassle-free customer experience. Since most MSMEs in India lack adequate collateral for loan applications, AAs can help lay the groundwork for shifting to cash-flow based lending from asset-based lending. With the upcoming Public Credit Registry, the AA framework would empower lenders to offer sachet-sized loans based on cash flow predictions of businesses.

- **Reduce non-performing assets (NPAs):**

  - AAs can help lenders de-risk their loan books and reduce NPAs by enabling them to offer more personalised loan products to customers, through the use of advanced analytics and authentically available data.

  - Lending institutions can use the AA model to reach out to underrepresented groups, thus promoting financial inclusion.

Digital lending economy to get boost from AA ecosystem

According to a report by the Ministry of Electronics and Information Technology (MeitY), titled India's Trillion Dollar Digital Opportunity, the digital economy in India generated about $200 billion of economic value in fiscal 2018 – 8% of India's GVA in fiscal 2018 – largely from the existing digital ecosystem comprising information technology and business process management, digital communication services (including telecom), e-commerce, domestic electronics manufacturing, digital payments, and direct subsidy transfers. MeitY estimates that by 2025, India could create a digital economy of $800 billion to $1 trillion.

Size of digital economy

$90 billion – $120 billion to be contributed by cash-flow based lending (made possible by AAs)

CAGR 9-11%
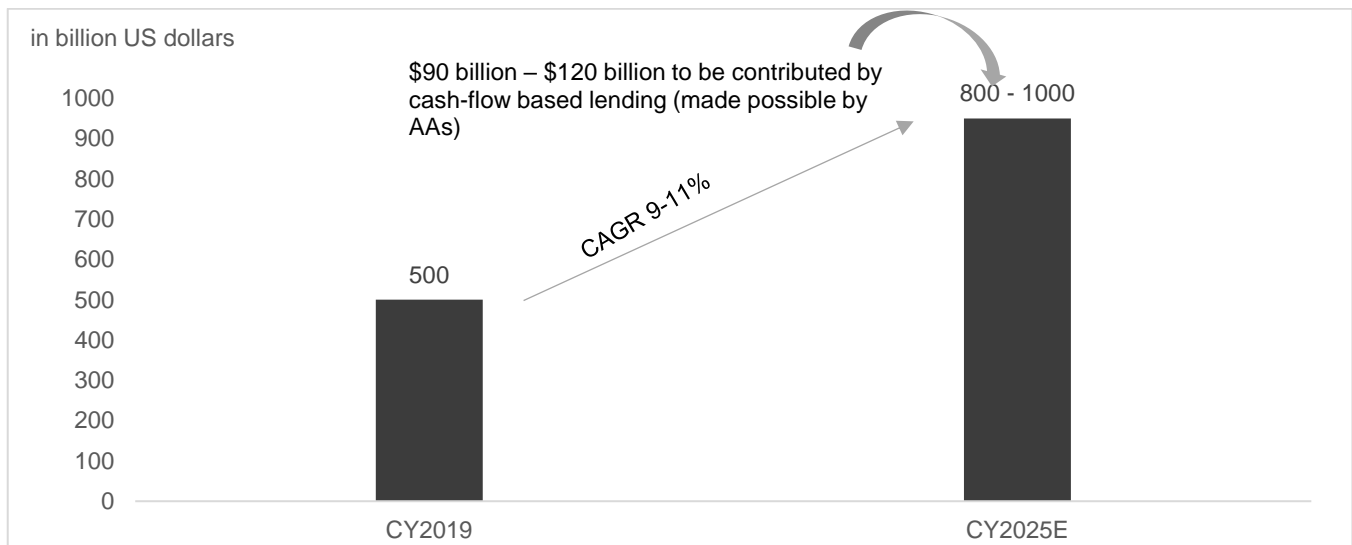
Note: E- estimated

Source: MeitY, CRISIL Research

The MeitY report mentions that the existing digital ecosystem contributed around $500 billion of economic value in CY2019, but the potential economic value for India could be as much as double of that, if digital technologies are used to unlock productivity, savings and efficiency across more diverse sectors such as agriculture, education, energy, financial services, government services, healthcare, logistics, manufacturing, trade and transportation.

The report stated that the cash-flow based lending, made possible by the AA ecosystem, could fill 60-80% of the credit gap faced by MSMEs, which, in turn, could generate $90-120 billion of economic value by 2025.

CRISIL Research identified Rs 2 billion annual potential from retail lending and monitoring alone, assuming 15-30% rejection rate and 25% of retail loans applied will have calls made to AAs for financials information. Additional Rs 1.5-2.5 billion from MSME loans is expected, assuming that 25% of new MSME accounts opt for AA services and 15%-20% of old accounts opt for updation from fiscals 2022 to 2024. The personal finance management and robo advisor segment will further increase the revenue potential for AAs. There is possibility of a large upside with increased penetration and faster roll-out of AA-based services.

Banks will first offer account opening and deposit services using AAs, followed by lending products. It could take at least 1-2 years more for mutual funds and insurers to come on board, as per industry sources.

Banks are currently in the first phase of launch for AA services, which are restricted to opening of current and savings accounts; opening deposits will soon follow. Banks have been testing services in a closed group environment.

AAs will drive the next wave of fintech innovation, similar to the role played by UPI transactions in the online transaction space.

Innovative approaches to SME lending, similar to Account Aggregator ecosystem, have been implemented in some countries

Kabbage: Kabbage, Inc. is an online financial technology company based in Atlanta, Georgia that provides funding directly to small businesses and consumers through an automated lending platform. Kabbage has a 100% digital online underwriting based on both traditional and untraditional data. All operational and fraud checks are conducted using data and surfing patterns collected from the internet. Underwriting limits set on a daily basis based on data updates. It also includes an automated payback system that is based on the availability of funds in customer accounts. Collections are triggered automatically and are largely performed via email and telephony, with the use of lawyers in extreme circumstances. All of this enables Kabbage to sanction small SME loans in less than 10 minutes. As of July 2020, Kabbage has provided $4 billion dollars in funding to more than 209,000 businesses

Taobao by Ant Group, China: Taobao is a Chinese online shopping platform. It is headquartered in Hangzhou and is owned by Ant group, which is an affiliate company of the Alibaba group. Ant group has been using big data to vet small working capital loans, up to $8, to merchants on Taobao. Ant group has created its own unique Zhima Credit Score by analysing and processing data from five dimensions: anonymized credit history, behavioural preferences, contractual fulfilment capabilities, identification features, and social connections. Zhima's scoring service enables Taobao to provide rapid credit to the small businesses and entrepreneurs registered on its platform. As of September 2016, about $107.3 billion had been given to 4.1 million small and micro businesses.

Protean eGov Technologies Ltd. has formed a separate company for the AA business

Protean is a chief architect & implementer for some of the most critical & large scale technology infrastructure in the country. Protean closely works with Central & State Governments, Regulators, and Financial & Non-Financial entities in creating population scale e governance Solutions. Protean conceptualized designed and implemented the infrastructure for Central Recordkeeping Agency (CRA). It has also been responsible for setting-up the tax information network and the technology infrastructure for Aadhaar authentication and e-KYC services. Company has over the years used its project management capabilities & technology expertise to deliver state of the art e-Governance solutions.

Going ahead, Protean plans to leverage its experience and capabilities in technology infrastructure to be an integral part of the Account aggregator ecosystem being set-up in the country. It has formed a separate company, called NSDL e-Governance Account Aggregator Limited (based on former name of the company), for the same purpose. The company is still under process of being approved by RBI to be empanelled as an Account Aggregator. Thus, NSDL e-Governance Account Aggregator Ltd. along with Protean eGov Technologies Ltd. plan to become agents of financial inclusion by shifting from asset backed lending to cash flow based lending.

7   Overview of Open Credit Enablement Network (OCEN)

Offline lending is digitised using OCEN

Digital marketplaces continue to operate in silos and prevent users the ability to operate over a single platform. To allow digital technologies to effectively serve users, it is vital that such digital ecosystems are created in a manner that integrate across networks and platforms. Accordingly, there is a growing requirement to create inclusive open digital networks allowing users to participate without access barriers. For decades, formal credit flow to the most vulnerable sectors of our economy, particularly small companies, has been disrupted. Financial institutions have a hard time reaching these huge groups of customers, which results in significant distribution costs. Besides, these small businesses generally have very specific credit needs like smaller loan amounts, shorter repayment timelines and quick access to funds, all of which only constrain financial institutions, forcing them to instead focus on big businesses.

Also, traditionally, lending has been a balance sheet-based activity centered on analysing and collateralizing loan borrowers' assets. Small firms that cannot provide the same level of security are sometimes seen as riskier customers by banks. MSMEs are often forced to accept higher interest rates and harsher payback terms as a result of this. Furthermore, borrowers that require the greatest credit are often unable to produce the same level of thorough documentation, formal data, or reputational proof that larger commercial clients can, thus making them less-than-ideal consumers.

So now we have a situation where the banks and NBFCs are happy to meet the larger credit requirements of 'safer' enterprise customers. At the other end of the spectrum, you have microfinance institutions and moneylenders catering to the bottom of the pyramid (albeit in an inefficient and expensive manner). As result of this our India's delivery is a severely underpenetrated. According RBI's UK Sinha led MSME committee's report in 2019, only about 11% of the 63 million MSMEs in the country had access to formal credit.

Open Credit Enablement Network (OCEN), a credit protocol infrastructure announced at the Global Fintech Festival in 2020, is expected to solve these problems for MSME lending. It is a framework of Application programming interfaces (APIs) for interaction between small borrowers, lenders, loan service providers, and account aggregators. The APIs will act as a common language connecting marketplaces to use and create innovative financial credit products.

OCEN aims to make credit accessible to all

OCEN enables the various service providers we use on a daily basis to become fintech-enabled credit marketplaces by standardising the building blocks that make up a typical credit cycle. Consider this: the Indian start-up scene is populated by colourful characters such as kirana tech players, food delivery applications, logistics companies, ed tech platforms, Saas providers, and others, all of whom already fulfil the role of gathering customers (whether they be businesses or individuals). If these companies are allowed to easily add lending as a feature via standardised OCEN APIs, this means that the cost of customer acquisition for a lender is basically brought down to zero. Moreover, the usage data that is already being captured on these platforms can serve as an addition to a borrower's profile to better assess their credit worthiness. This enables a new mode of operation based on the analysis of present and future cash flows rather than static balance sheet based loans.

OCEN is putting together an infrastructure protocol that enables consent-based access to verified information from multiple public and private data sources and connects borrowers with lenders through an ecosystem that offers access to affordable credit. Using OCEN, lenders will be able to create personalized loan products to meet the

financial needs of small businesses. They will also be able to underwrite new types of loans by gaining access to a financial data about the MSMEs that helps them monitor credit. Online intermediaries such as e-commerce enterprises and digital businesses (also known as loan service providers) can simply include credit products without having to engage in technology development or sign up with multiple lenders. The turnaround time and finance costs would be reduced, due the simplification of the loan application process and also since competition among lenders will increase.

Key participants in the OCEN eco-system:

Lenders - These are traditional financial institutions like banks and NBFCs that will benefit from the OCEN protocol's pooled scale and efficient distribution. These financial institutions (lenders) may now design solutions and fulfil the needs of small companies successfully by using existing digital infrastructure and gaining access to verified data from borrowers. Lenders will be able to underwrite loans based on new types of data and, most significantly, would have ongoing access to data for credit monitoring.

Loan Service Providers (LSPs) - Loan Service Providers are online intermediaries such as marketplaces, e-commerce firms, consumer platforms, and digital businesses that are close to the end clients (LSPs). These LSPs can now include a lender's credit products as part of their core offering without having to spend heavily in technology or form several relationships with different lenders. Providing credit solutions to their customer base, which includes a large number of small businesses, can help both small businesses and LSPs enhance revenue and partner lifetime value.

Borrowers - End borrowers are small enterprises, who will now be able to compare lending choices from numerous lenders on LSP's platform. The credit procedure for these borrowers will be totally digital, with quick access to funds, thanks to consent-based data sharing and Aadhar/UPI enabled infrastructure. Financing will gradually shift from "one-size-fits-all" to "customised" credit solutions, with continuous cash flows being prioritised over income and assets. Borrowers should soon notice credit solutions offered by their partner marketplaces and e-commerce platforms.

Technology service providers (TSPs) and Derived data providers (DDPs) - TSPs and DDPs will be specialised companies that provide LSPs and Lenders with the required IT infrastructure and data solutions. Borrowers are unlikely to be aware of these entities, but they will play a critical role in the whole ecosystem. Existing players, particularly in the fintech sector, will be presented with new chances as these TSP and DSP opportunities open up for them.

Working of the OCEN network:
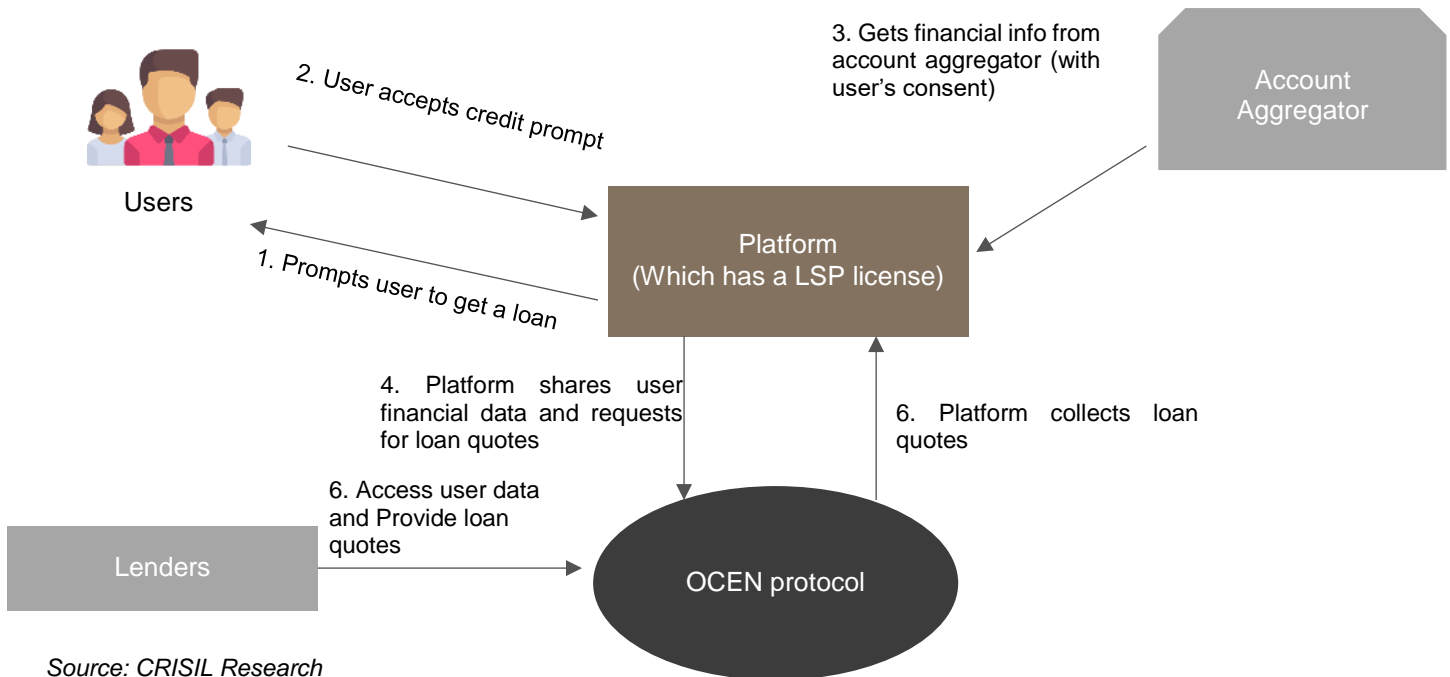
Source: CRISIL Research

The loan origination process through OCEN would follow the following steps:

- User is purchasing a product from an e-commerce or online platform which has a LSP license.

- When user arrives at the checkout screen, he/she is presented with an opportunity to avail of a consumer loan. Say the user selects "Yes".

- User is redirected to his/her Account Aggregator login and is required to give consent to the platform to query user's bank account for:

  − Details on user's income/payments/assets etc (one-time)

  − Occasional access to assess his/her financial position (loan monitoring; optional)

  − Platform takes these financial details, along with the purchase detail for which loan is being taken and posts them on to the OCEN protocol.

- The different banks, registered as lenders on the platform, respond with loan quotes i.e. interest rate and loan covenants (repayment structure, default criteria etc)

- The platform collects these quotes & applies its discretion in showing user the top choices.

- The user makes his choice and avails the loan.

OCEN's value proposition to the different players on its eco-system
a. Customers:

- Supplied with a wide range of loan quotes which should translate to a better price with the most competitive interest rates.

- Retain data sovereignty via the consent architecture, i.e. using Account aggregators to query financial

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information

b. **Platforms (LSPs):**

- 'Single Api for credit' - platforms no longer need to integrate with different banks/loan providers to enable lending to their customers

- The availability of wide range of loan quotes should translate to better commission rates (i.e improved monetization)

c. **Banks/ NBFCs (Lenders):**

- Availability of a wider range of customers for loan disbursal

- Reduced defaults by having a better credit assessment due to the operational cash-flow data available from the Account Aggregators

Implementation of OCEN is already under-way

The OCEN eco-system is already being implemented in the country and various potential LSP use-cases are being analysed. A non-profit organization called CredAll has been established to manage the eco-system and the Sahay app is the first implementation of the OCEN protocol.

CredAll - It is a non-profit collective, formed to oversee the implementation of OCEN and give access to the new protocol to industry participants. Its primary responsibilities include stakeholder education, publishing guidelines and principles, connecting TSPs with lenders and LSPs, helping LSPs create business cases, and empaneling certification agencies.

Sahay – Sahay is OCEN's first rendition. Sahay app is ready to implement the invoice-discounting use case, where a merchant can receive loans against outstanding invoices. Merchants can sign up and get instant loans from lenders by providing their GST identification numbers and bank details. Sahay GST and Sahay GeM (government e-marketplace) apps would be the first reference apps for OCEN, just as BHIM was the first reference implementation for UPI. Businesses on the GST network and the Government eMarketplace will be able to apply for loans utilizing their GST invoices and transaction history as data surrogates to acquire loan offers from associated lenders using these apps. Like BHIM UPI, the idea for these apps is not to corner the market and turn a profit, but rather to inspire the private sector by illustrating how these moving parts in OCEN all come together.

TSPs - Technology service providers (TSPs) like Setu and Apollo Finvest have already published APIs that make it easy for both lenders and LSPs to integrate with OCEN. Apart from these companies like Lentra, Perfios and JusPay have established the OCEN sandboxes wherein LSPs can register to get the APIs needed to connect to the OCEN network.

Furthermore, there are a number of lenders and LSPs already onboarding to the network, keen to explore if OCEN represents a significant step forward or not.

OCEN will empower MSME sector

MSMEs are also a major contributor to India's GDP. The share of MSMEs to total GDP of India has been continuously increasing. The sector contributed ~30% to the total GDP of India in fiscal 2019.

Share of MSME in GDP of India
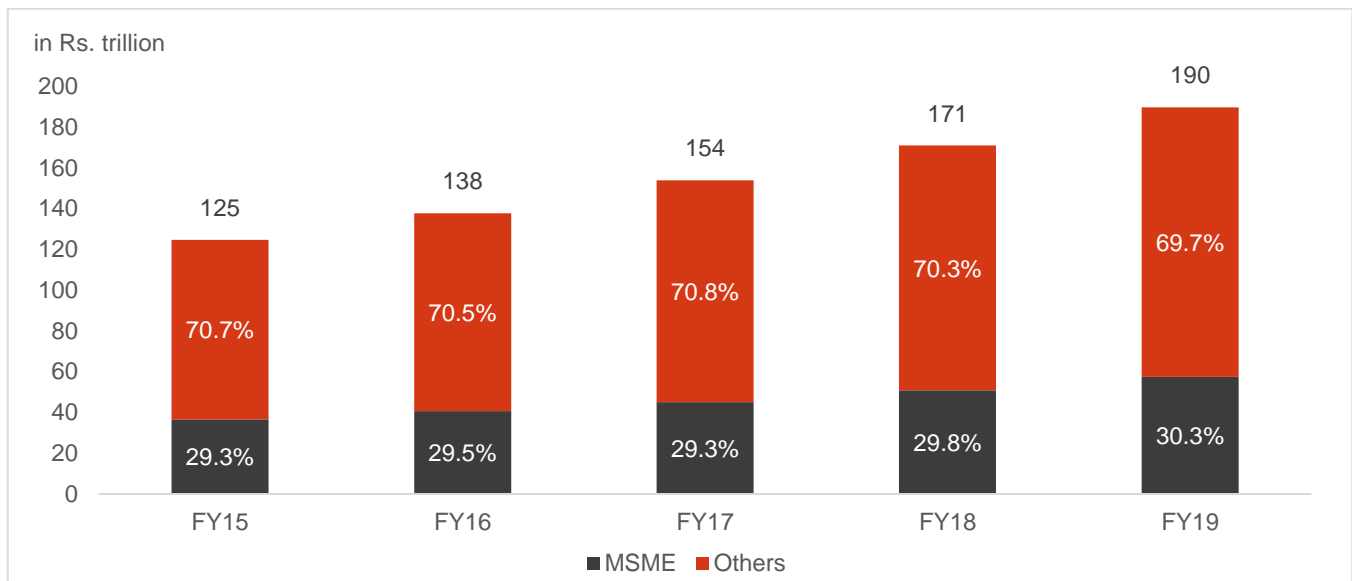
Note: Figures above bars represent total GDP of India in Rs billion
Source: CSO, CRISIL Research

The lending to MSMEs from formal lending institutions has been continuously increasing, driven to a great extent by the RBI norms for Priority sector lending. MSME Bank credit growth has grown from Rs. 8.7 trillion in fiscal 2013 to Rs. 18.4 trillion in fiscal 2020, increasing at a rate of ~10% CAGR. The MSME credit grew by ~7% for fiscal 2021Going ahead, driven by an improved global economy pushing India's exports, CRISIL Research expects the overall MSME credit growth to be ~7-9% CAGR for fiscal 2023.

MSME credit growth
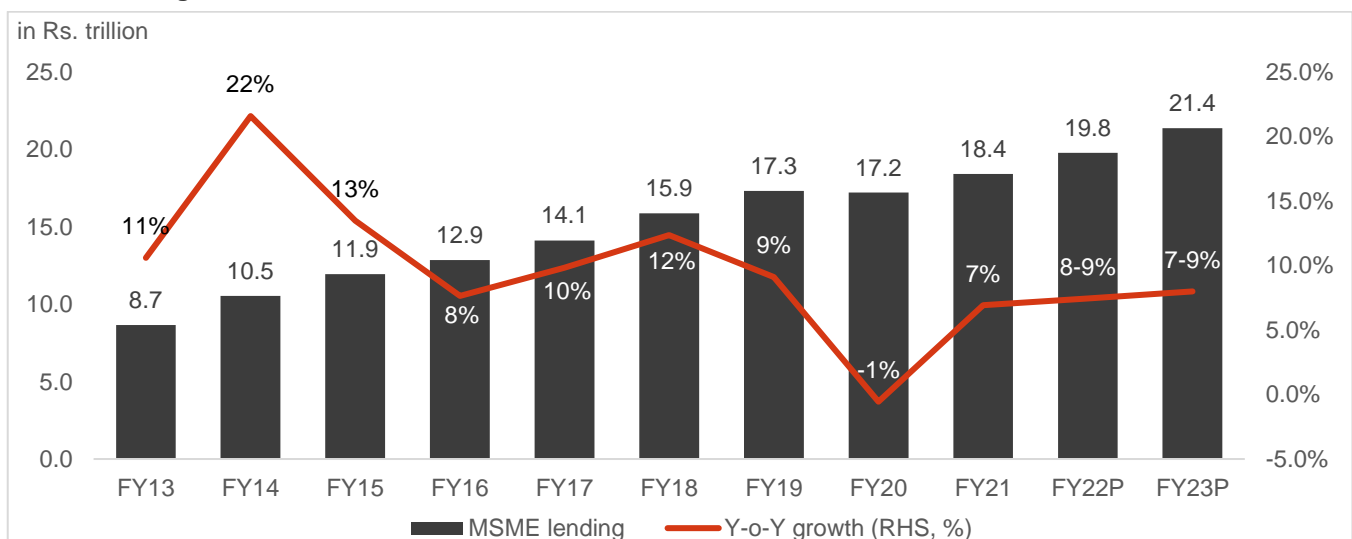
Source: CRISIL Research

According RBI's UK Sinha led MSME committee's report in 2019, only about 11% of the 63 million MSMEs in the country had access to capital

Inspite of the increasing lending to the MSME segment, majority of the MSMEs in India still don't have access to formal lending. According RBI's UK Sinha led MSME committee's report in 2019, only about 11% of the 63 million MSMEs in the country had access to capital from organised lenders. The report also says that a $330 billion credit gap existing in the MSME segment in India.

- Since most MSMEs operate in the informal sector, they are generally seen as riskier customers by banks. MSMEs are often forced to accept higher interest rates and harsher payback terms as a result of this. Furthermore, small firms that require the greatest credit are often unable to produce the same level of thorough documentation, formal data, or reputational proof that larger commercial clients can, thus making them less-than-ideal consumers.

- A successful implementation of OCEN has the potential to meet the credit gap existing in the MSME segment. OCEN can enable lenders to provide custom packet-sized loans to MSMEs by leveraging the operational cash-flow data of companies. Besides, according to a report by Ministry of Electronics and Information Technology (MeitY), cash-flow based lending can add $90 billion to $120 billion to the digital economy of India by 2025.

Demand for digital authentication data will increase in future

OCEN network collects data about individuals from Account aggregators, which in turn collate in from the GSTN. Besides, to sign-up on OCEN network, an individual has to login using his Aadhar/e-KYC authentication. So, OCEN shares personal data about individuals, which is inturn depend on the information available on different platforms like eKYC, GSTN, etc. Going ahead, as these systems are more widely adopted across India, the data available from on them is also expected to increase which will help aid the implementation of the OCEN network throughout the country.

Digital payments to get huge boost in fiscal 2022

There has been a manifold increase in digital payments in the recent past. To further boost digital transactions, the finance minister in Union Budget 2021-2022 earmarked Rs 15 billion for a proposed scheme that would provide financial incentive to promote digital mode of payments. Initiatives such as tax audit exemptions for businesses based on digital payments usage and establishing of a financial technology hub were also announced.

Government Spending to Promote Digital Payments

(Rs billion)

■ Promotion of Digital payment   ■ Total-DIGITAL INDIA Program

BE: Budget estimate RE: Revised estimate
Source: Union Budget, CRISIL Research

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The government has been focusing on growing the digital payments ecosystem over the past few years. Budget announcements, direct budgetary allocations or indirect interventions, such as tax exemptions, caps on pricing structures, cashbacks, and measures to discourage cash-based payments, are some of the steps taken to encourage the expansion of digital payments.

Increasing share of digital channels in domestic monetary transactions

Due to the efforts of government to grow digital payments in the country, the share of different channels in domestic money transfer has changed significantly over the past five years. Banks, for example, are witnessing a change in customer behaviour with fewer customers visiting bank branches for transactions. The preference has also shifted from cost factors to convenience and ease of performing transactions, which helps in saving time spent in queues, not disturbing the daily working hours and avoiding any potential monetary loss.

Digital transactions in volume terms

Note: P: Projected; Digital transactions includes RTGS – excluding interbank clearing, ECS, NEFT, IMPS, NACH, cards and prepaid instruments; Non-digital transactions include cheques/paper clearing and ATM transactions. Amount above each bar indicates volume of transactions in the year.

Source: RBI, CRISIL Research

Digital transaction in value terms

In Rs tn

	898	930	1,028	1,226	1,481	1,745	2,196	1,471
Non-digital transactions	13%	12%	10%	9%	7%	7%	5%	4%
Digital transactions	87%	88%	90%	91%	93%	93%	95%	96%
	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21

■ Digital transactions ■ Non-digital transactions
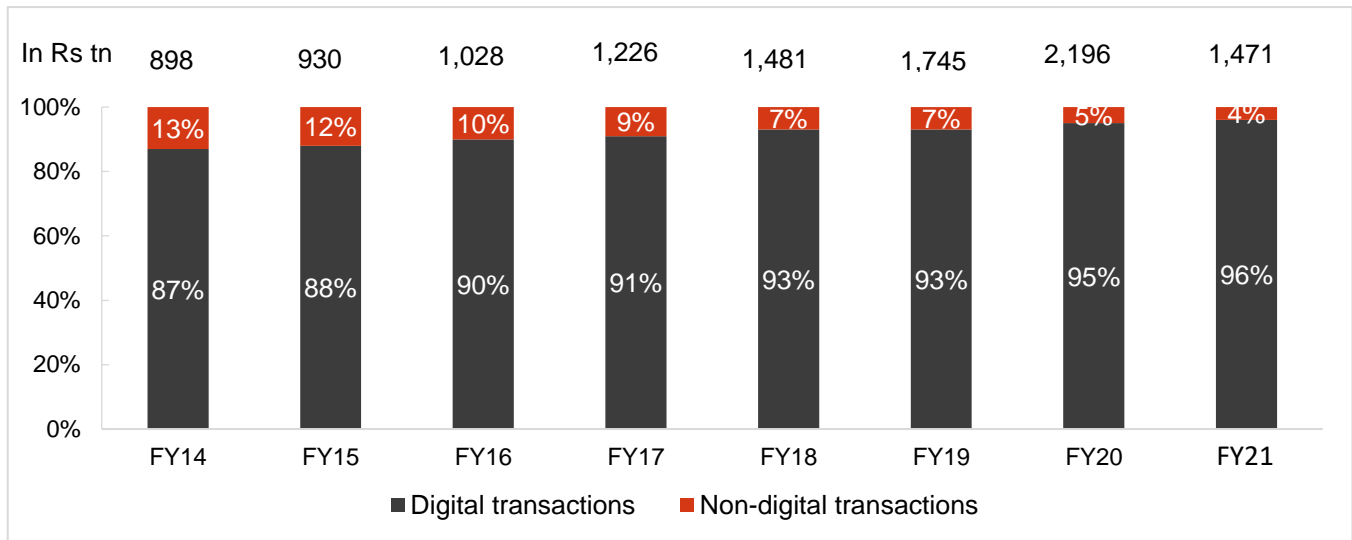
Note: P: Projected; Digital transactions includes RTGS – excluding interbank clearing, ECS, NEFT, IMPS, NACH, cards and prepaid instruments; Non-digital transactions include cheques/paper clearing and ATM transactions Amount above each bar *indicates value of transactions in the year.*
Source: RBI, CRISIL Research

Given the growing share of online transactions between fiscal 2014 and 2021 in the Indian financial services sector, the demand for analytical services such as OECN is expected to increase in coming years based on the large amounts of data that is processed.

Dependence on e-KYC for authentication is continuously on a rise

Number of transactions e-KYC have seen a growth over the years as it plays a major role for financial institutions in verification of individual identity. On cumulative basis, 7,973.8 million e-KYC transactions were recorded as of FY20 from 0.1 million transactions in FY14.

Cumulative e-KYC transactions over the years

Million

FY14	FY15	FY16	FY17	FY18	FY19	FY20
0.1	29.9	84.2	1170.2	5019.8	7079.7	7973.8
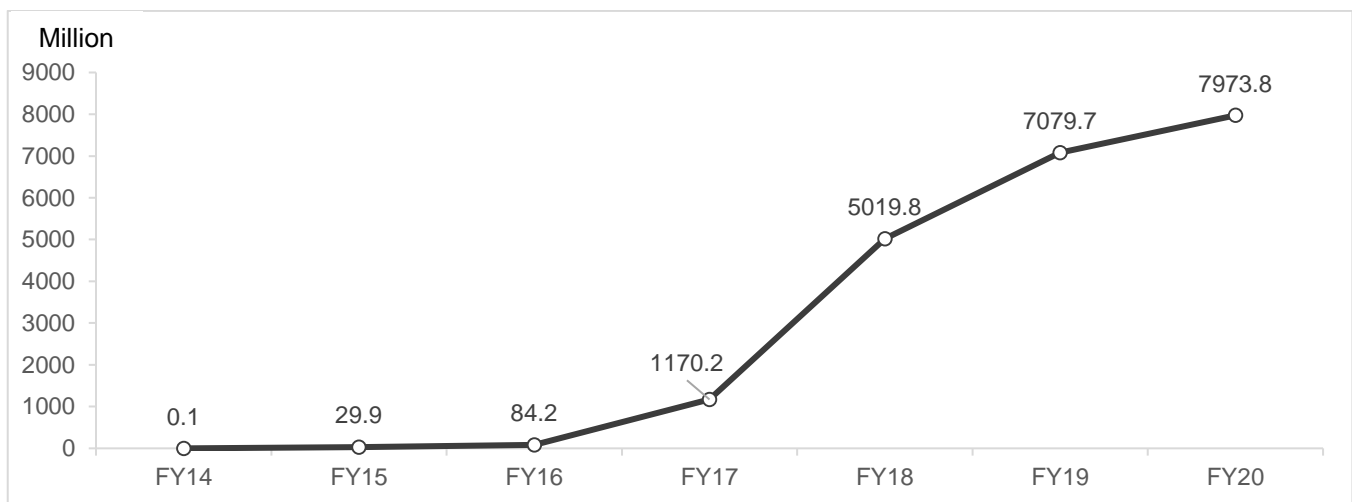
Source: UIDAI annual report, CRISIL Research

e-KYC helps the credit disbursal agencies to easily authenticate documents provide by the beneficiary. As Aadhaar is necessary document to be submitted for availing of loan, e-KYC helps checking if duplicate proofs have been submitted thus reduce the operational risk for the entity. It also reduces the turn-around time required to avail the

loan. Similarly, e-KYC processing is done by asset management companies for investments such as mutual funds would provide them easy and secure on-boarding of investors in less time frame. In addition to these, e-KYC also has vital importance in key government initiatives such as Direct Benefit Transfer (DBT) and National Mission on Financial Inclusion.

Going forward, further growth in these spaces would in turn lead to raise in requirement for e-KYC infrastructure in the nation.

GST verification has aided customer on-boarding and credit disbursal space

The launch of GST has proven to be instrumental in the formalisation of the country's informal sector, especially in today's digital era. GST has paved the way for digitalisation, leading to wider availability of digitised financial data of companies. This data can be leveraged by lending institutions and fintech firms to find new ways to assess the creditworthiness of applicants and make better informed and more data-driven decisions, especially about lending to SMEs.

Besides, more and more lending firms today are making the shift from the traditional asset-based lending process to data-based lending, by gaining access to consented GST data. Following are some of the benefits of using GST data for credit assessment:

1. A more customer-centric lending process

   Data from the GSTN can be used to form an accurate and personalised profile of loan applicants. This will help deliver personalised loan offerings with competitive interest rates that cater to the needs of end users.

2. Analytics-driven decision making by leveraging access to the vast amount of data available

3. Access to real-time data to prevent frauds

   Real-time information from the GSTN can be used to verify if an applicant is providing the right financial information. This can help get rid of false positives and assess if the borrower will be able to repay the loan, by understanding the financial health of the business.

4. Multidimensional assessment of creditworthiness

   Rather than relying on data provided by the applicant and on the credit score, lending firms can now gather data across various points from the GSTN and make a quick, thorough assessment.

Data from the GSTN, combined with the credit score, bank statements, KYC, etc, can help generate great insights into the overall credit behaviour of applicants.

Protean eGov Technologies Ltd. to benefit from the increased use of authentication data

Apart from the above use-cases, several new innovations like the Account aggregator eco-system, OCEN network, etc. are already being implemented by the Government of India. All of these rely on authentication data from GSTN, e-KYC, etc. for their operations. OCEN network collects data about individuals from Account aggregators, which in turn collate it from the GSTN. Besides, to sign-up on OCEN network, an individual has to login using his Aadhaar/e-KYC authentication.

Going ahead, as these systems are more widely adopted across India, the demand for digital authentication data is also expected to increase significantly. Accordingly, Protean eGov Technologies Ltd., which is involved in processing PAN applications, setting-up the e-KYC, e-Sign and Aadhaar authentication services, is expected to benefit from this increased use of authentication data.

Protean also plans to become an active part of the OCEN network by becoming a Technology Service Provider (TSP) to help set-up the backend of the entire ecosystem. Implementing a solution like OCEN requires Aadhaar authentication, e-kyc, e-sign and Account Aggregator (AA) in its eco system to enable the transfer of money and flow of information. Protean has been involved in building most of these projects. Protean has been appointed as a Registrar by the Unique Identification Authority of India to provide residents with services like Aadhaar-Authentication and e-KYC. It is also responsible for developing the e-sign service and it has also been appointed as GST Suvidha Provider (GSP) as well as Application Serviced Provider (ASP) in the GSTN ecosystem. Protean can leverage its extensive experience to get empanelled as a TSP in the OCEN ecosystem.

Several Innovations in lending are being implemented throughout the world

The OCEN network offers an ecosystem to access affordable credit for all individuals. Similar innovations in credit-lending, right from insurance underwriting, easy processes of opening new accounts online, to credit profiling using unconventional methods are being implemented by several fintech-companies in across the globe.

1. **Using data to develop alternative credit scoring mechanisms:**

    The traditional method of credit scoring would not qualify small businesses and self-employed individuals for loans. Their rigorous and out-of-date credit score standards would only qualify large, well-established businesses for loans, or individuals with fixed income jobs who could obtain a salary slip to support their loan application. As a result, traditional credit scoring procedures were becoming increasingly difficult for small business owners and SMEs to obtain capital. The fintech industry saw the need for a more flexible and qualitative scoring system that would allow for a proper analysis of credit scores in these circumstances using alternative data points.

    Taobao, a chinese online shopping platform, owned by Ant group which in turn is an affiliate company of the Alibaba group has been using big data to vet small working capital loans, up to $8, to merchants on Taobao. Ant group has created its own unique Zhima Credit Score by analysing and processing data from five dimensions: anonymized credit history, behavioural preferences, contractual fulfilment capabilities, identification features, and social connections. Data sources for this include data received from e-commerce transactions on Alibaba, online financial data from Ant Financial, and data from public institutions like Public Security Bureau. Zhima's scoring service enables Taobao to provide rapid credit to the small businesses and entrepreneurs registered on its platform. As of September 2016, about $107.3 billion had been given to 4.1 million small and micro businesses. Value proposition to merchants is Zhima's fast and easy credit approval process: a three-minute application, one-second loan granting, and no manual intervention.

    Another case in point is the India-based Capital Float, which assesses applicant suitability based on 2,000 data points. This data comes from an array of sources including online customer feedback and transaction history from ecommerce marketplaces. Another feature that distinguishes Capital Float is its psychometric evaluation. The platform asks applicants a series of questions to determine how well-equipped founders are to scale a firm, their attitude toward credit, and how they compare to competitors. Using these qualitative, soft data sources to determine creditworthiness is a powerful and distinct way of doing so.

2. **Harnessing AI to transform lending:**

AI is transforming the financial services industry in a variety of ways, from process automation and personalised banking to risk management and fraud detection. AI is a tool for lenders to develop a more responsive and flexible relationship with small firms in the context of SME lending. Automated cash flow provider Kabbage has lent around $7 billion in capital to 185,000 businesses. Kabbage has a 100% digital online underwriting based on both

traditional and untraditional data. All operational and fraud checks are conducted using data and surfing patterns collected from the internet. Underwriting limits set on a daily basis based on data updates. It also includes an automated payback system that is based on the availability of funds in customer accounts

8 Overview of Ed-tech and e-learning in India

8.1 Key offerings in Ed-tech space

Education plays a significant role in balancing the socio-economic fabric of a country. Basic education is key to achieve a better quality of life, and higher quality of education warrants an all-round development of citizens and growth of economy. It is the country skilled human force which helps is nation building making education a very important parameter for growth.

Education technology (edtech) is an area of technology that facilitates and enhances learning through the development and application of information technology (IT) tools and mode of teaching and evaluation.

Key offerings of Ed-tech space
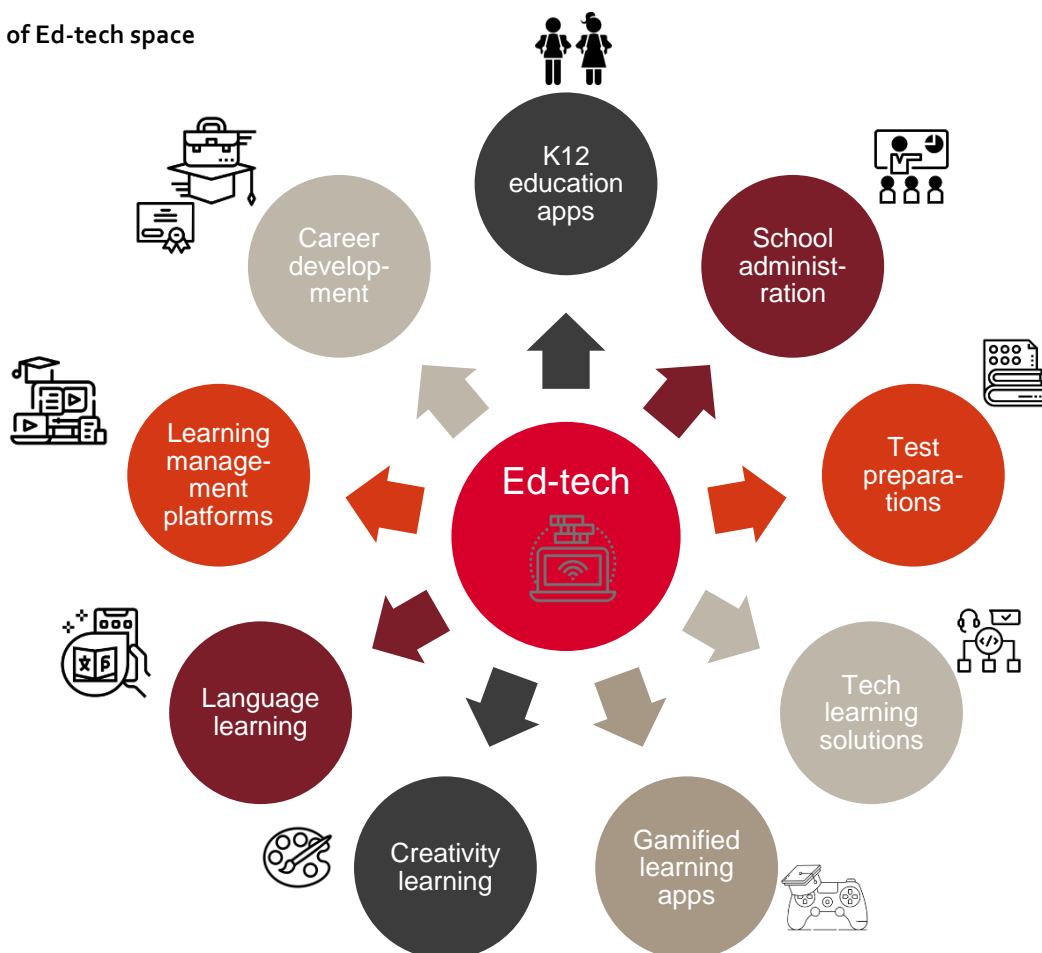
Source: CRISIL Research

The ed-tech industry's key verticals are as follows:

Learning and coaching: This segment offers online learning materials that supplement school curriculums, as well as provide tutoring and coaching to students. It mainly targets students up to Grade 12 and these apps have seen the widest adoption in India (50-60% share) from increase in its top 3 players.

Test preparation: This segment helps students prepare for tests after K-12, with a focus on IIT-JEE, CAT, UPSC, SAT, and medical entrance tests. It is one of the largest evergreen category in India, due to to the country's obsession with grades, admission to engineering courses and government jobs.

Hobby or skill enhancement: Edtech companies also provide skill/enhancement programmes. It is essentially a learning and community platform, where students can pursue their non-academic interests and hobbies such as language classes, art and craft, and coding.

Career training and skill development: Skill advancement is essential to stay updated with evolving industry dynamics. In this context, edtech startups have leveraged this opportunity by providing avenues to expedite skill development, upskilling, and reskilling. These programmes bring engineers and software developers up to speed with the latest and most prevalent technologies

Solution and platform providers: IT solution providers provide ed-tech platform and system offerings for traditional and ed-tech players to develop ed-tech products and services

Ed-tech business model landscape
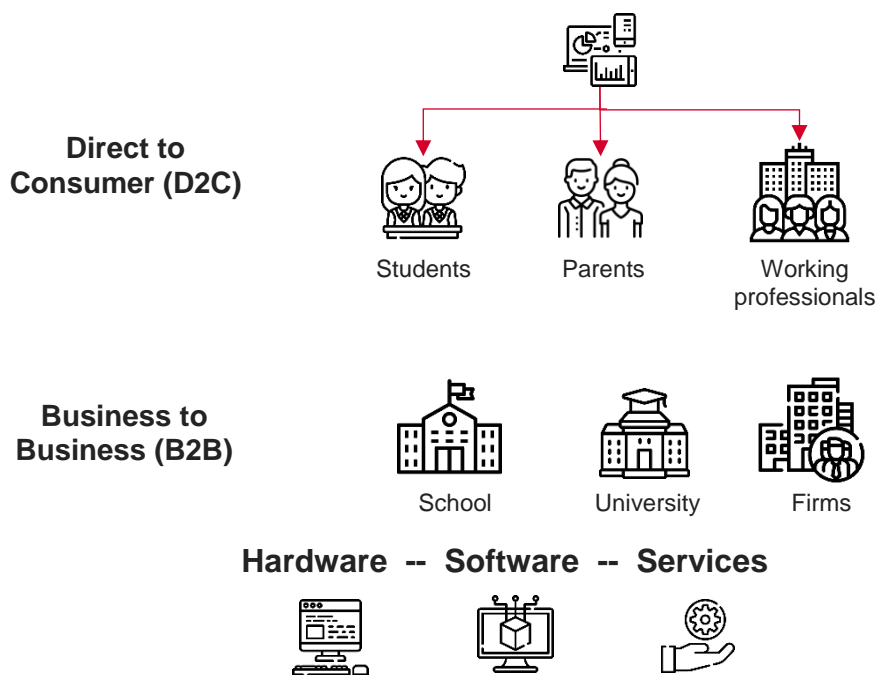
Source: CRISIL Research

Private sector business models in the education sector

Segment	Offerings	Remarks
Vendors to educational		
ICT - Information and Communication Technology	ICT equipment (hardware)	
Software systems	LUMS, KM etc.	Core Projects & Technologies
Multimedia	Pictures and videos	
Bundled products	ICT + Software system+ Multimedia + support personnel	Educomp- SmartClass, Everonn-Vitels
Private educational institutions	Educational services: Pre-School, K-12, Higher education and continuous education	Oberoi schools, Manipal University, DJ Sanghvi College of engineering etc.
Coaching / Certification providers	Supplementary educational services	

Segment	Offerings	Remarks
Coaching - Supplement to Formal	K12 supplementary education services	Unorganised and private regional or local chains, Mahesh Tutorials
Coaching - Entrance Exams	Entrance exam preparations for various levels of educations – Graduation entrance (Engineering, MBBS, etc.), MBA entrance, etc.	Career Launcher
Certification - Technical & Soft Skills and coaching for professional certification		NIIT, AutoCad
Test administration	Test infrastructure and exam administration	Prometric, VUE

Source: CRISIL Research

Technological innovation empowering traditional education system

Traditional methods of teaching are upgraded by technological advancements, such as artificial intelligence (AI), robotics, cloud computing technology and augmented reality (AR)/virtual reality (VR), and their integration into learning. These cross-curricular learning opportunities in the ed-tech sector are expected to enable institutes and teachers to streamline resource commitments, as well as develop students' knowledge through practical and cross-curricular applications. Technology helps to impart knowledge by holistic learning experience and visual appeal which led to better understanding.

Developed economies, such as the US, the UK, and Germany, are leading in developing and introducing innovative ed-tech offerings, supporting education administration, student and community engagement, and reducing teacher workload. Emerging economies, such as India, have a lower market share, but are focusing on utilising technologies to provide access to education. As a result, ed-tech is anticipated to see significant growth in such economies to educate the rapidly growing population.

Global ed-tech market estimated at $80-90 billion in 2020

As per industry sources, the global ed-tech market size is valued at $80-90 billion in 2020 and is expected to expand at a compound annual growth rate (CAGR) of 18-19% over 2021-25. The market has also benefited from digital technology, which would improve access to education. Students are increasingly shifting toward ebooks, which can be accessed remotely. Digital content is comparatively easy to generate than printed content, which tends to incur higher production costs. Moreover, digital books are available in different languages and can be easily translated and retrieved by a wider user base.

The major factors driving the growth of edtech in the future are increasing penetration of mobile and tablets, easy availability of internet users and the impact of Covid-19 on growing online teaching-learning models.

8.2 India education landscape is among the largest market in the world

India's education system is one of the largest systems in the world. With population of 490-500 million under the age of 20 years, India has large pool of student to target. According to Unified District Information System for Education (UDISE) and All India Survey on Higher Education (AISHE), India has more than 248 million students enrolled in more than 1.5 million schools and around 37.2 million undergraduate and postgraduate students enrolled in 39,931 colleges, 993 Universities and 10725 Stand-alone institutions across India as of 2018-19.

Formal education in India spans primary and secondary school education, graduation, post-graduation, and diploma courses.

School Education Infrastructure in India

Particulars	2018-19
Number of schools	1,551,000
Number of teachers	9,430,839
Number of Students	248,338,584

Source: UDISE, CRISIL Research

Total number of schools

Total number of teachers

Total number of students
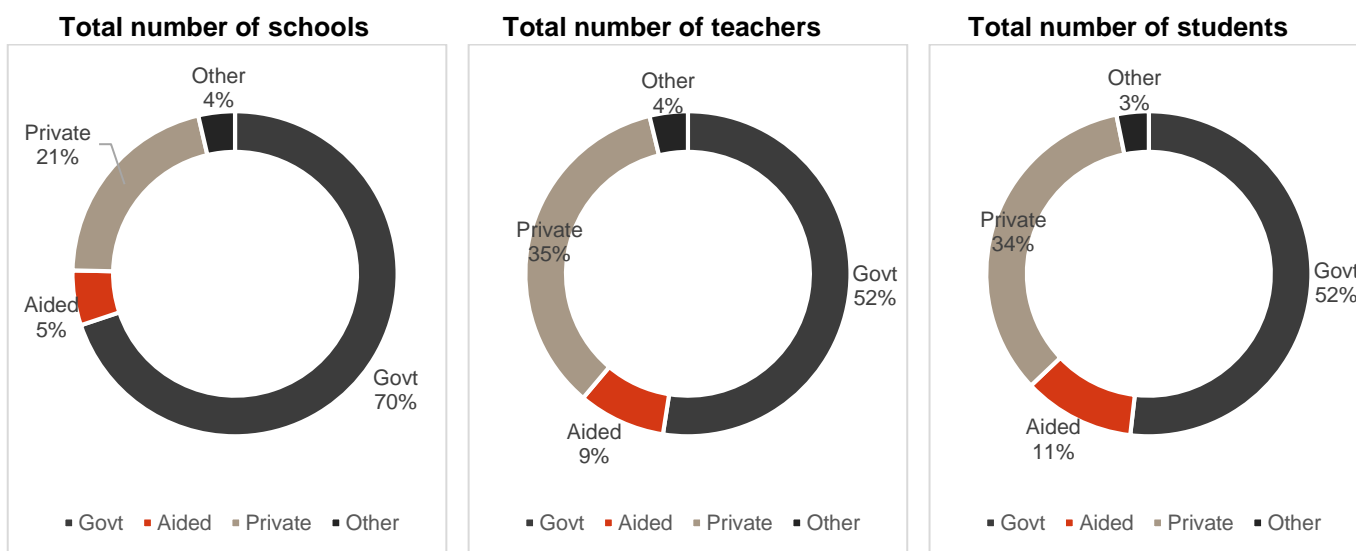
Source: UDISE, CRISIL Research

Countrywide comparison of population under education age group

As per UN population estimates, India has the world's largest population of 490 million in the age bracket of 5-24 years in 2020, which provides a great opportunity for the ed-tech and education sectors for expansion of education related products and services.

Total number of student for India remained almost stable since fiscal 2014 ranging from 297-300 mn students contributing to 60%-62% of population in age bracket of 5-24 years between fiscal 2014 and 2020.

Percentage of total population in education age group (per 100 total population)
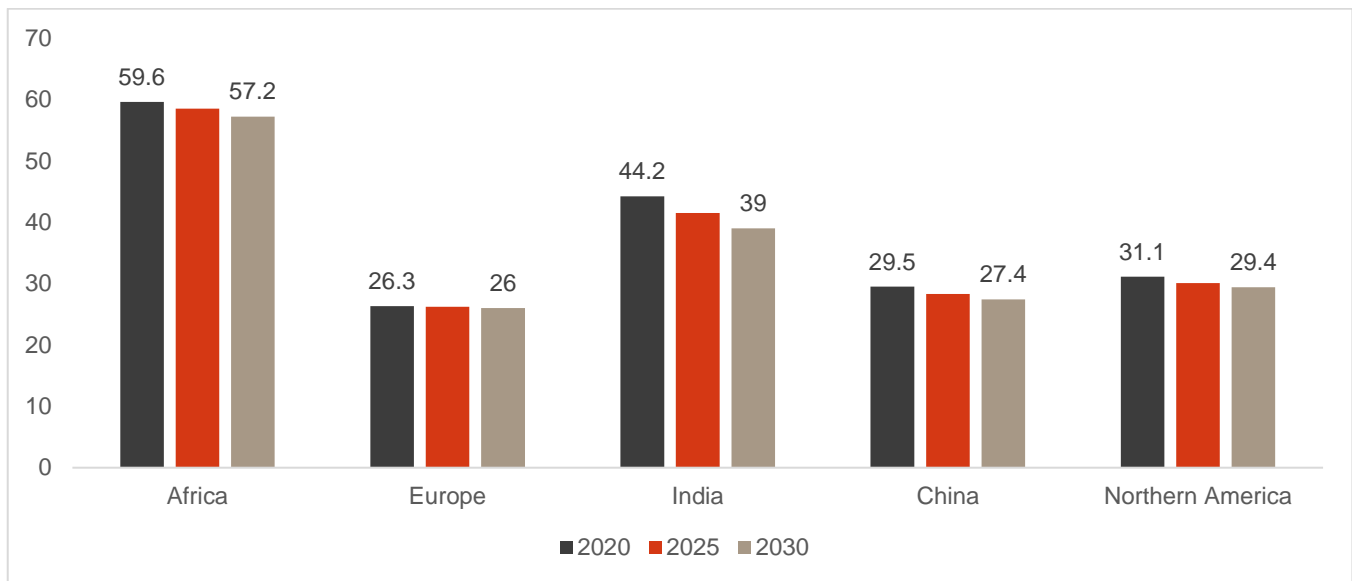
Source: United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, CRISIL Research

As per the world bank, India is the second largest country in terms of population with total population of ~1.36 billion people in 2019. Considering ~44.2% of it is below 0-24 years of age, there is humongous potential for education/ed tech companies to expand their reach to the students. The education penetration is low specially in the rural region due to low availability of teachers/schools, providing huge scope for the ed-tech companies to expand as well as for new companies/start-up to grab the under penetrated market.

Literacy rate (2018)
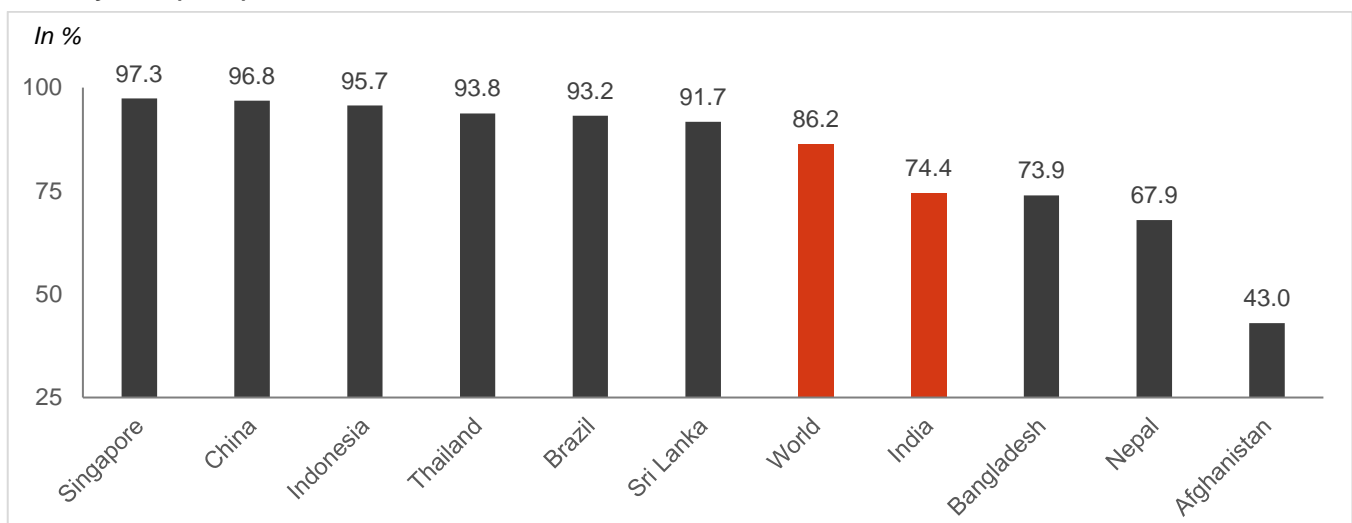
Source: World Bank, CRISIL Research

Student population and enrolment ratio

Total number of students
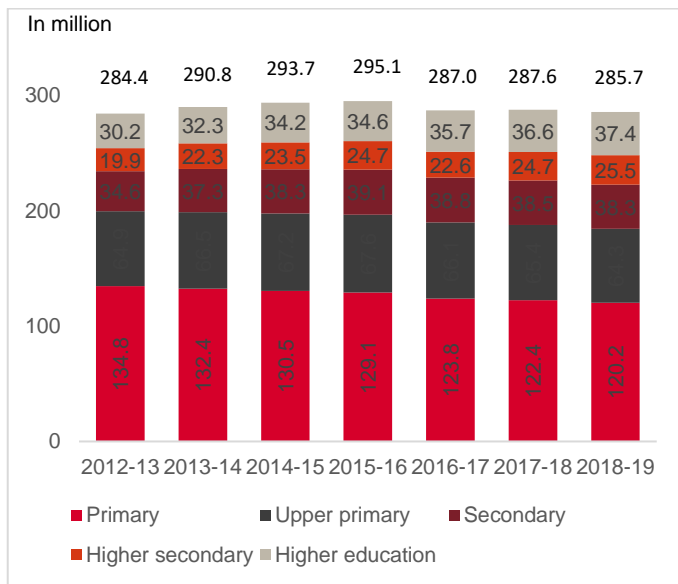
Enrolment ratio
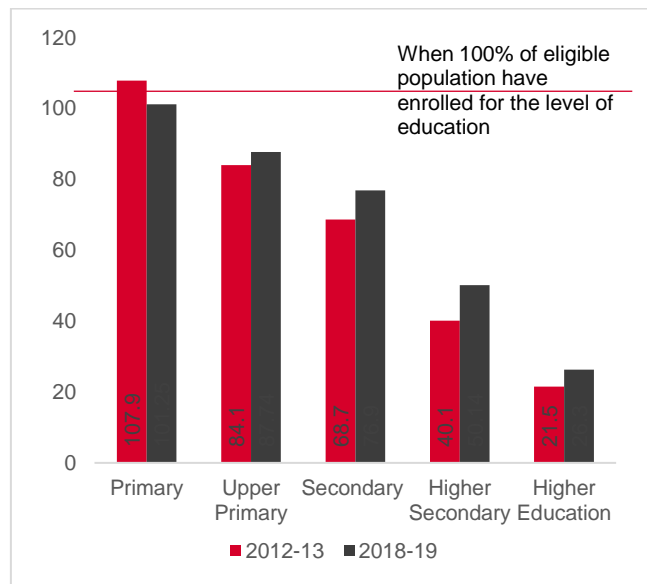
The United Nations Educational, Scientific and Cultural Organization (UNESCO), describes "Gross Enrolment Ratio" as the total enrolment within a country "in a specific level of education, regardless of age, expressed as a percentage of the population in the official age group corresponding to this level of education

Source: Seshagun, Aishe Report, CRISIL Research

Gross enrolment ratios (GERs) has scope for improvement in higher secondary and education

As can be seen in the GER chart, there has been increase in GERs for upper primary, secondary and higher secondary. GERs primary education declined as the ratio was more than 100% indicating that more number of students were enrolled than the age group for the level of education. With penetration of basic education to all, the primary education outstanding population decline leading to lower GER for primary education. The K-12 segment typically reports a lower GER vis-a-vis the elementary segment as well. One of the reasons for the low enrolments (below 100) is the lack of awareness about the importance of education. Many students are forced to pursue employment before completing their K-12 education to support their households. This situation is further exacerbated by a lower number of schools delivering education at higher grade levels (grades 9-12), which is one-fifth of schools delivering education at the elementary grade level (grades 1-8).

Consequently, drop-out rates plummeted from elementary to secondary. Other problems such as weak infrastructure, unavailability of schools, and vacant teacher positions also have a bearing on the attendance and enrolments in K-12 schools. Ed-tech is expected to resolve such issues in the education sector and bring more population under the gamut of secondary and higher education.

Higher education in India characterised by low but improving GERs

According to AISHE, the percentage of students enrolled in higher education in 2018-19 was 26.3% against 21.5% in 2012-2013. The 75th National Sample Survey Organisation's (NSSO) survey data reveals that 10.6% of the country's population above 15 years of age are graduates (21.7% of urban population and 5.7% of rural population) in 2018 indicating significant disparities in higher education. The number has improved from 8.2% of the country's

population above 15 years of age being graduates and above (17% of urban population and 4.5% of rural population) in 2014 as per the 71st National Sample Survey Organisation's (NSSO) survey data.

The country's education sector is also plagued by a shortage of well-trained faculty, regional disparities in enrolments, vacant faculty positions, poor infrastructure, and outdated curricula.

Within K-12, the GER for the elementary segment (standards 1 to 8) is expected to be 70-80% in FY21. During the same year, GER in higher education was estimated at 20-30%, casting doubts on whether the government's target of 100% GER by 2030 will be attainable as per the New Education Policy 2020.

Covid-19 compelled the education institutes to adopt online methods

Both formal and non-formal segments of education have shifted to online mode by conducting the classes through online channels on account of pandemic. The mode of communication has also changed from the offline mode to the online mode. However, many institutes have successfully maintained teacher-student interaction and ratio by using online applications to conduct classes and exams. Institutes are using a combination of offline-recorded videos and online lectures.

Institutes that were not able to adopt to the online mode remain dependent on study material, which is distributed and collected on specific days.

E-learning will pave the way for advance learning methods in ed-tech

Digitisation of education remains one of the topmost priorities of the Government of India. With the internet penetration rate in India at 58.5% in December 2020, as per Telecom Regulatory Authority of India, the market is conducive for penetration of ed-tech market. Many e-learning portals have been set up in the wake of the pandemic to provide uninterrupted access to learning. They are performing well as an increasing number of learners are enrolling in online courses — the new normal since the onset of the pandemic.

Starting 2020, Indian universities and colleges, which were earlier not permitted to offer more than 20% of a degree online, are now lifting the restrictions on online learning to increase access to higher education and improve their global ranking. Many edtech companies are offering learning management resources, including blended learning, 3D and do-it-yourself (DIY) kits and AI-based experiential and interactive learning to improve the learning experience.

India's ed-tech is marked by presence of several start-ups

India ed-tech landscape is several players across various offerings. The ed-tech landscape in India has around 7,000+ start-ups in India as per industry sources. Start-ups have entered the market in 2010 onwards and are developing their offerings and expanding their reach across in India. Covid-19 pandemic has increased active user base for ed-tech app and the segment has seen rising penetration even in tier II and III cities in India.

Ed-tech vertical and players

Verticals	Players	Verticals (B2B)	Players
Child development / preschool learning	Kutuki, Playbees ABC, Shape Builder, Jumpstart, Daniel Tiger's Grr-Ific Feelings, Wheels On the Bus	School learning management	WizIQ, Schoolguru, Lead School, Next Education, Disprz
Supplement education for K12	Byjus, Vedantu, cuemath, mastree, Unacademy, Doubtnut, xtramarks, Khan Academy	Digital tutoring enablers	Classplus, teachmint, classpro
Test preparation	Toppr, Byjus, Unacademy, radeup, testbook	**Education services (B2C)**	**Players**
Certifications and online courses - academic	UpGrad, simplilearn, Greatlearning, edupristine	Finance / Loans / ST lending	Auxilo, Eduvanz, mPokket, Pocketly, RedCarpet, Sahukar
Language classes	enguru,cultureAlley, englishbolo	Gamification	Quizizz, Miko.ai, PlayShifu
Creative, hobby, adult engagement classes	Yousician (Finland), Udemy (Yoga), Skillshare (USA)		
Executive / employee training program	Eruditus, Simplilearn, Virohan (healthcare)		
Skills development certifications	Coursera, simplilearn, UpGrad		

Note: List is not exhaustive

Source: CRISIL Research

Product offerings in edtech are widespread, thereby making it a highly fragmented market

K-12		
Type	*Details*	*Companies*
K-12 Supplemental Education	offers online learning materials which supplement school curriculums	e-Basta, ePathshala
Coaching/tutoring & test prep	guiding students in K-12 education in coaching to develop in-depth subject expertise	Byju's, Vedantu, Classplus, embibe
Digital content & resources	Resources for learning	Leadschool, Instasolv, Quizizz
Steam, Coding & Language Learning	Edtech companies helping provide skill/enhancement programs	Cuemath, mastree, doubtnut, FrontRow, Enguru, Englishbolo and Cullurealley
XR, Games & stimulation	Fun and Learn concepts	Fintobox, Stepapp, EduIsFun
Discovery and admissions	Help for admission and other details	AdmitKard, edushala, Univariety
Learning Management systems	Software application for the administration, documentation, tracking, reporting, automation and delivery of educational courses, training programs or learning and development programs	Schoolguru, Zeus Learning, eZnetLMS
Post K-12		
Higher Education	Distance-based degree programmes	Keystone, IGNOU
Test Prep	Postgraduate admission tests, professional certification exams and Government job entrance exam preparation	Unacademy, Toppr, Gradeup

K-12		
Technical Skilling	Reskill/upskill programmes, typically for technical or functional new-age skills	Udemy Upgrad, Simplilearn, Edruditus, Upskill

Note: The K-12 segment represents education from kindergarten to class XII and is the largest segment within the education space in India. It can be further divided into primary (1-5), upper primary (6-8) secondary (9-10) and higher secondary (11-12) levels.
Source: CRISIL Research

Ed-tech is still at nascent stage in India with major players entering the market in the last decade (2010's)

Started in year	Ed-tech company	Offerings
2007	Extramarks	K-12 supplementary learning
2009	Simplilearn	Portal for professional certification programs
2011	Byju's	Coaching, K12 subject prep, competitive exam prep
2011	Cuemath	Coaching, live class for school students
2013	Toppr	Live class for K5-K12, JEE/NEET prep
2014	Vedantu	Coaching, live class for K5-K12, JEE/NEET prep
2014	Eduis fun	learning platform through gamification
2015	Unacademy	Coaching, exam prep

Source: CRISIL Research

Digital learning grew at a CAGR of 35-40% over fiscals 2017-21

Digital learning market size witnessed a 50% growth in fiscal 2021 as many students explored digital learning in the first few months of lockdown since March 2020. Most players offer freemium products in this category and offer discounts to attract students. However, fee-paying students accounted for only smaller portion of current users, below 10%.

Digital learning is expected to grow at a CAGR of 38-42% over fiscals 2021-25

This segment has benefited from the lockdown, as in fiscal 2021, BIF players received funding that was 3x-4x funding received in fiscal 2020. CRISIL Research estimated the digital education industry to be worth about Rs 145-165 billion in fiscal 2021. Over the next four years, the industry is projected to grow at a CAGR of 38-42% as e-learning gains momentum to reach Rs 575-600 billion in fiscal 2025 driven by demand supported by COVID-19 pandemic movement restrictions, higher penetration of ed-tech learning at home and schools, higher demand for skilling at corporate employees and higher education students, development of technology and rationalisation of prices of new tech solutions.

Digital education market size in India

Chart: Digital education market size in India (Rs. billion)
- FY16: 25-35
- FY20: 100-110 (30-40% CAGR)
- FY21P: 145-165 (Y-o-Y ~50%)
- FY25E: 575-600 (38-42% CAGR)
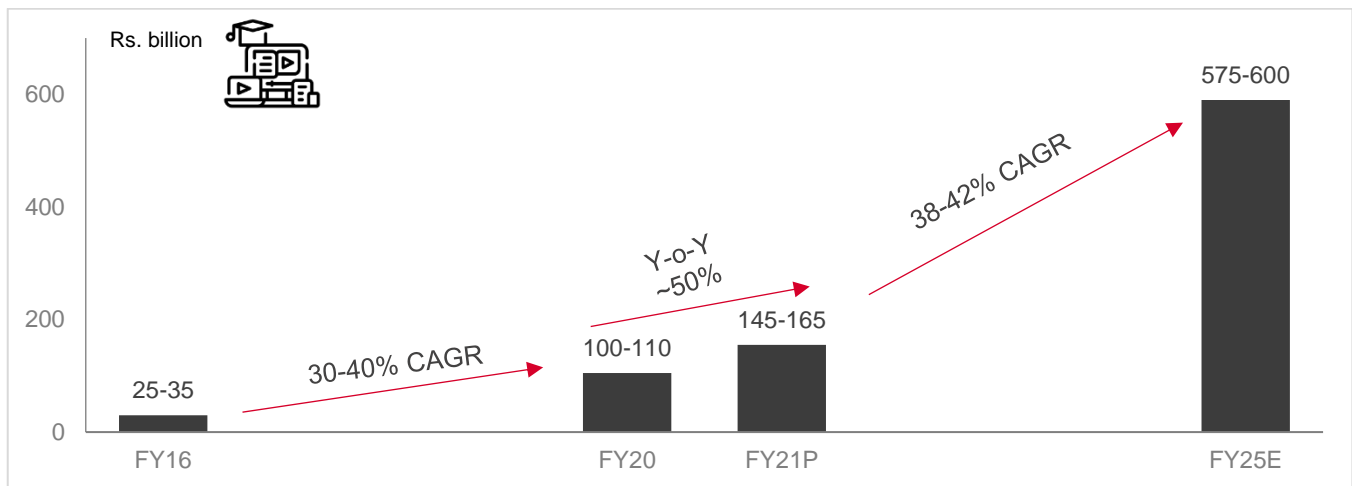
Source: CRISIL Research

Private schools will help gain momentum

As per CRISIL research, over the forecasted period, e-learning's share is expected to rise at a CAGR of 20% in private schools. In contrast, the demand for digital education from government schools is expected to decline at a CAGR of 4% as players reduce their exposure to this low-margin segment. The e-learning segment's revenue will outpace the other two segments as penetration cost declines with the decrease in the cost of high-speed internet access and smart devices, and the growth of online test prep and app-based learning.

Between private and government schools, players are continuing to shift their focus towards private schools, with the **number of schools digitised expected to increase to 55% by fiscal 2023 from 50% in fiscal 2020**. Demand from private schools is expected to continue to grow as they try to gain a competitive edge through digitisation.

E-learning to witness sharper growth

The segment's revenue is expected to grow multi-fold to Rs 574-600 billion by fiscal 2025, due to the declining cost of high-speed internet access and increasingly affordable digital devices. The number of players entering this segment is not restricted to the niche digital education service providers. On the contrary, publishing houses, skill-training centres, coaching classes and even individuals are a part of the industry commercialising educational content developed over a period of time. The government's initiatives, to develop massive online open courses (MOOCs), such as National Programme on Technology Enhanced Learning (NPTEL) and Study Web of Active-Learning for Young Aspiring Minds (SWAYAM), as well as other initiatives to provide technological access to rural areas, will support the segment's growth.

Since the onset of the Covid-19 pandemic, edtech firms such as Udemy, Byju's, Coursera, and Doubtnut saw a substantial rise in traffic share, with a consistent increase in traffic each month. Courses on data science and digital marketing are some of the topics of interest among students. Byju's added 7.5 million new users during the lockdown. Toppr also recorded 100% growth in the paid-user base.

Digital learning has lower employee cost than other segments, but content management cost is high

Digital learning has lower employee cost compared with other segments as it has recorded and live lectures. The digital segment employee cost accounts for 20-30% of the total expenses; however, content management cost is high at 30-40%.

Growth drivers in the education industry

Rapid urbanisation, higher disposable income, India's current demographic profile, rising fees, lower penetration and an increase in enrolments are the education industry's growth drivers.

Rapid urbanisation

India's average annual urban population growth rate was almost double its overall population growth rate. Urban areas offer more job opportunities and higher pay. They also provide better access to quality education inducing people to spend more on education. There are more schools in proximity to households in urban than in rural areas, resulting in higher enrolments and lower dropouts.

Rising household spending on education

Rising disposable income increases spending by households in all categories, with education benefiting from this increase, in particular. Households set aside a large portion of their monthly income for securing quality education for their children.

Demographic profile

As per UN population estimates, by 2025, a significant share of India's population will be in the working age group; currently, more than 38% of India's population falls in the under-19 age group, indicating a mammoth demand for education at all stages.

Low penetration in education gives room for growth and expansion

India has low education penetration compared with the world, which is evident from its low literacy rate and GER across grades. To address this, India will have to invest in educational institutes. GER is especially not sustained in higher grades. Enrolments declined at higher levels (with a GER of 73% at the K-12 level to 24% at the higher education level) due to teacher absenteeism, high pupil-teacher ratio and dropout rate, and poor infrastructure.

Demand from private schools – highly underpenetrated market

Private digital education has expanded rapidly since fiscal 2017, up 18% annually, and was valued at Rs ~10-15 billion in fiscal 2020 as per CRISIL Research estimates. The key driver has been **robust demand for value-added products from schools** (primarily private schools in relatively affluent urban areas) looking to enhance their curriculum and differentiate themselves. Players in the segment have been marketing aggressively to generate volume, at the cost of margins, which has supported growth. Robust growth is underscored by the huge, but untapped, potential in the market. The penetration of digital education in urban private schools stood at 50% (schools with at least one digital classroom per school) in fiscal 2020.

Keener competitive intensity has lowered per-class realisation. Additionally, several schools are building their own e-content with appropriate teacher training and infrastructural investments, and sharing it with other schools at

nominal rates. As a result, although the market is expanding, core players are finding it difficult to grow aggressively in this segment.

Drivers for edtech in India

Internet penetration
Increasing reach and lowering cost of internet allows large population to come online and have the access to this market

Bandwidth increase
Increased internet bandwidth has made watching video content online easy

Digital India
The Indian Government's Digital India campaign will boost the edtech sector

Disposable income
Rise in disposable income across the country will push Indian Edtech

Mode of delivery
Dissatisfaction in the current education system will accelerate the shift towards the new delivery mode

Population
The rise in middle class population will boost education demand

Low cost
Online education provides a low-cost alternative

Job search
The rise in the number job seekers will boost the demand for industry-specific training

8.3 Role of new-age edtech solutions and infrastructure needed for developing the market

The government has taken initiatives to improve the reach of education by making it digital and interactive. Still the Indian education system is facing problems such as poor quality, cost and access. The aforementioned problems can be resolved through new-age technologies, such as cloud computing, artificial intelligence, virtual reality and augmented reality.

Cloud-based services

With the help of cloud-based technology, the problems of access and lack of infrastructure in education can be solved – students can access regularly updated content (videos, expensive books, interactive lab simulations) on their mobile devices from anywhere.

Artificial intelligence

With AI, it has been possible to create adaptive learning technology, which facilitates students in managing their own learning. It provides every learner personalised courses based on their ability and performance. It analyses a vast pool of data to tailor the content as per students' interest and knowledge. Based on this, adaptive learning technology appropriately assesses individual differences of students and creates learning paths for every student.

Virtual reality/augmented reality

The use of AR/VR in education is of paramount importance, for it provides a cost-effective solution to study the phenomena or environments that are difficult or impossible to replicate in real life, such as space. These technologies can provide learners with simulated environments, where they can develop their skills without the real-world consequences of failing.

Gamification

Gamification in education is aimed at increasing learners' motivation and engagement by incorporating game design elements such as storytelling, problem-solving, badges, levels, and points in educational environments.

By designing lectures as a game, educators encourage students to face and accomplish various challenges and goals. This promotes higher student engagement and could help students retain knowledge more effectively. It also helps students reframe subjects they may consider burdensome or boring as engaging and fun.

Learning management systems

Learning management systems (LMS) help teachers deliver online lessons, share reading materials, and grade assignments. These platforms can streamline much of the work for teachers by centralising a number of features on one platform, including the tools needed to run a virtual, hybrid, or in-person classroom, as well as assisting with tracking student progress and connecting with parents.

Tech-led private labelling of education

Technology has put the power right in the hands of teachers and creators, the real owners of the knowledge. With tools such as Zoom and Canva – a self-publishing software – a teacher is no longer reliant on an intermediary like a publisher or a school to get her knowledge across to students. While there will be concerns about quality control, public ratings and review will weed out inferior quality, letting genuine teachers and strong content thrive.

IOT to build digitally wired classrooms

IOT will play a key role in universalising education and creating connected experiences for students. Imagine a remote classroom with an IOT-enabled black board. A remote teacher can virtually demonstrate concepts on the remote connected dashboard, bringing concepts alive for the class. Seattle-based education IOT startup Promethean builds interactive ActivWalls for schools equipped with natural language writing, dry erase and multi-media display. Devices such as Alexa can double up as study buddies by providing contextual answers to a child's questions.

Skill development

For K-12 and test preparation, the edtech startups would **expand into skill-development initiatives across the industry and development expertise in learning management solutions**. The conventional education system has had limited impact on redressing issues that India's economy is posing. From developing new skills to re-

skilling and up-skilling initiatives, university-level courses have not created adequate levels of traction. This is where the ed-tech revolution has shown the potential.

More than half of India's workforce could need re-skilling and up-skilling over the next two years to meet the industrial demand for new skills. Emerging skill requirements would be focused primarily on technology-led design and programming, complex problem solving, reasoning, ideation, emotional intelligence, critical thinking, and analysis. In addition, India's working-age population accounts for 67% of its total population of 1.3 billion people, which makes it imperative for edtech companies to expand their focus to include skill-development initiatives.

Factors such as the deep penetration of the internet and the rampant use of smartphones and other electronic devices have spiked the online content consumption in India. This has also, in turn, impacted India's addressable market for edtech products and services. The report also noted that it is the youth of the country that is driving the adoption of edtech products and services in India. These two factors have exponentially increased the capitalisation opportunity in Indian edtech. This is seen in the business done by edtech startups over the last two fiscals. Growth in digital learning space have been strong with market growing at 25%+ growth rate.

Recent deals in ed-tech

India has emerged to be among the top three countries in the world after China and the US to get venture capital funding in the edtech sector. India's edtech sector has attracted many private equity investments in the last five years, which has led to the emergence of global edtech leaders such as Byju's commanding a valuation of $15 billion. The market has also witnessed the consolidation of the sector with aggressive merger and acquisition activities leading to share growth among market leaders such as Byju's, Unacademy, UpGrad, Vedantu, among others.

Recent deals in ed-tech

Date	Sector	Companies	Investors	Investment ($ million)
21-Jun	Test preparation	Byju's Classes	ADQ, Blackstone, Others	350
21-Jun	Enterprise software (SaaS)	Classplus	Falcon Edge, GSV Ventures, RTP Global, Blume Ventures	30
21-May	Training and certification	Avalon Meta	Tanglin Venture Partners, Whiteboard Capital, Blume Founders Fund, Others	Undisclosed
21-May	Educational kits - robotics	Avishkaar Box	Auxano	Undisclosed
21-May	Mobile VAS (teaching tools)	Teachmint	Lightspeed Ventures, Learn Capital, Moneta Ventures	16
Mar-Apr 2021	Elearning - higher studies	upGrad	Temasek, IFC	165
21-Mar	Test preparation	Byju's Classes	Footpath Ventures, B Capital Group, Others	460
21-Feb	Consumer app (math)	Doubtnut.com	Lupa Systems, Susquehanna International Group, WaterBridge Ventures, Omidyar Network, Sequoia Capital India	30
21-Feb	Consumer app (preschool)	Kutuki	AET Fund, Omidyar Network, Others	2
21-Feb	Online education - admission - foreign colleges	Leverage Edtech	Tomorrow Capital, DSG Consumer Partners, Blume Ventures, Others	5
21-Feb	Elearning - maths	SplashLearn	Accel India, Owl Ventures	18

Date	Sector	Companies	Investors	Investment ($ million)
21-Jan	Test preparation	Unacademy	Steadview Capital, Dragoneer Investment Group, Tiger Global, General Atlantic	50
20-Nov	SaaS - HR - training	MindTickle	SoftBank Corp, Qualcomm Ventures, Accel India, Norwest, NEA, Others	100
20-Sep	Test preparation	Unacademy	IIFL VC, Soft Bank Corp, Nexus Ventures, Sequoia Capital India, General Atlantic	150
20-Aug	Higher education (management)	Eruditus	Chan Zuckerberg Initiative, Prosus venture, Sequoia Capital India, and others	115

Source: CRISIL Research

Rise in funding for the ed-tech industry since the onset of the Covid-19 pandemic

Funding, a key factor contributing to edtech growth, also saw a substantial shift since the onset of Covid-19. A major portion of this funding was accounted by Byju's and Unacademy, which collectively raised over $300 million. There are many startups that have raised funding since March 2020, according to data intelligence platform Tracxn, such as Qin1, Expertrons, Lido, and Univariety.

The industry has also attracted private equity in the last few years. Elearning, test-preparatory apps (coaching), pre-schools and vocational training have been some of the popular areas in the informal sector for private equity investors. Successful initial public offerings of players such as MT Educare, CL Educate, Career Point and S Chand Publications have also helped revive investor confidence in the sector.

Most active investors in the edtech sector in India

Investor	Investments
Sequoia Capital	Byju's, Unacademy, Cuemath
Elevation	Unacademy, Toppr
LightspeedVenture Partners	Byju's
Sofina	
Verlinvest	
UnitusSeed Fund	Cuemath, Curiositi, LabInApp
AccelPartners	Vedantu, EduPristine
Tiger Global	Byju's, Vedantu
Omidyar Network India	Vedantu, Doubtnut
Temasek	upGrad

Source: CRISIL Research

Education loan on decline even as students in higher education level rise

Education loan
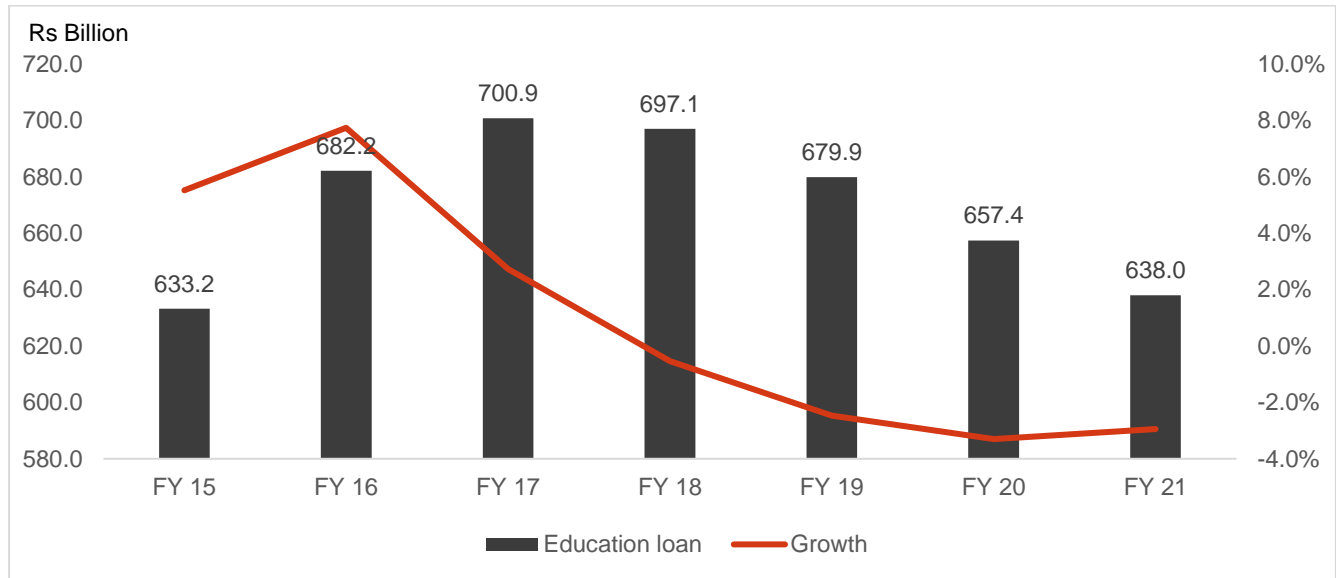
Source: RBI, CRISIL Research

Traditionally, banks have offered education loans. However, rising loan defaults by students have prompted banks to steadily cut down on education lending since 2018, according to the Reserve Bank of India. In fact, the exposure has been declining. The outstanding loans, as on March 2021, fell to Rs 638 billion compared with Rs 657.4 billion in March 2020. Banks' education loan portfolio has shrunk 3% year-on-year. The pandemic has boosted demand for low value loans for remote learning which are granted by education focused fin-tech lending platforms. However, the value of these loans was low and had a much shorter term, unlike those for overseas education that are repaid by students after completing education.

However, due to the rising cost of education and limited access to formal credit, the demand for education finance continues to soar. Organised lenders account for a very small share of the market; therefore, there is significant opportunity in this segment.

In the last 2-3 years, a new crop of start-ups, digital lenders and NBFCs have attempted to fill this void in the education finance space by offering flexible loans at low or zero interest rates, admissions and career counselling support, and a 'Study Now, Pay Later' option — an extension of FinTech's popular 'Buy Now, Pay Later'.

To improve the education system and help those in need PM Narendra Modi launched Vidya Lakshmi Portal for providing financial assistance in terms of education loans and scholarships all under one portal. This portal has been developed under the guidance of Ministry of Finance, Ministry of education and Indian Bank Association (IBA). With Vidya Lakshmi, students can apply to multiple banks and different schemes of Education Loan through a single application form. A total of 34 banks are registered on Vidya Lakshmi with more than 71 loan schemes.

Going forward, there is lot of scope for edtech companies to provide information about **loan aggregation** such as different loan schemes of banks, interest rates, application form, facility to apply to multiple banks for loans and facility for banks to download loan applications.

8.4   Government initiatives to support ed-tech

There are numerous initiatives and programmes launched by the government of India and the MHRD for students. The digital world and e-learning are expanding their presence globally. Here is a list of some digital initiatives launched by the MHRD for school students and for those seeking undergraduate and post graduate education.

Shagun 'online junction'

Shagun is an online platform for school education, launched by the MHRD. The Department of School Education and Literacy, under the MHRD, and all states and union territories (UTs) have launched several e-learning platforms on the Shagun online platform. The primary aim of the Shagun is to facilitate both teachers and students with a platform where they can interact through digital medium for further learning. There are three e-learning platforms under Shagun:

National Repository of Open Educational Resources (NROER): With about 16,000 registered users and 14,527 e-learning resources, NROER is one of the excellent initiatives of the MHRD. Through the NROER platform, students will get an exposure to e-libraries, e-books, e-courses, as well as a chance to participate in online events and theme-based education. Apart from this, students can access the website in both Hindi and English languages

DIKSHA: The MHRD has launched the National Digital Infrastructure for Teachers (DIKSHA) portal to equip teachers from the first to 12th classes into the world of e-learning. The platform is available for both teachers and students requiring learning material. The portal is available in multiple languages for students. In the first few weeks of the lockdown, DIKSHA had over six million views

e-Pathshala: Through this web-portal, students from first to 12th classes will be able to access audios, videos, e-books (e-pubs) and flip books. The digital repository has been made available by the NCERT to make sure that students do not miss out on any important concept taught in classes. E-Pathshala is also available in several languages,

Swayam: An initiative of the government of India for students pursuing education from class ninth to 12th and also for the aspirants seeking undergraduate and post-graduate level degree programmes, Swayam facilities study material at one destination. Students can access study material in the form of video lectures, reading material, self-assessment tests, online discussions and sessions for clearing doubts. The portal is connected to national coordinators, such as AICTE, NCERT, IGNOU, UGC, NPTEL, NIOS, IIMB, NITTTR, and CEC for delivering updated and excellent quality content to the aspirants. Students registering for the courses at Swayam need not pay any fee, as the course is free of cost; however, to get the certification, registration is required, for which a minimal fee has to be paid.

Swayam Prabha Swayam Prabha is a collection of 32 DTH channels, which run 24x7 for students. Every day, a new content of at least 4 hours duration is floated on the website, which runs five times in a day. Top education bodies of the nation, such as NPTEL, IITs, UGC, CEC, IGNOU, NCERT and NIOS provide content to students from classes 1st to 12th classes. Additionally, undergraduate and postgraduate aspirants can get access to interactive learning through this medium.

There are several other platforms, such as:

National Academic Depository (NAD), run by UGC, has tie up with about 55 school boards, 359 state universities, 123 deemed universities, 47 central universities and 260 private universities.

National Digital Library of India, run by the MHRD under its National Mission on Education through Information and Communication Technology (NMEICT), to provide content to not just school students but also those pursuing higher education and Ph.Ds.

Virtual Labs is another key initiative of the MHRD and the government under the mentorship of NMEICT. It is a consortium of 12 IITs, which aim to disburse online classes and study resources through virtual labs, wherein 700+ virtual experiments are designed and promoted for the aspirants to study and understand.

National Education Policy (NEP)

The edtech sector will get a further boost from the newly released National Education Policy (NEP), 2020, which promotes the use of technology to improve multiple aspects of education. The policy proposes to create a body, called the National Educational Technology Forum (NETF), to **provide a platform for free exchange of ideas on the best use of technology for enhanced learning, planning, assessment and administration for education**.

The NEP 2020 recognises the need to leverage the advantages of technology while acknowledging its potential risks and dangers. It emphasises the need for carefully designed pilot studies to determine the benefits of online education. The existing digital platforms are to be optimised and expanded to meet the challenges, with the aim of providing quality education for all. To this end, the focus on Digital India campaign will be ramped up and teachers will be given the required training to become effective online educators.

The policy, a much-needed revision of the system of education prevalent for 34 years, highlights the need to create enlightened students, who are productive, empowered, and contribute to the economy. It stresses the need for education in the mother tongue or regional language. It emphasises Early Childhood Care and Learning (ECCE).

Another policy released by the RBI, 'National Strategy for Financial Education 2020-2025′ (NSFE), has suggested a multi-stakeholder-led approach for creating a financially aware and empowered India. The five Cs, outlined by the strategy paper, are: Content, Capacity, Community, Communication and Collaboration.

To achieve the vision of creating a financially aware and empowered India, NSFE has laid down strategic objectives, like inculcating financial literacy concepts among various sections of the population through financial education to make it an important life skill and encourage active savings behaviour.

Among other strategic objectives are encouraging participation in financial markets to meet financial goals and objectives, developing credit discipline and encourage availing credit from formal financial institutions as per requirement, and improving usage of digital financial services in a safe and secure manner.

The document stresses on the development of financial literacy content for school children (including curriculum and co-scholastic), teachers, young adults, women, new entrants at workplace/entrepreneurs (MSMEs), senior citizens, persons with disabilities, illiterate people. It also calls for development of a financial literacy mobile app, and leverage social media.

National Digital Education Architecture (NDEAR)

NDEAR has been conceived by Government of India as a unifying national digital infrastructure to energise and catalyse the education ecosystem. It is federated, unbundled, interoperable, inclusive, accessible, evolving which aims to create and deliver diverse, relevant, contextual, innovative solutions that benefit students, teachers, parents, communities, administrators and result in timely implementation of policy goals.

8.5 Other information and training platforms in ed-tech space

Apart from traditional education, working class information and training platforms are on rise

Key niche segments in ed-tech platform and potential for growth in future

Key verticals in edtech	Meaning/purpose	e-tech platforms
Financial literacy	The e-platforms providing skills and knowledge allow an individual to make informed and effective decision with their financial resources.	Coursera and ISB launch investment management courses to address the lack of personal finance skills in India
Agri information	Agri-information using the technology is named as Agri-tech. It means the use of technology for farming to improve efficiency and profitability. It also includes the use of automation as well as information monitoring and analysis of weather, pests, soil and temperature	Cisco's LaunchPad portfolio startup, Sensegrass, is creating 360-degree smart-farming solutions
Advisory services and training	It provides professional development online through workshops and coaching. These services are offered across sectors such as finance, accounting, real estate and education	Edtech provides professional development in-person and online through workshops and coaching
Health advisory and training	Provides healthcare training and advice leveraging technological advancements such as EHRs, machine learning, AI, cybersecurity or other technologies.	VIVO Healthcare is a leading healthcare education and training company. It offers a wide range of educational and training programs, including career training, health and safety, and emergency life support.
Loan aggregation	Loan aggregators are platform providers that offer consumers a comparative synopsis of the best solutions in the market, fine-tuned to their search filters, patterns, keywords, location tagging, profile and browsing history.	Capital Float offers an online platform for consumer and business loans.
Education information exchange platforms	These platforms help by providing all education-related information at one place, such as financial assistance in terms of education loans and scholarships, all under one portal.	Vidya Lakshmi portal

Source: CRISIL Research

Agri information

The government has started laying the foundation for 'digital' transformation in the agriculture sector in 2016, when it launched the **National Agriculture Market (eNAM)** to promote online trading of agriculture commodities. As per a 2019 report, more than 200 million active internet users are in rural India, of which 97% users access the internet on mobile devices. This means, with more than 145 million farmers in India, there is a massive scope to tap in farmers across the nation.

India's **National Strategy on AI** recognises agriculture as a priority sector for implementation of AI-driven solutions. According to the Niti Aayog, AI in agriculture is expected to grow at a rate of 22.5% CAGR, and is likely to be valued at $2.6 billion by 2025. AI can help farmers predict weather patterns. Big Data helps improve the yield, reduces risk, and increases efficiency. With the right data, farmers will be able to take timely decisions, on what crop to sow, when to sow it, and what method to use.

More farmers are beginning to understand how leveraging solutions that use the latest technologies such as Artificial Intelligence (AI), Machine Learning (ML), and cloud offers them greater climate resilience, higher crop

yield, and better price control. Smart farming that uses modern digital technologies such as sensors, location data derived from GPS and satellites, robotics and analytics is changing the face of agriculture in India.

CropIn's digital platform, which monitors and captures farm-level data and delivers real-time advisories on season-wise crop configurations, weather-based advisories, information about sowing, soil health, seed treatment, fertiliser application, treatment of crop disease and treatment of livestock.

TraceX Technologies is another startup that is helping farmers adopt sustainable agricultural practices. Its digital agriculture platform makes the agricultural supply chain more efficient, traceable and transparent. This has led to better quality, food safety, and customer commitments.

Decision intelligence platforms, such as the one built by **SatSure**, use satellite images, machine learning, for accurate crop monitoring. In the aftermath of natural disasters, this helps decision-makers and authorities get accurate information to disburse relief to distressed farmers on time.

Direct farmer-to-consumer platforms developed by startups **like Kalgudi** that directly connect farmers to end consumers to prevent exploitation by middlemen, and improve their livelihoods.

Bengaluru-based agritech startup **BigHaat** leverages data science and analytics to provide end-to-end advisory on best practices in farming, a digital marketplace for agri inputs. BigHaat aims to engage with farmers through meaningful content, and a range of products that can greatly boost yield and revenue.

Empowering farmers with the right digital tools and knowledge on end-to-end contemporary agricultural technologies and practices including precision agriculture, sustainable agriculture, farm machinery management, marketing and consumer management, has made a significant impact on the agriculture sector.

Health advisory and training

Focus on digital health is one of the strongest forces that will bring a change in delivery of healthcare services. With the government's large healthcare schemes, such as AB-PMJAY, envisaging the National Health Stack for digitalization of healthcare records, focus on Hospital Information System and Healthcare Insurance Information Platform, increasing number of health apps for monitoring NCDs, and use of AI-based predictive care platforms, the healthcare system will witness several changes from the technology perspective.

Companies such as **eKincare and DocsApp** are also making progress via their digital healthcare platforms – enabling online doctor consultations. **Sigtuple and Sigmoid** are companies that are using ML-refined models and AI to help with complex diagnoses; Sigmoid is able to enhance poor quality images from X-rays and CT scans (low-end machines) to provide radiologists with markers. **Virohan** is an edtech startup providing vocational training for paramedics and allied healthcare practitioners. **Dozee** a healthcare startup is focused on building solutions that are based on non-invasive patient monitoring based on vibrations.

Advisory services and training

The main purpose is to provide professional development in-person and online through workshops and coaching. Technology consulting services include strategic assessment planning, instructional design, technology integration and planning, assistance with emerging technologies and online and blended learning and web and online course accessibility. These services are offered across sectors, such as finance, accounting, real estate and education.

L.E.K. combines primary research with advanced analytics and strategy consulting to help institutions and incumbent companies strengthen their presence in the digital arena. **Ed-Tech Solutions LLC,** located in United

States, provides educational institutions consulting services for the management, training, and evaluation of information technology by the educational institutions. **Educational Technology Consulting Services** provides professional development in-person and online through workshops and coaching.

Loan aggregators

These platforms or companies help to aggregate the loans from financial institutions and then securitizes them into mortgage-backed securities (MBSs). These companies have to pay attention to risk, underwriting, credit verification and appraisal, collection processes, KYC, and default management but do it using technology, machine learning algorithms, and tech intervention in traditional offline processes and also need to build, sustain and manage an ecosystem in the alternative finance space. These marketplaces have to build credibility among their user base, offer better rates to all participants on the platform, offer a whole host of decision-making tools, intelligence in appraisal and monitoring and build expertise of a different kind but that which delivers the same results to the participants on their platform. This entails an understanding of the whole end-to-end process and building the expertise at a fraction of the cost.

Lendingkart is an online lending platform providing business loans. It offers loans such as working capital loans, SME loans, business loans for women, and more. It provides an app-based platform that is available on Android devices.

InCred Finance is an online lending platform for consumer and business loans. It offers multiple financing products to customers, including personal loans, education loans, SME loans, automobile loans, and more. The loan amount is based on the credit assessment, loan terms, annual interest rates, and more. Repayment of loans can be done via credit/debit cards, bank transfers, and wallets.

KreditBee is an online lending marketplace for personal loans. The user can register using Facebook or Google, enter eligibility proof details, upload KYC documents, and attach bank details to avail personal loan. Upon applying for loans, the platform connects borrowers with multiple lending partners to choose from a range of financing products based on the interest rates and loan terms offered. It also features an app-based platform that is available for both Android and IOS devices.

Loan aggregators for education services include companies like

Eduloans is comprehensive financing platform connecting educational aspirants with potential financial institutions, investors and endowment funds. Its partners include banks, non-banking financial companies (NBFC's), international funds, us banks, investors and university / government grants through scholarships.

Eduvanz is a Mumbai-based startup which wants to make education accessible to all learners across K-12, test prep, up-skilling and Upper Graduate/Post Graduate courses by enabling them to apply for zero-interest loans through its 'Study Now, Pay Later' product.

Auxilo Finserve Pvt. Ltd. is a pro-education NBFC registered with the Reserve Bank of India. It endeavors to influx finance to catalyze aspirators by providing financial access to student or the educator.

Education information exchange platforms

These companies or platforms help students by providing all education-related information at one place. They have a learning platform and community, with workshops, classes, and resources for betterment of students. They also include platforms providing financial assistance in terms of education loans and scholarships under one portal.

Vidya Lakshmi Portal is a first-of-its-kind portal for students seeking education loans. The portal has been developed by and is being maintained by Protean eGov Technologies Ltd. Students can view, apply and track their education loan applications to banks anytime and anywhere by accessing the portal.

The **Adobe Education Exchange** is the free learning platform and community, with workshops, classes, and resources, all designed by educators for educators, to inculcate creativity in the classroom.

Vidyasaarathi, an initiative by Protean eGov Technologies Ltd. has a potential to bridge the gap in education finance in the country. It is an online platform that proposes to effectively bring together various stakeholders in the education ecosystem and is positioned as a user friendly, transparent, and demand driven platform which will help the corporate sector in playing a positive role in developing education finance for the Indian society at large.

Vidya Kaushal is a first of its kind platform developed to enable any Indian individual to apply for financial assistance / loan to pursue Skill development training courses. The unique skill platform aims to provide truly seamless access to skill loan funding aligned with the national vision of developing a skilled India, creating greater employment opportunities and employable skills. Vidya Kaushal provides the following broad features for various stakeholders.

8.6 Increasing potential for ed-tech sector in India with increasing private investments

Reasons behind growing interest of investors in edtech
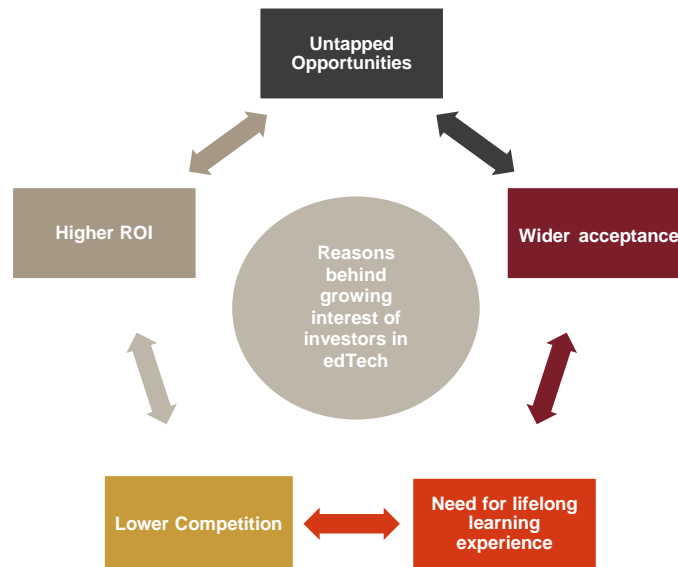
Source: CRISIL Research

1. Untapped opportunities

There are various regions and communities that do not have access to educational resources. They are not able to have even the basic learning experience. Likewise, there are various people who are eager to learn something new or polish their skills, but are unable to do so within the traditional educational ecosystem. The rural India also has lot of potential for growth from edtech. All such instances highlight a myriad of unexplored opportunities in the marketplace, which gives venture capitalists an assurance that investment in education startup ideas will definitely be profitable to them.

2. Wider acceptance

Edtech platforms bridge the gap between those who wish to learn and those offering the same service by bringing them on the same platform, virtually. They are enabling them to learn anything, anytime and anywhere at their own pace. Also, these platforms operate using the finest of technologies, such as AI and IoT. Because of these two reasons, edtech ideas are not solely being widely accepted by consumers, but are also attracting more investors.

3. Need for lifelong learning experience

The rate at which knowledge is growing these days, the time by which one learns a skill to apply for any job, another skill leads the show. This makes it imperative for them to embrace the idea of lifelong learning, eventually encouraging investors and developers to invest their time and money into developing mobile apps that are expected to be the future of the education industry.

4. Lower competition

Another reason why investors are supporting the idea of education mobile app development is that even today, there are various subdomains where only one or two brands are changing the story. Implying, there is lower competition and higher market scope, which turns out to be a profitable investment.

5. Higher ROI

The edtech market is growing exponentially. Its solutions are being accepted widely and competition is low. All these factors clearly indicate that the return on investment is exponentially higher in the case of online education domain, thereby attracting investors to this opportunity.

Growth will largely be volume-driven: a combination of an increase in the potential market as well as higher penetration of digital education in schools.

Technology integration in Indian education is still at its nascent stage. However, with the exponential rise in the number of technology users in India, edtech solutions can help the country get ahead of the roadblocks, by providing quality learning experience to even remote areas of the country without financial strain. Innovative solutions by the the edtech industry, along with a sound NEP, will gradually ensure educational rights and quality education for the future citizens of the nation.

9 Overview of GST filing infrastructure in India

Introduction of Goods and Services Tax (GST) is one of the largest indirect tax reforms in the history of India. The tax came into effect from July 1, 2017, after the implementation of the 101st Amendment of the Constitution of India. GST consolidates various taxes levied by the central and state governments into a single tax. The tax rates, rules and regulations are governed by the GST Council. It is the apex member committee to modify, reconcile or procure any law or regulation based on the context of goods and services tax in India. The council is headed by the Finance Minister and has 33 members, of which, two are from the Centre and 31 are from 28 states and three union territories (UTs).

To implement GST throughout the country, it was necessary to develop a digital platform that can handle the diverse tax systems of the states, UTs and the central government and provide a single interface to the taxpayers for all their GST functions. The GST Network (GSTN) was given the responsibility of building such a platform.

9.1 Overview of GST Network (GSTN)

GSTN is a non-profit non-government organisation. It provides shared IT infrastructure and services to central and state governments, taxpayers and other stakeholders.

Its responsibilities include, but not limited to, the following:

- Designing, developing and handling the GST system application
- Ensuring seamless migration of taxpayers to the GST regime
- Procuring information technology (IT) Infrastructure
- Building systemic resilience against failures and putting in place a disaster recovery mechanism
- Setting up and handling operations of the helpdesk
- Training and capacity building
- Creating and managing the GST ecosystem
- Creating the backend system for some states/UTs for assessments, appeals, etc

The central government holds 24.5% stake in the GSTN, while the sub-national governments (states and UTs) hold 24.5%. The remaining 51% share is divided among five financial institutions: LIC Housing Finance (11%) and ICICI Bank, HDFC, HDFC Bank and NSE Strategic Investment Corporation Ltd. (10% each).

9.2 IT infrastructure for GSTN

The GST portal has been envisaged as a single interface for taxpayers to access the GST system network. The GST portal (www.gst.gov.in) developed by the GSTN acts as the frontend of the overall GST ecosystem. The IT systems of the Central Board of Indirect Taxes and Customs (CBEC) and state tax departments function as backends that handle tax administration functions such as registration approval, assessment, audit and adjudication. The backend systems interact with the GST portal through application programming interfaces (APIs).

The work on the portal began in November 2015, with Infosys selected as the managed service provider for this project. The GST portal was officially launched on July 1, 2017.

The GSTN allows taxpayers to make payments through both online and offline modes. To make a GST payment, a challan needs to be generated first through the GST portal. Then, the payment can be made in either of the following ways:

Online mode: Refers to payments made through internet banking or debit/credit cards. Taxpayers can pay GST and file for returns through one of following:

1.   GST portal (www.gst.gov.in) or

2.   Third-party apps or GST Suvidha Providers (GSPs)

Offline mode: Includes payments through cheque, DD, cash, NEFT or RTGS. Taxpayers can pay through these modes upon generating the GST challan, before or after logging into the GST portal. Taxpayers have to take a printout of the challan, fill in the depositor and instrument details, and sign and submit it to the bank to complete the payment. In case of over-the-counter, banks will process the instrument in a day or two. Thereafter, the electronic cash ledger gets updated with the amount.

GST system
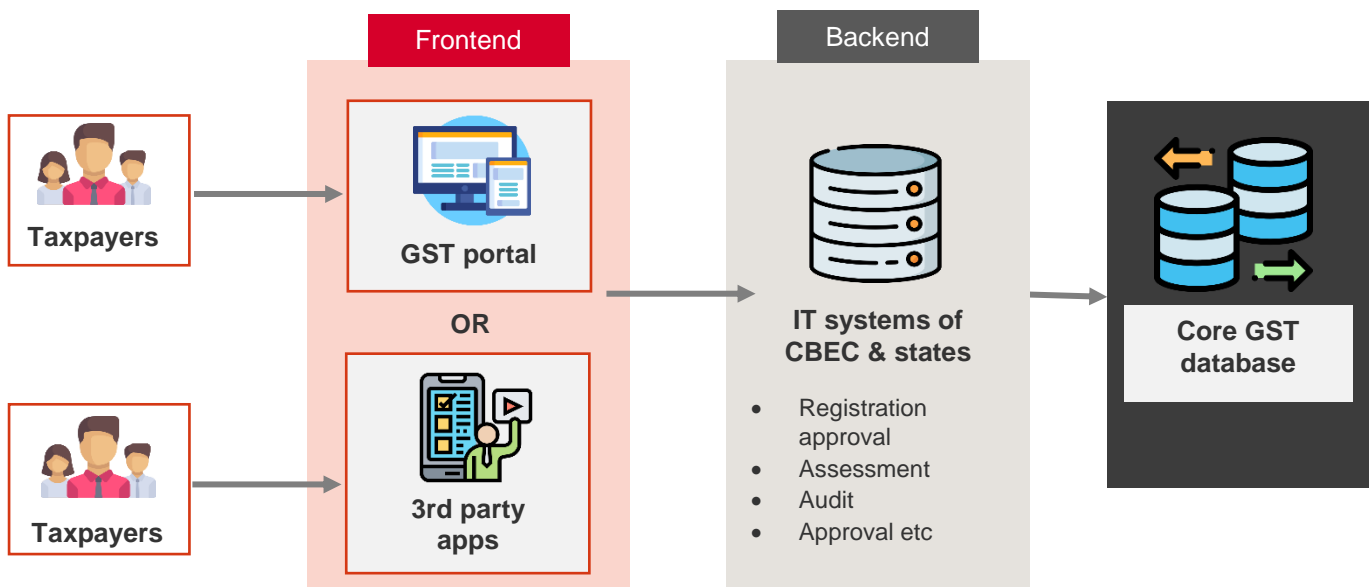
Source: Goods and Services Tax Network (GSTN), CRISIL Research

Information flow
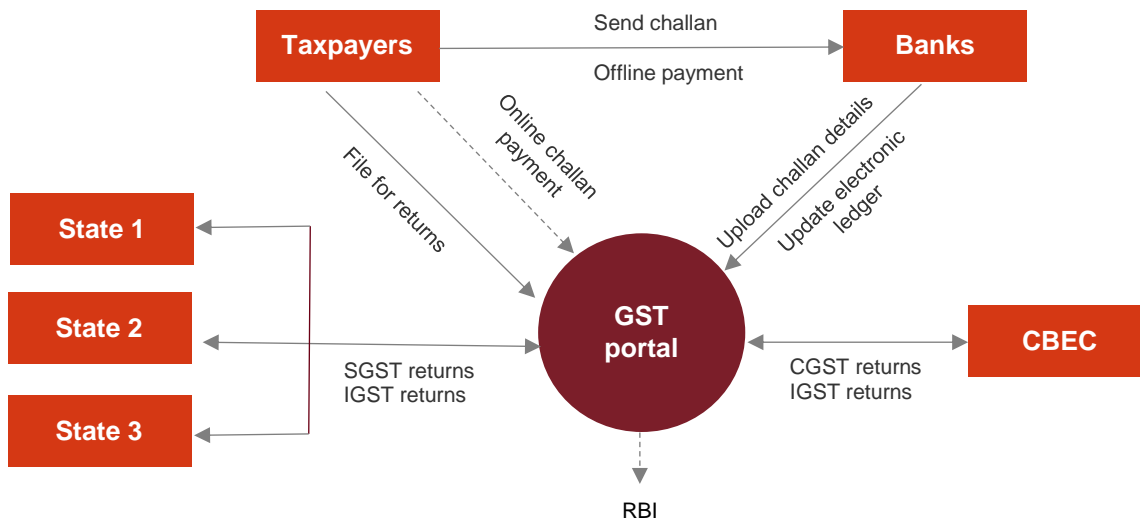
Source: CRISIL Research

A schematic representation of the information flow through the GST system is shown above. The GST portal is simply a pass-through device. The portal acts as the frontend of the GST system through which taxpayers can file for returns or make challan payments. After filing returns on the GST portal, taxpayers retain a copy of the returns for analysis, and forward it, in near real time, to respective states and CBEC IT systems. Central and state tax officials can then access the data to perform statutory functions like registration approval, assessment, audit, appeal and enforcement. The state and CBEC IT systems interact with the core GST server through APIs and over multiprotocol label switching (MPLS) to ensure a secure connection.

GSPs & ASPs

The government-to-business portal (www.gst.gov.in) is not the only way for taxpayers to access the GST system. Taxpayers can also use third-party applications, also called Application Suvidha providers or ASPs. The third party applications will connect with GST system via secure GST System APIs. All such applications are expected to be developed by third party service providers who have been given a generic name, GST Suvidha Provider or GSP. GSPs provide innovative solutions to taxpayers and other stakeholders to access the GST system, right from the registration of an entity to uploading of invoice details and filing of returns.

GSP ecosystem
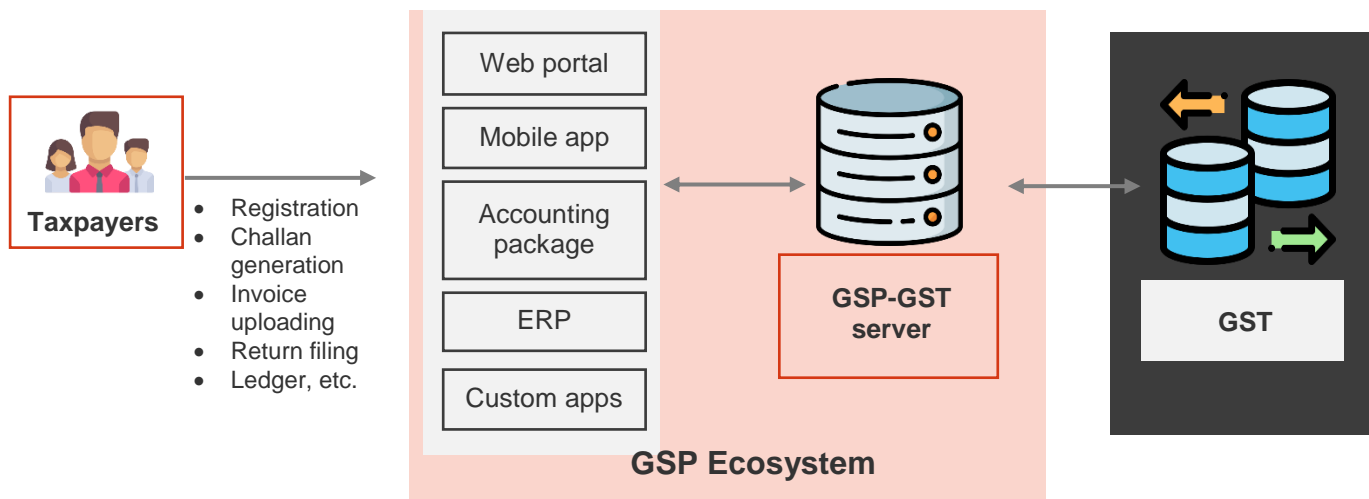
Source: GSTN, CRISIL Research

There are two types of interactions in the GSP ecosystem: between the app user and the GSP, and between the GSP and the GST system. GSP apps connect with the GST system via secure GST system APIs. The production API endpoints can only be accessed via MPLS lines, and all APIs can only be accessed over the HTTPS protocol, which ensures enhanced security for all data transmissions.

In addition to the services mentioned above, GSPs also provide a host of other services some of which are mentioned below:

1. Invoice generation - This service allows the customer to generate invoices in printable format.

2. Upload sales invoices in GST format - This allows the customer to upload sales invoices as well as file for GST returns in appropriate GST formats.

3. Ledger Balance - This service allows the customer to download/view cash and credit ledgers from GST Portal.

4. Utilization of ITC & Cash Balances - This service will allow the customer to submit cash/ credit utilization towards GST payable.

5. Reconciliation - Matching invoices as per dealer & as per GSTN.

GSPs need to be empanelled with the GSTN and as of June 2021, a total of 53 companies have been empaneled into the GSTN as a GSP. ASPs are basically just companies which build software applications on top of GSP infrastructure. These do not need to be empanelled with the GSTN. A GSP can also become an ASP in order to provide rich Software for preparing and filing GST Returns. On the other hand an ASP doesn't have to be a GSP as well. The ASP may simply procure the GSP API's in order to develop its own Application

9.3 Overview of paid and free models in GST filling

Different tax payers (SMEs, large enterprises, small retail vendors, etc.) require different types of services like converting purchase/sales register data to GST-compliant format. Similarly, tax payers in different industries tend to use specialised enterprise resource planning (ERP) packages for handling their accounting, and therefore, they might need to integrate their accounting packages/ERPs with the GST system. All of these requirements can be met by using the services of third-party providers or GSPs.

Some of the GSP apps may charge an access fee for these services. So, if a business files for GST returns using paid GSP services, it is said to be using a paid GST filing system. On the other hand, a business may also file GST returns by itself using the GST portal, for free of charge. Filing for returns via this method is called free GST filing.

Opting for a paid GST filing model offers several benefits, some of which are as follows:

- Painless reconciliation: Most of the paid GSP services make reconciliation simple by automatically matching a business' purchase transactions from its GSTR-2 to their vendor's GSTR-1. All one needs to do is amend or approve transactions that aren't matched in the GSTN.

- Online collaboration: Some GSPs also provide CAs role-based access to specific modules, to view or edit information.

- Ledger maintenance: Most of the paid GSPs provide ledger maintenance services like keeping track of the total tax amount paid, input tax credit available, and raising sales orders and invoicing.

- Multiplatform access: The GST filing services can be accessed from mobile app, desktop software or the web.

- Business reports: GSPs also provide detailed reports and access to dashboards showing data about e-payments, billing, invoicing, inventory management, etc.

Comparison of paid versus free models for GST filing

	Free model	Paid model
Pay GST online	✓	✓
File for GST returns	✓	✓
Pay using net banking	✓	✓
Notifications for payment on registered email and mobile number	✓	✓
Track status of GST refund application	✓	✓
File appeals online	✓	✓
Billing and accounting features	Only for businesses with annual turnover of less than Rs 1.5 crore	No limits on annual revenue
Multiplatform access	✗	✓
Ability to integrate with existing ERP	✗	✓
Online collaboration with CA/other team members	✗	✓
Advanced analytics tools	✗	✓
Reminder to recover payments from customers and vendors	✗	✓

Source: CRISIL Research

Even if one doesn't need the additional features offered, several individuals are still opting for the paid GST filing solutions due to the simplicity they bring in throughout the GST payment and return filing journey. Though GST has simplified the entire process of paying taxes, invoicing and filing taxes while remaining compliant with the GST

regime still involves some minor juggling. There are three categories for taxes to be paid, invoices must be in a GST-compliant format with different formats for different situations, e-way bills have to be generated in case of goods being moved, and there are several provisions for claiming refunds, which need to be adhered to as per the changing compliance requirements. Most players in the industry are now providing automatic compliance software, which require minimal intervention by the user, and thus, lead to significant time savings for taxpayers.

Another significant worry for firms has been to claim proper input tax credit (ITC). This is especially true for large organisations, where the loss due to delay in ITC could have a major impact on their working capital requirements. ITC can only be claimed if suppliers of a business have completed their GST compliance, uploaded invoices and filed their returns on a timely basis. Non-compliance can result in a loss of ITC. ClearTax, for example, has released technologies that helps businesses identify and plug ITC leaks, maximise input credit availability, and link vendor payments to vendor compliance, resulting in significant cost savings.

GST verification has aided customer on-boarding and credit disbursal space

The launch of GST has proven to be instrumental in the formalisation of the country's informal sector, especially in today's digital era. GST has paved the way for digitalisation, leading to wider availability of digitised financial data of companies. This data can be leveraged by lending institutions and fintech firms to find new ways to assess the creditworthiness of applicants and make better informed and more data-driven decisions, especially about lending to SMEs.

One of the important steps in making any lending decision is assessing the creditworthiness of applicants. Traditionally, most lending institutions have been relying on the credit score for this. However, these measures are arrived upon by a unidimensional assessment of data and are, therefore, not very reliable. Besides, for many SMEs, which typically don't have a formal borrowing history, credit score might not be available. Most SMEs operate in the informal sector, and often, there is no access to data points regarding their cash flow because they operate with unique business models. Thus, SMEs are more likely to rely on internal funds or cash from friends and family, to launch and initially run their enterprises.

The shift to GST has led to more SMEs transferring their financial and operational data to a centralised digital format. The data thus generated provides credible information on the supply chain of the business. The e-bill format of sales ensures absolute precision and transparency in the business. In short, data from the GSTN can help assess the financial health of the business in terms of its cash flow, supply chain and sales.

Using GST data for credit disbursal

More and more lending firms today are making the shift from the traditional asset-based lending process to data-based lending, by gaining access to consented GST data. Following are some of the benefits of using GST data for credit assessment:

1. A more customer-centric lending process

    Data from the GSTN can be used to form an accurate and personalised profile of loan applicants. This will help deliver personalised loan offerings with competitive interest rates that cater to the needs of end users.

2. Analytics-driven decision making by leveraging access to vast amount of data

    Data from the GSTN includes the following:

    –   Data about purchases – Inward supply information about goods and services

    –   Data about sales – Outward supply of goods and services and aggregate turnover

    –   Data about customers – Details of customers across products and their breakdown

    –   Location info – State-wise bifurcation of sales

    –   Data about vendors – Details of top vendors across products and their breakdown

    –   Public data – Compliance status, GST registration details, etc

3. Access to real-time data to prevent frauds

    Real-time information from the GSTN can be used to verify if an applicant is providing the right financial information. This can help get rid of false positives and assess if the borrower will be able to repay the loan, by understanding the financial health of the business.

4. Multidimensional assessment of creditworthiness

    Rather than relying on data provided by the applicant and on the credit score, lending firms can now gather data across various points from the GSTN and make a quick, thorough assessment.

Data from the GSTN, combined with the credit score, bank statements, KYC, etc, can help generate great insights into the overall credit behaviour of applicants.

GST revenue receipts have grown at 5% between fiscal 2018 and 2021

Since the GST came into effect from July 2017, the GST collections have been steadily increasing from Rs. 4,426 billion in fiscal 2018 to Rs. 5,151 billion in fiscal 2020, growing at a CAGR of ~5%.

Trends in GST revenue receipts

in Rs billion

CAGR ~5%

CAGR ~16%

	FY18	FY19	FY20	FY21
	4426	5816	5987	5151
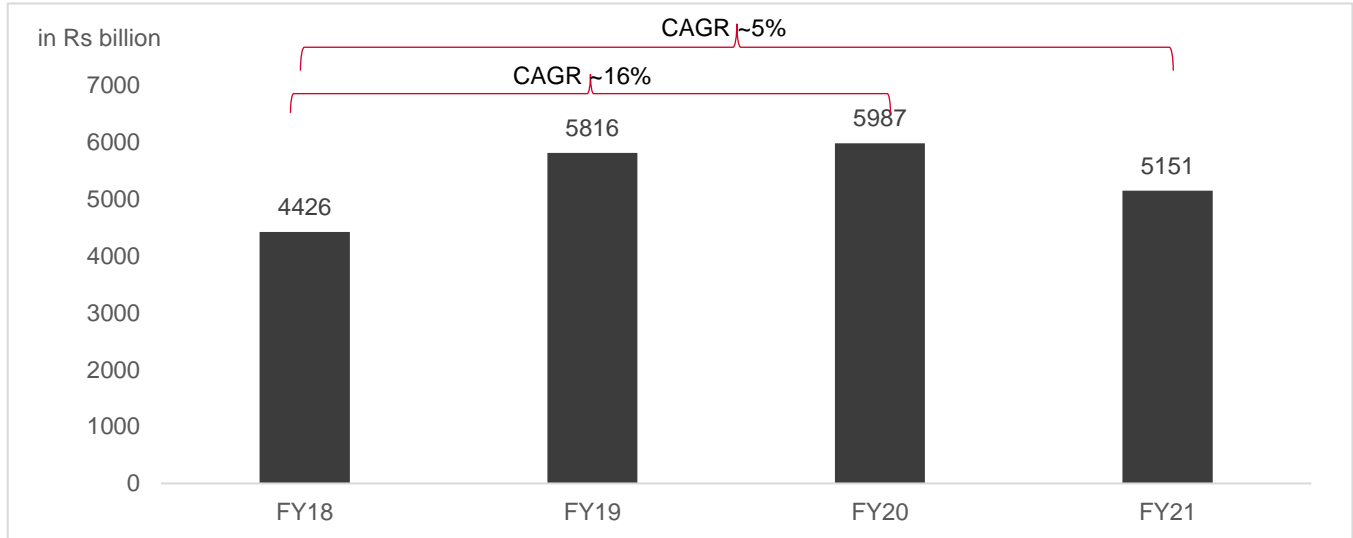
Source: Union budget, CRISIL Research

There are a total of around 12.9 million active taxpayers in the GST System as of 1st Nov 2020.

Number of GST return filed

in millions

2017	2018	2019	2020 (till 30th Sept)
70	157	161	123
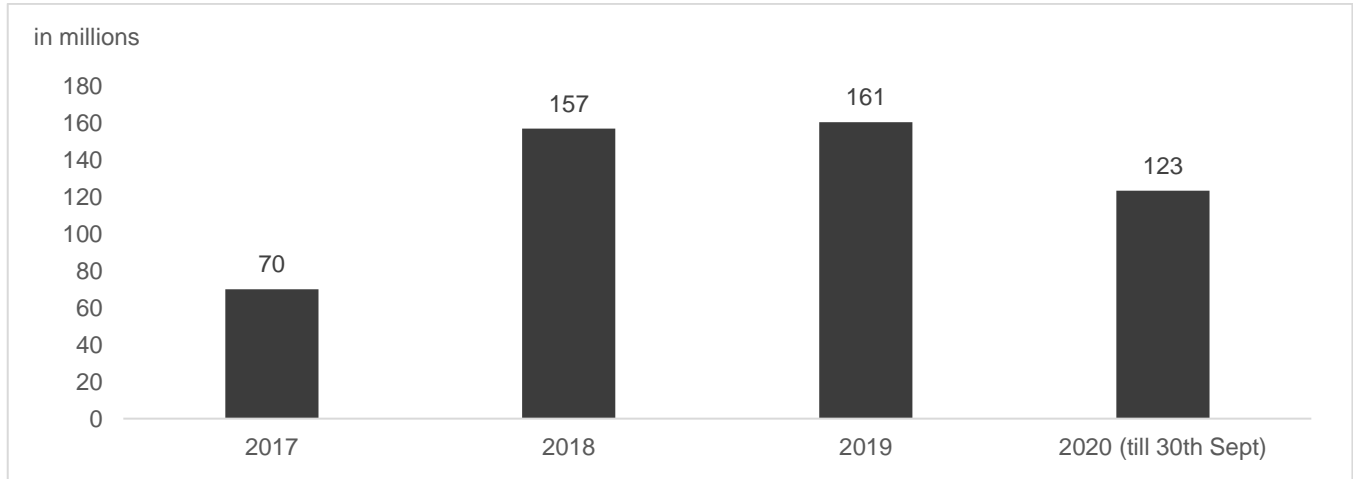
Source: GSTN annual report, CRISIL Research

In addition to the growing revenues from GST, the share of GST in total Tax Revenue receipt increased from 23.1% of in fiscal 2018 to 29.8% in fiscal 2020.

Trends in Tax Revenue Receipts
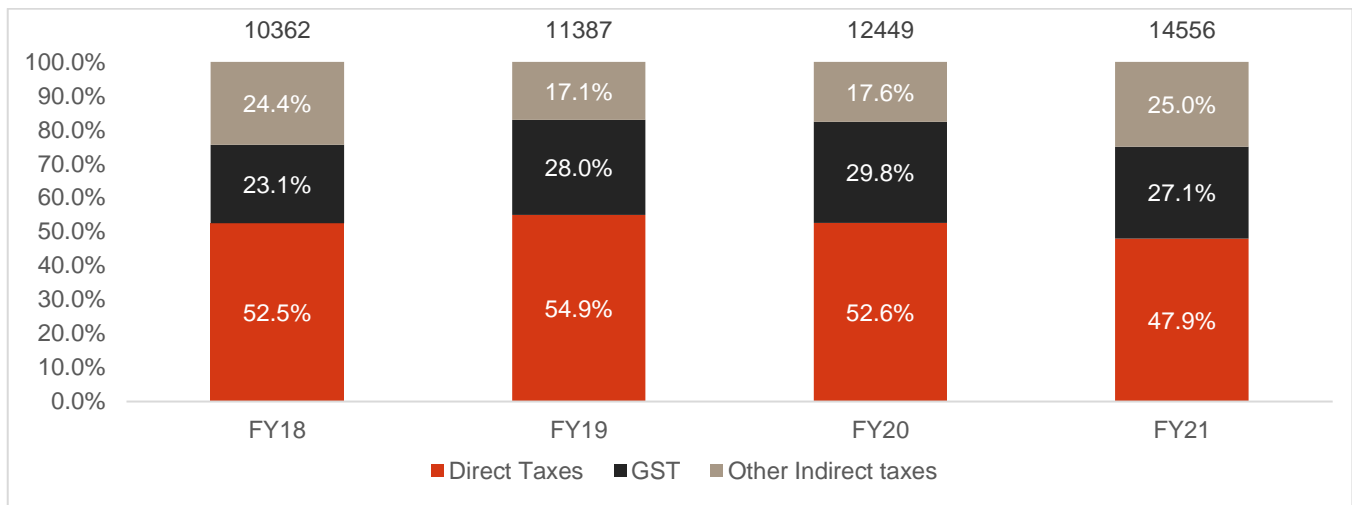
Note: Figures on top of Bars represent the total value of Tax Revenues in Rs. Billion
Source: Union Budget, CRISIL Research

More than 90% of SMEs operate in the informal sector and a lot of them aren't registered on GST yet. Going ahead, as new GST registration has become mandatory for businesses with an annual turnover of Rs. 4 Mn and above, CRISIL Research expects the number of taxpayers registered under GST to increase significantly.

Apart from an increasing number of taxpayers, many new analytic solutions are being developed, especially in the fintech lending space, which leverage the data available in the GST system. The flow based lending being developed by some players is one such example. Flow-based lending is a system wherein the borrowers provide credit to companies based on their cash-flow and operational data instead of asking for any collateral from them. This would be especially helpful for SMEs who typically don't have proper documentation and/or credit-score. It would enable lending companies to cater to the working capital requirements of SMEs with minimal documentation and allow quick loan disbursal.

Apart from GST return filing, most of the GST compliance solutions also provide the facility to generate e-Way bills. E-Way bill is an electronic way bill for movement of goods to be generated on the e-Way Bill Portal. A GST registered person cannot transport goods in a vehicle whose value exceeds Rs. 50,000 without an e-way bill. The number of e-Way bills being generated has been continuously increasing since its inception in 2018. In fiscal 2020, a total of 629 million e-Way bills were generated, up from 558 million in fiscal 2019.

Number of e-Way bills generated
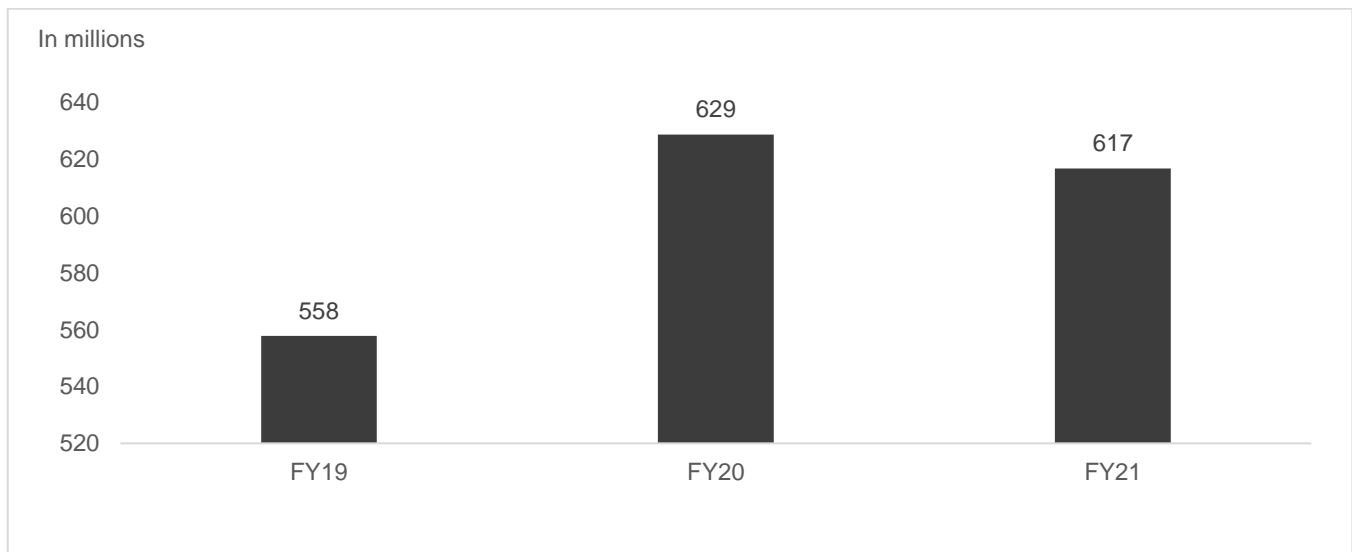
Source: National Informatics Centre, CRISIL Research

Going ahead, CRISIL Research expects road freight to grow at a rate of 9-11% in billion-tonne-km (BTKM) terms in fiscal 2022 and at a CAGR of 6-8% between fiscals 2021 and 2026. Revival in production across all segments and investment-focused government spending is expected to further boost freight movement. With an increase in road freight, the number of e-Way bills generated are also expected to increase in the near term.

Also, as can be seen from the below graph, India has always maintained a Tax buoyancy of greater than 1, i.e, the percentage increase in tax collections has always been more than the percentage increase in GDP. Going ahead, since CRSIL research estimates the GDP growth rate to increase, the tax collections are also expected to increase in tandem.

So, driven by an increase in number of taxpayers, need for new analytical solutions which leverage GSTN data and an increasing GDP growth rate, CRISIL Research expects the demand for GST filing and compliance solutions to only increase in the near future.

Trends in Tax vs GDP growth rate
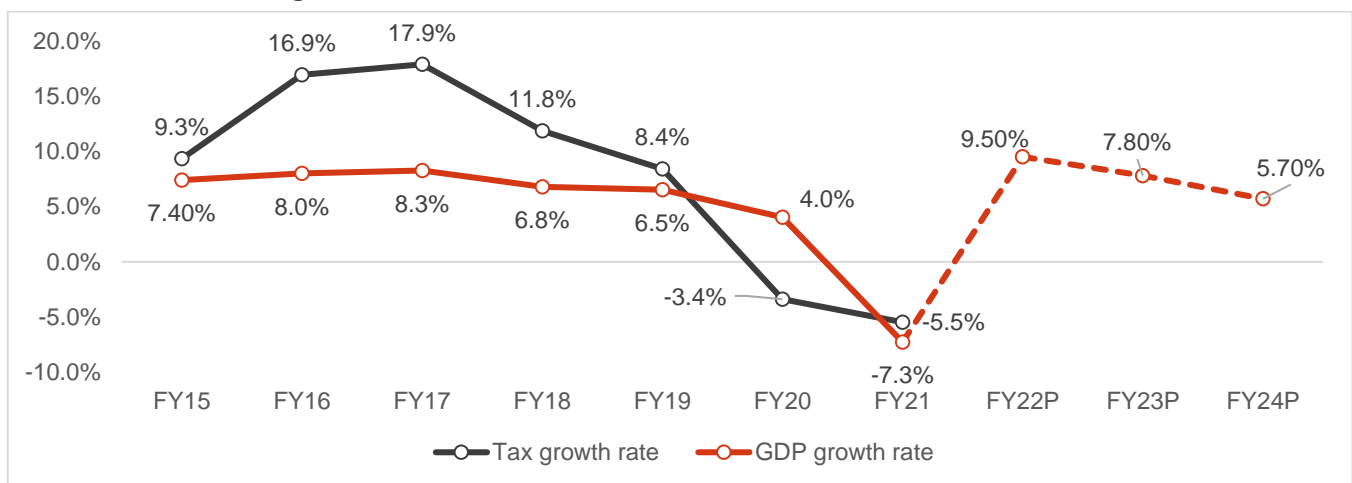
Source: Union Budget documents, CRISIL Research

9.4 GST suvidha provider space is fairly competitive

As of June 2020, a total of 53 companies have been empanelled with the GSTN as a GST Suvidha Provider (GSP) till 3rd batch. Additionally 4th Batch of GSPs is under process for on-boarding. Financial strength, technical capabilities and demonstration of technical activities are among the selection criteria for GSPs 4.0

Following is the list of GSP companies after 3rd batch of selection:

3i Infotech Ltd.	Mothersonsumi Infotech & Designs Ltd.
Abhipra Capital Limited	Protean eGov Technologies Ltd.
Adaequare Info Private Limited	Payswiff Solutions Private Limited
Alankit Limited	Perennial Systems
Amazon Seller Services Private Limited	Pinnacle Finserv Advisors Private Limited
Balaji Mariline Pvt Ltd.	Pricewaterhousecoopers Private Limited
BDO India LLP	Professional Softec Private Limited
Binary Semantics Limited	Rajcomp Info Services Limited
Bodhtree Consulting Limited	RAMCO SYSTEMS LIMITED
CDSL Ventures Limited	Reliance Corporate IT Park Limited
Chartered Information Systems Private Limited	Relyon Softech Limited
Clayfin Technologies Pvt Ltd.	Seshaasai Business Forms Private Limited
Cygnet Enterprise Private Limited	Shalibhadra Finance Limited
Cygnet Infotech Private Ltd.	SISL Infotech Pvt. Ltd.
Cleartax (Defmacro Software Private Limited)	Spice Digital Limited
Deloitte Touche Tohmatsu India LLP	Tally (India) Private Ltd.
Emudhra Limited	TATA Consultancy Services Limited
Ernst & Young LLP	Tera Software Limited
Excellon Software Pvt. Ltd.	Trust Systems & Software (I) Pvt. Ltd.
Focus Softnet Pvt Ltd.	Vay Network Services Private Limited
Gujarat Livelihood Promotion Company (GLPC)	Velocis Systems Pvt. Ltd.
Hazel Mercantile Limited	Virtual Galaxy Infotech Pvt. Ltd.
Hostbooks Limited	Webtel Electrosoft Private Limited
Image Infosystems Pvt Ltd.	Wep Solutions Limited
Iris Business Services Limited	Winman Software India Llp
KPMG India Private Limited	Zoho Corporation
Masters India Private Limited	

Source: GSTN, CRISIL Research

Partnerships and ASP offerings of GSPs

GSP	Provides ASP services	Has tie-ups with other companies	Pricing
Protean eGov Technologies Ltd.	Yes	Yes	Rs. 2700 per financial year (upto 9000 transactions in a year)
PricewaterhouseCoopers Private Limited	Yes	NA	NA

GSP	Provides ASP services	Has tie-ups with other companies	Pricing
Zoho Corporation	Yes	No	Free plan with 25 invoices per month Standard plan - 2000 per year with 2500 invoices and upto 10 users
Hostbooks Limited	Yes	Yes	Prices starting from Rs 3,999 per year upto Rs. 20,000 per year
Iris Business Services Limited	Yes	No	NA
Bodhtree Consulting Limited	No	Yes	NA
Cleartax (Defmacro Software Private Limited)	Yes	No	NA
Emudhra Limited	No	NA	NA
Ernst & Young LLP	Yes	Yes	NA

ASP – Application service provider Note: NA - Not Available

Source: Respective Company websites, CRISIL Research

Protean eGov Technologies Ltd. provides both ASP and GSP services and also has tie-ups with many other companies to provide integrated GST compliance solutions to corporates.

10 Overview of data center and cloud services

10.1 Overview of industry size

Growing data volume calls for more local storage

A data center is a dedicated centralized location composed of networked computers and storage that businesses and other organizations use to organize, process, store and disseminate large amounts of data. Since IT operations are crucial for business continuity, data center location generally includes backup components and infrastructure for power supply, data communication connections, environmental controls, and various security devices. The core components of data center includes routers, switches, firewalls, storage systems, servers, and application delivery controllers. These components along with necessary infrastructure provide network infrastructure, storage infrastructure, and computing resources.

With a population of more than 1.3 billion people, India has an increasingly informed and tech savvy customer base offering a vast commercial expansion potential for technology providers. As one of the most populated countries in the world, rising mobile penetration is leading to significant data proliferation amongst its consumers. India offers a large base of global users for digital mediums such as social media apps, IOT devices and OTT platforms. This presents a lucrative market for global investors and data center operators to expand into India. In last few fiscals, the industry has seen investments coming in from local players as well as foreign investors but with the recent spur in data consumption, increased cloud adoption, and governmental support, the investments are expected to increase manifold.

The Indian data center industry accounts for ~2% of the global investments made in data center industry. Investments in India are estimated to have clocked a compound annual growth rate (CAGR) of ~9.5% since fiscal 2016 to touch ~Rs 275 billion in fiscal 2020. Fiscal 2021 saw many fresh investments flowing in taking the market size ~Rs 320 billion. The growth in investments rode on a sharp increase in internet penetration from ~30% in fiscal 2016 to ~59% in fiscal 2021.

The data center business has received strong tailwinds over the past fiscal or so from an unlikely source – the COVID-19 pandemic. Even as the pandemic and associated restrictions threw life and business out of gear, stalling growth in most sectors, it became a massive catalyst for digital adoption. To be sure, the government had already begun to push India towards becoming a digital economy with its Smart Cities and Digital India initiatives before the pandemic struck. However, the crisis accelerated the transition to the digital medium as almost all aspects of daily life – be it banking, education, or shopping – switched to the digital medium almost instantaneously, leading to a boom in India's digital ecosystem. The upshot has been an exponential growth in data generation, and this has created unparalleled demand for data centers in India. Add to this the government's norms on data localisation, and the industry has a booster such as never before. As a result, data center investments have risen significantly over the last few years and this trend is expected to be maintained in the coming years.

On the back of growth driving cues, CRISIL Research expects investments to follow an upward trajectory escalating at 13-14% CAGR from current level till fiscal 2025 to reach at ~Rs 540 billion. Factors such as data center projects that were under construction, planned investments by existing and new players, and data center facility power consumption were considered to arrive at the market size for forecasting purposes.

The demand for datacentre services in India has gradually grown with the average power capacity of a single data centre facility increasing from less than 5 MW to over 10 MW in the last five years. Multiple on premise datacentre deployments of less than 2 MW have also contributed to this growth. In terms of power capacity by facility type,

purpose-built dedicated datacentres dominate compared to on premise data centres. India data center market investment by power capacity, which stood at ~360MW in fiscal 2021, is expected to expand to ~500MW by fiscal 2025.

Data center market size

Power capacity in (MW)

Industry size (Rs bn)

		360	500
			540
	CAGR FY16-20 9.5%	320	CAGR FY21-25 14-15%
190	275		
FY16	FY20	FY21	FY25P
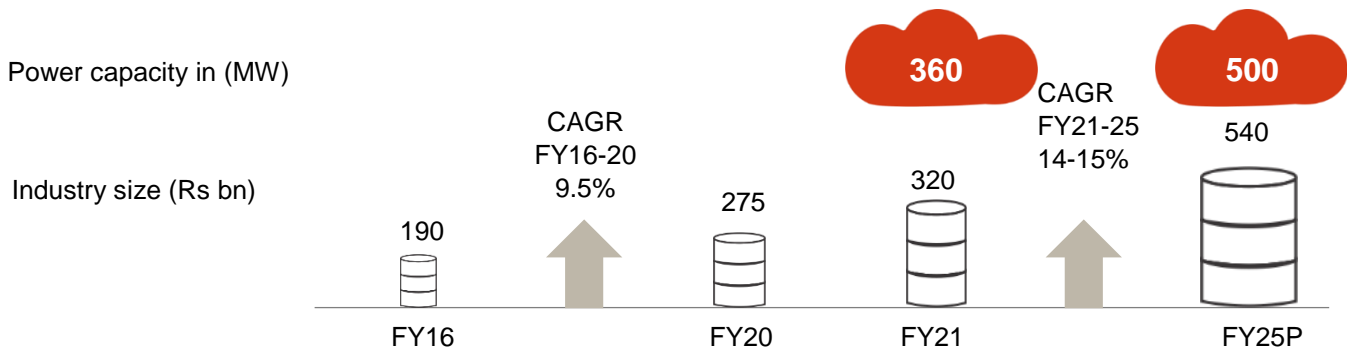
Source: NASSCOM, CRIISL Research

10.2 Growth drivers for expansion of data centers in India

CRISIL Research expects this rapid growth to be driven by:

Exponential increase in data volume and penetration

Demand for data centers has increased following the pandemic-induced lockdowns and the resultant switch to internet-related services. Most sectors such as internet technology (IT), and banking, financial services and insurance (BFSI) initiated remote working for employees early on. Even government agencies adopted cloud-based services where confidential state data can be stored securely. The education sector has been conducting classes online. Most enterprises conduct meetings, interviews and other daily tasks using online platforms. E-commerce transactions, too, have gained traction amid the pandemic. Further, with the entertainment sector under lock and key, preference for over-the-top (OTT) applications has increased. One can call it need of the hour.

The number of internet users has jumped. CRISIL Research expects internet penetration to increase to ~75% by fiscal 2025 amplifying the demand for data centers. Moreover, the government's impetus to the Digital India initiative and rapid digitalization of services across industries (Industry 4.0 and 5G) are already on the roll.

Data localization norms

Data localisation refers to various policy measures that restrict data flow by limiting the physical storage and processing of data within a given jurisdiction's boundaries. The Data Protection Act aims at protecting the data of citizens by storing it locally. Another reason for data localisation is to help the government form better domestic policies for its citizens. The Reserve Bank of India (RBI) has mandated companies to store all the financial data locally. Such measures by the government will support development of local data centers.

Transition to IaaS-based offerings, higher adoption by IT, e-commerce and media

According to the National Association of Software and Service Companies (NASSCOM), in fiscal 2020, more than three-fourths of the total IT infrastructure spend was concentrated on captive and co-location based operating model.

By fiscal 2025, however, the share of infrastructure-as-a-service (IaaS) in IT infrastructure spends is forecast to increase to more than 40%.

CRISIL Research expects the shift towards IaaS to continue as rapid adoption of Industry 4.0-led revolution leads to exponential growth in data volume and increases the need for scalability of resources. This growth will be driven by non-regulated sectors. We foresee limited adoption by the BFSI sector due to security and regulatory concerns.

Data center demand to transition from captive to co-location and IaaS-based offerings

Data centre operating models	Share in IT infrastructure spends	+	–	Typical end-user industry
Captive	High Medium Low	• Complete control from hardware to software selections along with security • Free from vendor lock-ins	• High capital expenditure (capex) along with maintenance and security cost • Difficulty in scaling up with increasing demand	BFSI
Co-location	High Medium Low	• Capex saving due to direct leasing of rack space • Customisation of hardware and software available	• Capex required for hardware and software • Hiring and training of staff required to manage systems	BFSI Manufacturing Government IT/ITeS
IaaS	High Medium Low	• No capex spend on IT hardware or software • Hyperscalability of infra based on demand • Pay-as-use pricing model	• Inability of deploy customised solutions	IT/ITeS Media E-commerce Telecom

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Advancement in big data and internet of things (IoT)

Rapid growth in internet speed and digital advancements in the country have ballooned data volume in several industries. In India, the market for big data and internet of things (IoT) is still in the nascent stage. IoT, which connects the digital and physical worlds through a network of sensors, contributes to the fast development of data traffic. In the Indian market, IoT and big data are the strong drivers for data center investments. The Indian market is witnessing the adoption of a variety of IoT-enabled devices at a slow and steady pace. The penetration of connected cars and home products is likely to emerge and grow significantly in the coming years. The implementation of 5G network for mobile devices will aid growth of IoT and big data analytics. The Indian government has launched a big data management policy through the Comptroller and Auditor General of India (CAG). This policy will help the central and state governments to manage the vast amount of data generated. Big data solutions are being used by the education, retail, wholesale, transportation, healthcare, BFSI and government sectors. Increasing demand for big data has been fuelling demand for data centers.

Cloud adoption on the rise in India

Digitalisation is driving the demand for cloud-based services in India. The adoption of advanced technological solutions that include IoT, big data and artificial intelligence (AI) increases the demand for cloud services across verticals. According to NASSCOM, cloud computing market size was estimated to be ~US$ 2.5 billion in 2018 and is expected to reach ~US$ 7.1-7.2 billion by 2022.

The presence of some of the largest cloud service providers in India will create opportunities for data center operators to develop more facilities in the coming years. However, many small and medium enterprises (SME) prefer SaaS (software as a service) cloud services. Major cloud service providers such as Microsoft, AWS, Google, Alibaba, Oracle, and IBM are developing hyperscale data centers in India to cater to the rising demand for cloud computing.

Over the past few years, the adoption of IaaS services has seen significant interest. In India, cloud adoption by enterprises is fuelled by the pandemic. Many Indian organisations have adopted the cloud platform for their digital innovations. The move by government agencies to migrate their workload to cloud will also increase the demand for private and hybrid clouds. Moreover, the demand for data center services such as colocation, managed and cloud connectivity services will gain momentum as enterprises seek to adopt cloud services such as PaaS and IaaS.

Colocation service providers are also witnessing high demand for cloud connectivity solutions in the region. Moreover, with growth in internet backbone and colocation facilities, cloud connectivity solutions are expected to grow.

10.3 Geographical presence of data centers

Geographic presence of data centers
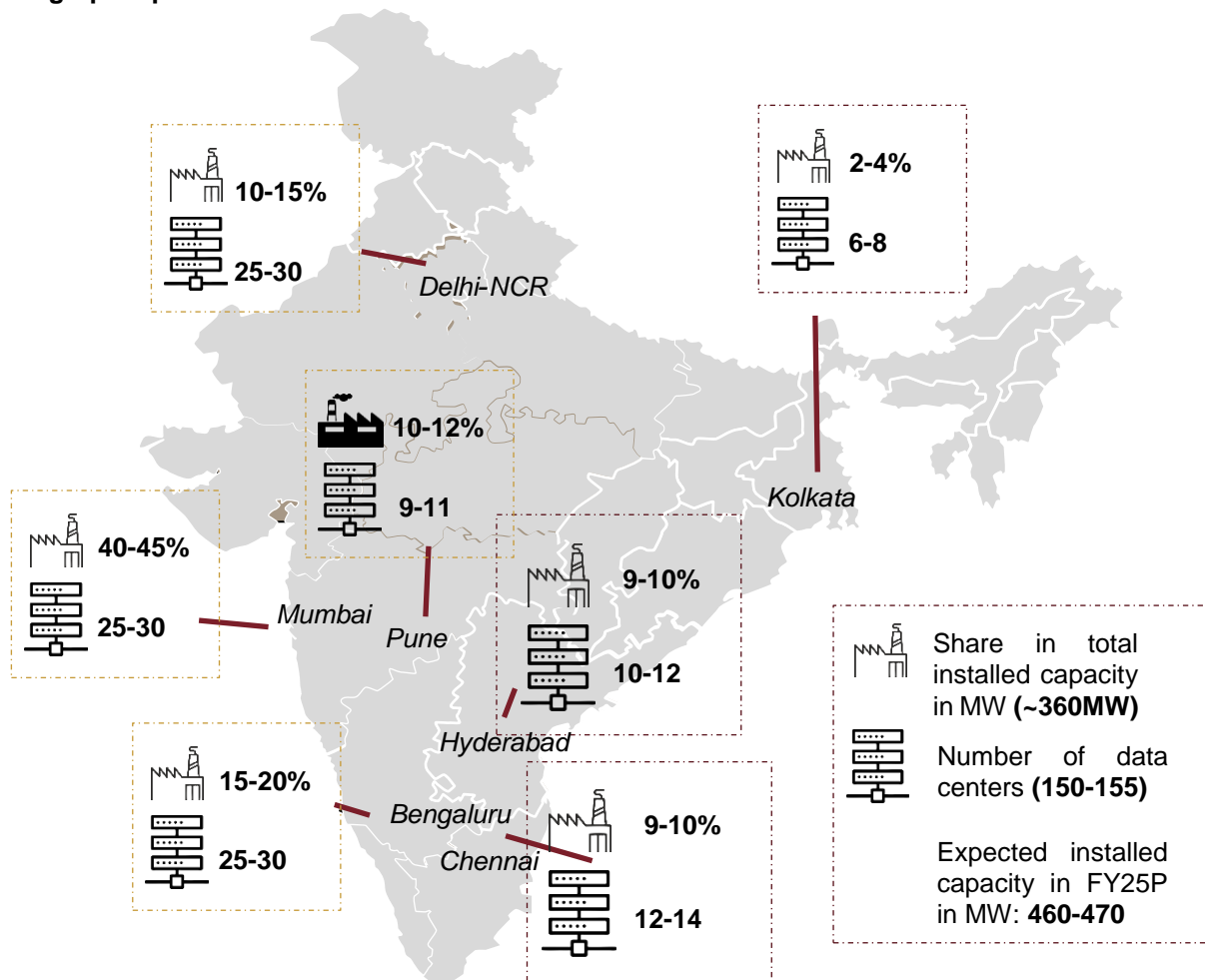
Source: CRISIL Research

The data center industry has been largely concentrated in Mumbai, Delhi, Bengaluru and Chennai, the top four, which account for ~60% of total data center sites and more than 75% of IT load capacities.

Mumbai alone accounts for over 40% of total installed capacity given the availability of required infrastructure in terms of adequate linkages with global cable landing stations, reliable power supply, broadband connectivity and skilled manpower.

Some state governments also offer incentives to the data center industry. For instance, Maharashtra and Telangana are offering incentives connected to land and electricity along with a special single-window clearance for permissions to set up data centers.

Next rung of cities to see next wave of growth

Due to lack of quality and reliable infrastructure across most locations in India, ~60% of the total number of data centers are located in the top four cities. In fact, the top seven cities accounted for more than 75% of the total data centers in India.

Players have only recently begun gravitating towards setting up data centers in other cities on account of high rental costs and space constraints in the top four cities.

CRISIL Research expects the share of the top four to decline marginally over the next five years as lack of space and higher rental costs along with improved infrastructure availability leads to some larger hyperscale data centers being set up in the next rung of cities.

10.4 Global and domestic players operating in Indian market

Prominent data center operators in the Indian market

Airtel India (Nxtra Data)

Airtel India is one of the leading telecommunication service providers in India. The company offers data center services through its subsidiary Nxtra Data. It operates over 100 edge data centers in India, located in Bengaluru, Chennai, Mumbai, Pune, Bhubaneswar, Noida and Manesar. The company provides public, private and hybrid cloud platforms. It provides colocation, managed hosting, remote infrastructure management, cloud and disaster recovery services.

CtrlS

CtrlS is a data center company headquartered in Hyderabad, Telangana. CtrlS has data centers in Hyderabad, Mumbai, Bengaluru and Noida. It offers colocation, cloud, disaster recovery, and network services.

Mantra Data Centers

Mantra Data Centers provides wholesale colocation services such as rack and row space, cages, dedicated server suits and built-to-suit solutions. It caters to sectors such as BFSI, government, e-commerce, cloud & IT services, telecom, media & entertainment, healthcare, retail and others. The company is planning to build seven data centers across six cities in India: Delhi, Ahmedabad, Hyderabad, Mumbai, Chennai and Bengaluru. In November 2020, the company signed a memorandum of understanding (MoU) with the Maharashtra government to build a data center, facilitating job creation in the state.

NTT Global Data Centers (Netmagic)

NTT Global Data Centers is a leading telecommunication provider in Japan that operates data centers across the globe with a strong presence in the APAC region. It established a strong presence in India through the acquisition of Netmagic in 2016 to strengthen its position in the APAC data center colocation market. It provides colocation, interconnection and network services.

Pi Data Centers

Pi boasts of hyperscale facilities for offering a wide range of colocation services for small, medium and large enterprises. It provides server colocation, rack colocation, private suite colocation, cloud-based and managed services.

RackBank

Headquartered in Indore, Madhya Pradesh, RackBank is a carbon-neutral data center provider in India. The company develops both hyperscale and wholesale data center facilities for cloud and large enterprise customers. It caters to IT, manufacturing, bulk messaging, media & entertainment, real estate and streaming sectors. RackBank provides colocation, wholesale/ hyperscale data center, managed and cloud-based services.

ST Telemedia Global Data Centers

ST Telemedia Global Data Centers is a data center service provider with footprints in Delhi, Mumbai, Bengaluru, Pune, Ahmedabad, Chennai, Kolkata and Hyderabad. It offers colocation, connectivity, cloud, support and network services.

Sify Technologies

Sify Technologies, an IT service provider in India, provides data center and colocation services to its enterprise customers. The company has data centers in Mumbai, Bengaluru, Kolkata, Chennai, Hyderabad and Noida. It provides data center colocation; cloud-based; data center design, build and consulting; migration and network services.

Web Werks

The company operates data centers in Delhi, Pune and Mumbai. It also provides colocation services such as rack space and private cages. Web Werks also has footprints in the US, the Netherlands and Dubai. It offers colocation, cloud-based, dedicated and managed services.

Yotta Infrastructure (Hiranandani Group)

Founded in 2019, Yotta Infrastructure is an India-based subsidiary of Hiranandani Group (a leading real estate builder in Mumbai). The company entered the data center market with the design, construction and operation of scalable data centers to manage India's growing digital data. The company has a presence in major fibre cable landing stations in Mumbai and Chennai. It offers colocation, connectivity, cloud and IT services; and data center build support.

New entrants in the market

Adani Group (Adaniconnex)

In December 2020, Adani Group announced it was setting up a hyperscale data center facility with an investment of around $340 million in Chennai. The company had partnered with the global colocation service provider,

EdgeConneX, to build and operate 1 GW of data center campuses across the country, powered by renewable energy power plants. The plant is likely to be operational by end-2021 or early-2022. It plans to provide data center and connectivity services.

Colt Data Center Services (Colt DCS)

Colt Data Center Services offers data services globally. In the APAC region, the company offers data center facilities in Japan, Singapore, India, Hong Kong and South Korea. Currently, the company is developing a data center in Mumbai, supporting an IT load of 100 MW on full build. This will be Colt DCS' first facility in the country. It provides colocation and connectivity solutions.

Equinix (GPX Global Systems)

The US-based Equinix specialises in internet connection and data centers. In August 2020, the company announced its expansion into India through the acquisition of India operations of GPX Global Systems, Inc. for an all-cash transaction value of $161 million. The acquisition will extend Equinix's operations to India with the addition of two world-class, highly interconnected data centers, providing a platform for additional expansion across the country. GPX India offers a cloud-dense environment and access to major cloud services, including Amazon Direct Connect, Google Cloud Dedicated Interconnect and Oracle Cloud Infrastructure FastConnect.

Princeton Digital Group (PDG)

Princeton Digital Group (PDG) is involved in design, development and operation of data center infrastructure in Asia - across Singapore, China, Indonesia and India. In March 2020, it announced the development of its first hyperscale data center campus in Mumbai, Maharashtra. The Mumbai campus will include two buildings and support IT load capacity of about 48 MW on full build. The first phase of the facility is expected to be operational by 2022. In July 2020, it also signed a MoU with the Tamil Nadu government for ~$100 million to establish and operate data center in the state.

10.5 Investment in data center industry

Private equity, global players steadily increase presence via acquisitions

Considering the challenges in setting up data centers, big international players have acquired local players to foray into the Indian market. For instance, Netmagic was acquired by NTT, a Japanese firm. CRISIL Research expects such acquisitions and partnerships to continue, given the expected growth in the data center space.

Key deals in the industry

Year	Company	Investors	Investment type	Amount ($ million)
2020	Nxtra Data Ltd.	Carlyle Group	PE investment	235
2020	GPX Global Systems (India)	Equinix	Acquisition	161
2019	Tata Communications Ltd.	ST Telemedia Global Data Centers	Acquisition (balance stake)	Undisclosed
2018	Netmagic Solutions Ltd.	NTT communications	Acquisition (balance stake)	35
2016	Tata Communications Ltd.	ST Telemedia Global Data Centers	Acquisition (74% stake)	634
2015	NxtGen Ltd.	International Finance Corporation (IFC), Axon Partners Group and Intel Capital	PE investment	13.5
2012	Netmagic Solutions Ltd.	NTT Communications	Acquisition (74% stake)	128
2008	CtrlS	Och-Ziff Capital	Private equity (PE) investment	57

Source: CRISIL Research

11 Overview of e-commerce retail industry in India

11.1 Overview of e-commerce industry market in India

Evolution of e-commerce in India

In early 2000s, businesses started offering online services such as e-mail and instant messenger, along with information and entertainment content. Bulk of revenues of most such portals came from advertising. With search engines beginning to operate, content on the web experienced rapid scale up. With the advent of online ticketing system, e-commerce industry in India started taking shape. Back in early 2000s IRCTC started offering online bookings on its portal. During mid-2000s, India was getting introduced to multiplex cinema which gave space for online ticketing platforms. BookMyShow entered at the right juncture and became India's largest entertainment ticketing website. In 2007, product based e-commerce in India started taking shape with Flipkart coming into existence. India's increasing internet penetration in the early 2010s along with launch of commercial 3G and 4G phones aided to the growth in e-commerce industry. Demand for businesses offering online products and services went up with internet becoming more accessible in tier 2 and tier 3 cities. Sensing the changing needs of the country, online food delivery and cab hailing businesses commenced operations.

Evolution of e-commerce in India

Source: CRISIL Research

Advancement in technology shaping the e-commerce industry

The e-commerce industry is reliant on technology in playing a crucial role in areas such as value chain, recruitment, marketing, advertising, warehouse management, and product delivery, among other things • E-commerce companies are no longer competing solely on the grounds of their product offerings and geographical presence. E-commerce competition now has expanded to areas which include providing digital experience to the customers using analytics, virtual reality, robotics, and other advanced technologies. Companies are integrating deep analytics in sales and marketing software to enable dual-way communication between e-commerce brands and their customers. Indian E-commerce giants like Amazon, and Flipkart, have implemented artificial intelligence (AI) and machine learning (ML) technology in personalized targeting, customer care services, and marketing activities. E-commerce companies have also adopted faster, efficient and secure payment options like Apple Pay, Google Pay, and Amazon Pay to target India's unbanked population.

From the user's perspective, India is witnessing rapidly rising number of smartphone user base and so as there is spike in internet penetration. Rising number of internet users make the tech-advanced platforms more accessible to the masses. CRISIL Research expects internet penetration in the country will reach ~75% by fiscal 2025 giving boost to overall e-commerce market.

E-retail to clock CAGR of 25-27% in the medium term

The Indian e-retail industry was estimated at ~Rs 2,300 billion in fiscal 2020 and witnessed a strong on year growth of about 36% to reach ~Rs 3,120 billion in fiscal 2021. CRISIL Research projects the Indian retail e-commerce sector to clock 25-27% CAGR between fiscals 2021 and 2025. Consumption slowdown and ban on sale of non-essentials following second wave will impact demand in the first quarter of fiscal 2022. Subsequently, we expect demand to bounce back and the sector to be poised for growth in the medium term.

Over the past few years, online grocery platforms have seen a growing wave of investor interest, with many major players making significant investments in the segment, given its potential to become the fastest-growing segment. Moreover, major players in the segment continue to focus on boosting growth in existing business segments, such as electronics, which is likely to drive e-retail as well. With the omni-channel strategy gaining prominence, the e-retail industry appears to be more focussed on boosting the overall organised retailing sector rather than posing competition to existing players.

E-retail growth forecast through fiscal 2025
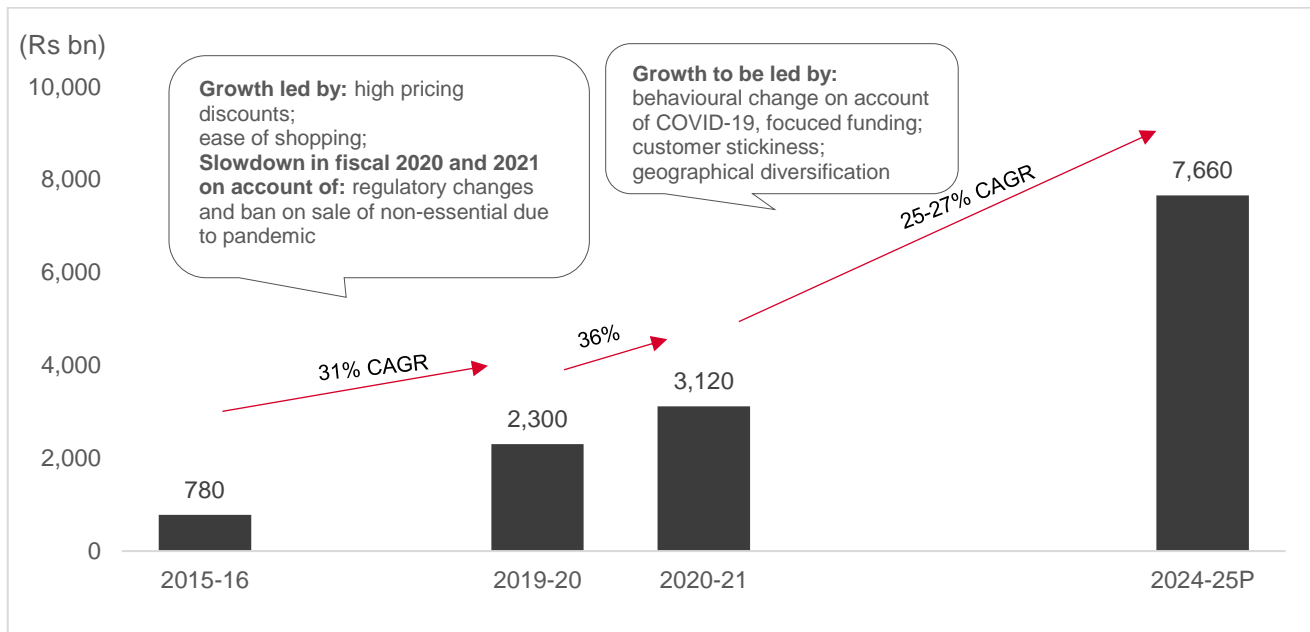
Note: P: projected; CAGR: compounded annual growth rate
Our definition of e-retail includes products sold via online retail and online marketplace business models.
Source: CRISIL Research

Increasing participation and lucrative offers set the pace for whopping growth in e-retail

The launch of Flipkart.com in 2007 provided a much-needed fillip to the Indian e-retail industry, comprising both inventory and marketplace models of operations. Snapdeal switched to a marketplace model in 2012 from being just a deals website in 2010, and global e-retail giant Amazon commenced its Indian operations in 2013. Moreover, the industry was flush with early-stage and venture capital funding that led to growing e-commerce penetration in different retail product segments. Apart from primary growth drivers, such as increasing internet penetration, higher

disposable incomes, and rising urbanisation, user-friendly interfaces of portals, ease of shopping, increasing awareness, relatively high pricing discounts (in comparison with brick-and-mortar stores), and easy delivery and innovation have propelled growth.

The cash crunch after demonetisation dealt a big blow to the cash-on-delivery (CoD) business. The slowdown in funding in fiscal 2017 compounded woes, leading to slower growth in fiscal 2017. The introduction of goods and services tax (GST), confusion around its implementation and teething troubles in its usage system affected sales in the first half of fiscal 2018. However, with frenzy over GST settling and consumer sentiment improving, growth rebounded and is estimated to have clocked 40% year-on-year in fiscal 2018.

Investments by major e-retailers, discounts, advertising, and supply-chain expansion helped demand grow in fiscal 2019, too. Festive season saw bumper demand on account of heavy discounts, easy payment options, and swift delivery. Growth was affected in the last two months of fiscal 2019 with changes in government regulations. Thus, the industry is estimated to have grown ~46% in fiscal 2019.

The Department of Industrial Policy & Promotion's recent clarification on foreign direct investment (FDI) policy by e-retailers restricts equity ownership in sellers, caps percentage procurement for sellers from e-marketplaces, and puts curbs on marketplaces mandating exclusive partnership with brands or on providing favourable services to a few vendors. With these policy changes initiated to create a level playing field for all sellers, discounts came down, which resulted in slower growth in fiscal 2020. Thus, the industry grew 20-22% in fiscal 2020.

Consumption slowdown following COVID-19 affected demand in fiscal 2021, with the first quarter bearing the brunt on account of a ban on the sale of non-essentials. The sector performed exceptionally well during the festive season with demand coming in from tier-2- and tier-3 cities apart from metro and tier-1 cities. Social distancing norms and fear of spread of infection in the wake of the pandemic prompted people to shift towards online shopping. Online electronics sale, fashion, and food and grocery segment drove the growth of e-retail industry during the fiscal. Thus, where most sectors witnessed de-growth during the fiscal, online retail is estimated to have grown around 36%.

Overall, the industry is estimated to have clocked a CAGR of ~33-35% between fiscals 2018 and 2021 to reach ~Rs 3,120 billion.

Online retail deals

Timeline	Target	Acquirer/PE/VC	Amount ($ mn)	Type of deal
Oct-20	Aditya Birla Fashion	Flipkart	203.8	PE
Apr-19	Nykaa	TPG Growth	14.4	PE
Sep-18	Nykaa	Lighthouse Advisors Pvt. Ltd.	15.7	PE

Timeline	Target	Acquirer/PE/VC	Amount ($ mn)	Type of deal
Aug-18	StalkBuyLove	Blue Dynamic, Integrated Asset Management,Kalaari Capital, Singularity Ventures,VCDE Venture Partners and Kabs Ventures	2.96	PE
May-18	Nykaa	Sunil Munjal, Harsh Mariwala and private equity investor at Warburg Pincus Dalip Pathak	24	Series D
Apr-18	ShoeKonnect	Info Edge (India) Ltd.	0.46	M&A
Apr-18	Zilingo Pte	Sofina, Burda Principal Investments, and Sequoia Capital India.	54	Series C
Apr-18	CoutLoot	Jadevalue Fintech	1	Series A
Mar-18	Fynd	Google	-	Series C
Jun-17	Fynd	IIFL Seed Ventures, Kae Capital, FJ Labs, Singularity Ventures, GrowX, Tracxn Labs, Axis Capital	2.4	Private Equity
Apr-17	YepMe	Gokaldas Exports Ltd.	-	Private Equity
Apr-17	Book My Diamond	Chirag Nikunj Sheth & Others	-	Seed Funding
Apr-17	YepMe	Rainbow Digital Services Pvt. Ltd., ILearnFinance Academy Pvt. Ltd.	0.7	Private Equity
Apr-17	StalkBuyLove	Trifecta Capital	1	Private Equity
Apr-17	Clovia	Ivycap Ventures Advisors, Singularity Ventures and Ravi Dhariwal	4	Private Equity
Mar-17	LatestOne	Florintree, Mathew Cyriac, Chidambaram Palaniappan, Bharat Sheth	3.4	Private Equity
Feb-17	Johari Shop	Undisclosed Investors	0.1	Seed Funding
Feb-17	Voonik	RB Investments, Sequoia Capital	6	Private Equity
Jan-17	Native Special	Indian Angel Network, Native Angels Network	-	Seed funding
Jan-17	LensKart	Ronnie Screwvala	3.5	Private Equity
Jan-17	GoFynd	Anand Chandrasekaran, Rajiv Mehta, Ramakant Sharma	-	Seed funding
May-16	lifestyle e-tailor	HT Media	4.4	PE/VC
May-16	Freecharge	Snapdeal	-	PE/VC
May-16	Schoolwear.in	Seed funding	1.5	PE/VC
Apr-16	Koovs.com	New Investors	32	PE/VC
Nov-15	Pluss	IDG Ventures India	1	PE/VC
Nov-15	Fourseven	IAN	0.4	PE/VC
Apr-15	Eat.Love.Shop	London based investors	3.5	PE/VC (Round 2)
Feb-15	BabyOye	Mahindra Group	-	M&A
Apr-14	BigBasket	Singapore based private investor	3	PE/VC
Mar-14	Sports365	Powerhouse Ventures	-	PE/VC
Mar-14	KoolSkool	Bookadda.com	-	M&A
Feb-14	Jabong	Series of investors including CDC	-	PE/VC

Source: CRISIL Research

Funding to be focussed in the medium to long term

The e-commerce space witnessed aggressive funding in the past from investors. Investor sentiment remained robust as private equity investors/venture capitalists invested in newer start-ups through Series A and Series B funding to try and identify the next unicorn, similar to Flipkart and Shopclues. The bigger players continued to receive funding.

However, lately, the number of players being funded has declined after the failure of start-ups such as LocalBaniya, PepperTap, and Shopo. Investors have adopted a cautious stance and focussed their funding to achieve profitability. In the past four fiscals through fiscal 2021, the top two players pocketed around 75% share of funding of over Rs 1000 billion in the online retail space. Investors have, therefore, started focussing on the top two-three players, as they are more likely to survive and garner major market share. We expect this trend of focussed funding to continue over the medium to long term.

GST to benefit in the long term

The central sales tax (CST) was abolished following the implementation of GST, thereby plugging the gaps in inter-state delivery and subsumed the entry tax levied on e-commerce shipments. Interactions with industry players indicated that they will now be able to align supply-chain and achieve economies of scale. One player said that for fulfilling an order coming from Nagpur, it used to (before GST implementation) source goods from its Mumbai or Pune warehouse as they would not attract CST being in the same state. However, following GST implementation, it can now source the same from a warehouse in Hyderabad, which is much closer to Nagpur and will provide logistical simplicity. Thus, players are expected to benefit from rationalisation of logistics costs because of flexibility in procurement and seamless movement of goods across states. GST would also drive market share gains for organised players. This will likely boost e-commerce growth, as tax arbitrage, which used to help unorganised players, will be reduced.

Limited penetration gives room for future growth

The overall retail market in India was estimated to be worth around Rs 57 trillion in the previous fiscal. The market is dominated by unorganised players, with organised retailing accounting for only ~10% in the previous fiscal. E-retail penetration in the overall retail market is significantly low, thereby providing sizeable headroom for growth.

Online retail market accounted for about 5.5% of overall retail market in FY21
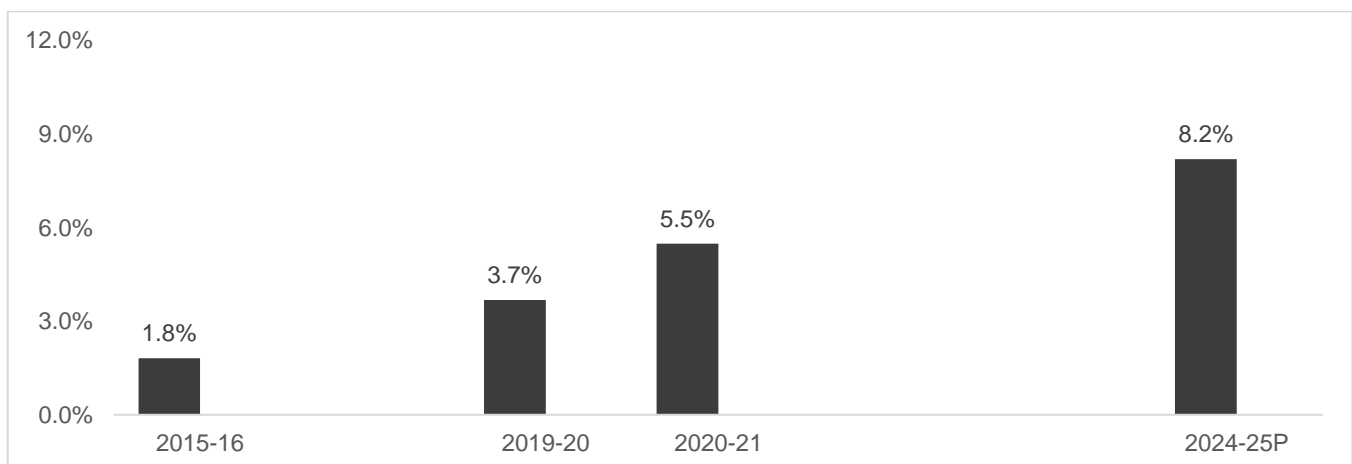
Source: CRISIL Research

In fiscal 2020, online retail penetration was ~3.7%. However, due to the pandemic, e-retail industry saw a robust growth taking the penetration level to ~5.5% in fiscal 2021. By fiscal 2025, CRISIL Research expects share of e-retail in overall retail industry would reach to ~8-9%.

Focussing on the bottom-line

E-commerce players are fortifying their bottom-line by focussing on the points mentioned below.

- **Building integrated processes**

  Players are acquiring, partnering with payment wallets, and providing complimentary product portfolio to enhance seamless operations. Acquisitions in the e-retail space are across the value chain. Companies have been acquiring established companies, online deal players and the likes to boost business and improve profitability (for example, Flipkart's acquisition of eBay India in April 2017 and Paytm's acquisition of Nearbuy and Little in December 2017 to boost its online-to-offline business model)

- **Using data-analytics to customise offers**

  Companies are using high-end data analytics to provide discounts. When compared with past trends, discounts in the space have definitely reduced, and companies have adopted a customised discounting mechanism. Companies use the buying history of consumers, gap between two purchases, last purchase data and the likes, and accordingly make customised offers to ensure consumers stick to the portal. For instance, Amazon uses data analytics to extend special privileges to Prime members, such as faster delivery, better deals, and preference in case of limited sales quantity. Furthermore, players such as Myntra are using data mining and artificial intelligence to analyse popular designs and styles and then come up with new designs to place in the market.

Omni-channel presence — the new success mantra

The growing presence of e-retailers has eaten into the pan-India revenue share of brick-and-mortar retailers over past two-three years. After factoring in the surge in sales volume of e-retailers and consequent increase in competition from other online channels, brick-and-mortar players have started focussing on building their online sales presence. Companies such as Shoppers Stop, Bombay Dyeing, The Mobile Store, Trent, and Future Retail have launched online platforms to sell products. Though the revenue share of online channels has been very small, these stores are placing increased impetus on these to combat competition from their online counterparts. These brands are trying to outdo e-retailers' funding-dependent discounts by offering more sustainable membership benefits in the form of added discounts and loyalty points to get repeat customers.

On the other hand, instead of opening their own online channels, a large number of offline brands are adopting shop-in-shop model by partnering with top e-retailers for promoting their brands online or even for keeping a dedicated brand page on the e-retailers' website. This serves the dual purpose of increasing presence while not incurring added investments in technology and logistics.

Online players too are focussing on expanding in the offline segment. The table below shows the actions taken by both online and offline players to increase their omni-channel presence. Players have been increasingly keen on tapping the food & grocery segment, given its growth potential.

Hence, considering that both online and offline models have their respective benefits, CRISIL Research believes that more brick-and-mortar players will shift towards adopting and strengthening their omni-channel presence (and vice-versa) to strengthen their brand names.

Players focusing on omni-channel

Company name	Steps taken by companies
Reliance Retail	• Launched Jiomart in 2020 to sell groceries online • Bought Mumbai-based hyperlocal delivery company Grab a Grub Services • Acquired C-Square Info Solutions, a company that provides software solutions for distributors and retailers • To launch new ecommerce platform in Gujarat by tying up with 12 lakh small retailers
Pepperfry	• Started offline studios where customers can touch, feel & experience products • Offline sales-30%+ • Currently 60 offline stores in 20 cities
Flipkart	• Pilot project in Telangana to on-board Kirana stores for pushing omni-channel strategy • Kiosks rollout planned in Bengaluru to sell private brands • Set up first offline store in Bengaluru in furniture segment
Amazon	• 5% stake in Shoppers Stop • Stake in 'More' • Started "Smart Stores" concept recently
Shoppers Stop	• Relisting its products on Amazon through its subsidiary Shoppersstop.com • Exclusive flagship store on Amazon after 5% stake sale
Future Retail	• Started listing nearly all its brands and products across fashion, grocery and electronics on Amazon • Launched Tathastu or Retail 3.0 which is an omni-channel strategy
Caratlane	• Currently 95+ stores, plans to add 50 stores every year • Offline revenue-60%+
ABFRL	• Acquired Jaypore.com, an e-tailer, selling apparel, home textiles and accessories online

Source: CRISIL Research

Together, brick-and-mortar and online strategy complement each other

Why online?

Increasing brand-recall

Lower fixed establishment costs

Better payments and delivery options

Easier and faster expansion

Providing look-and-feel experience

Building brand trust and value

Lower return probability with try options for customers

Why offline?
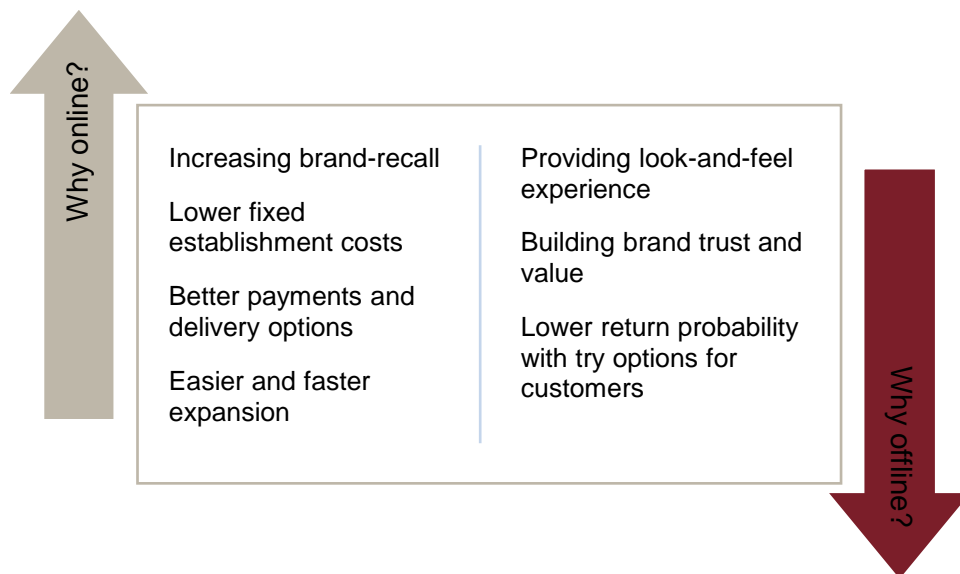
Source: CRISIL Research

Grocery to grow fastest among e-commerce segments in the medium term

Fashion and consumer electronics form the majority of the e-retail pie

Apparel and consumer electronics established their presence in the e-commerce space very early and have been growing continuously. As of FY21, these segments account for three-fourth share in e-retail.

Going forward, while apparel and electronics are expected to account for the majority share of e-retail, grocery is expected to grow at a much faster pace and increase its share in the overall pie.

Consumer electronics considered for e-tailing comprises mobiles and accessories, personal computers, household appliances and small electronics. The segment forms close to half of the e-tail pie. Of the overall consumer electronics e-tail sales, over three-fourths is accounted by mobile phones. Wider choices, competitive pricing, easy delivery owing to small size, exclusive online sales by some brands, and flash sales have propelled mobile phone growth on the online platform. However, even in the online-mobiles market, the share of relatively low-value products is significantly higher. Sales through online platforms will grow at a slower pace compared with the past three years. Earlier, growth was because of lower base and demand generated by first-time urban users for lower-range mobile phones. Higher-range smartphones will start taking precedence, and, thus, with a shift towards high-value purchases, people would like to see and touch products before buying.

With the imposition of the lockdown, sales of non-essential services (electronics comes in this category) were restricted for most part of the first quarter, impacting sales. However, after the ban was lifted, there was pent-up demand for home electronics, with education going online and people remaining at home. With education going online, there was increased demand for CTVs and smartphones to meet the needs of online classes for children. Electronics sales are expected to have witnessed healthy growth during the festive season, with mobiles leading the segment. Thus, the electronics segment posed a strong growth of 30-35% in fiscal 2021. The first quarter of fiscal 2022 will witness the impact on sales, as sales of non-essentials got banned for most part of the quarter. Post that, the segment is expected to witness good growth.

Although online retailers have increased the range of electronic products offered online, they have found it difficult to penetrate consumer durables, especially bulky appliances, such as refrigerators and washing machines, due to the logistical challenges and associated costs. However, with the entry of new players in the TV segment and the majority of their sales taking place online, this segment has seen higher share of sales through online platforms. Further, sales of even large appliances saw increased traction on online channel, due to social distancing in place and fear about the spread of infection. The segment is expected to show healthy growth of 20-22% in the medium term.

Online grocery and pharmacy: Emerging segments

The online grocery segment is at a nascent stage, but the segment is poised for growth. The segment has seen an increase in the number of players entering the segment and also increased investor interest. The government has allowed 100% foreign direct investment in online retail. Major players such as Big Basket and Grofers are increasing their focus as well as new players such as Flipkart, D-Mart, Quikr and Reliance, among others, have entered the segment. Players like Amazon have introduced strategies, such as same day and next day delivery', to cater to consumer needs efficiently. In fiscal 2021, with the country under lockdown, sales of groceries through online channels picked up. Thus, where other sectors were hit hard because of COVID-19, the online grocery segment witnessed a healthy on year growth of ~75% in fiscal 2021. We expect the segment to grow around five times over the next four years.

The online pharmacy segment is at a nascent stage, and is gaining popularity in Tier 1 cities. Netmeds, PharmEasy, 1mg.com, Medlife, Medstar, BookMEDS, mChemist, and Medidart are some of the major players in this segment. The segment has faced flak from regulators in the past, but the scenario is changing now. The government has started discussions to frame a policy for online sales that will help consumers get access to quality medicines and also to attract more players to sell online. The segment saw an on year growth of 75% in fiscal 2021. CRISIL Research expect the segment to grow at CAGR ~35% in the next four fiscals.

Players entering niche segments like grocery and pharmacy

	Segments		Growth	Example of companies
Fast growing segment	Home and Living		▲▲▲	Flipkart, Snapdeal, Amazon
	Grocery		▲▲▲	Bigbasket, Grofers
	Jewellery		▲▲▲	Bluestone, Caratlane, Voylla
	Fashion and Lifestyle		▲▲▲	Myntra, Amazon
	Toys, Kids and Babies		▲▲▲	Firstcry, Babyoye
	Mobiles and accessories		▲▲▲	Flipkart, Snapdeal, Amazon
	Pharmacy		▲▲▲	Netmeds, Pharmeasy
Moderately Growing segment	Furniture and Handicrafts		▲▲	UrbanLadder, Pepperfry
	Computers, Laptops, Gaming		▲▲	Flipkart, Snapdeal, Amazon
	TVs, Appliances, Cameras		▲▲	Flipkart, Snapdeal, Amazon
Slow growing segment	Sports, Health and Gourmet		▲	Flipkart, Snapdeal, Amazon
	Travel, Hobbies, e-Learning		▲	Flipkart, Snapdeal, Amazon
	Automotive and Aparment		▲	Snapdeal, Flipkart

Source: CRISIL Research

11.2 Challenges for e-commerce industry in India

Challenges faced by E-commerce players

Key challenges	
Scaling of organisation and profitability	Majority of the companies rely on discounting for customer acquisition leading to absence of long term sustainable models. From a profitability perspective, the losses have grown faster than sales.
Counterfeit goods	There is an increasing incidence of cyber thefts and payment thefts in the industry today. Additionally, supply of fake, counterfeit products by the merchants on the platform are on a rise.
High cost of customer acquisition	Intense competition and heavy discounting makes customer acquisition and retention costly for e-commerce companies.
High level of interference from investors	The operations of the e-commerce companies are primarily funded by private equity investors and venture capitalists, in return for an equity stake. The company's strategic decision making could be influenced by them limiting the flexibility of the e-commerce company.
Cash on Delivery as a mode of payment	Customer's preference for cash on delivery increases possibility of return and results in locking up of working capital for the platform as well as sellers.
Network and bandwidth dependency	Access to e-commerce platform, through desktops, mobiles, and other devices are dependent on the network bandwidth. Hence, network disruptions pose challenge for the industry growth environment.
Digital payment transaction failure	The E-commerce industry lacks high speed bandwidth and inefficacies in Payment gateway technology leading to high transaction failure rates.
Merchants lack of online experience	Small merchants need to be trained on the use of e-commerce technology as they are uncomfortable and unfamiliar with technology.
Dependence on telecom operators for rural penetration	E-commerce companies, who want to expand into 2 & 3 tier cities, are dependent on the telecom operators to roll out 3G/4G into such area for connectivity.
Reverse logistics	Inefficiency in reverse logistics could result in high inventory and increased cost.
Lack of customer loyalty	Generally, e-commerce players attract customers through discounts and offers, this could lead to little brand loyalty, with customers switching platforms based on discounts offered.
Government Regulations	Amendments to consumer protection rules(E-commerce) 2020, proposed by Government of India (GoI) to limit flash sales and to increase compliance in E-commerce market place, among others, are in draft phase. Hence, its impact on E-commerce players and industry remains a key monitorable

Source: CRISIL Research

Challenges faced by policy makers

Key challenges	
Lack of skilled manpower	Scarcity of rained manpower with deep understanding of e-commerce business operation in the government ecosystem makes it difficult to effectively implement policies.
Differentiate between local goods and inter-state goods	It is difficult for state governments to differentiate between local goods and inter-state goods, especially the ones sent by parcel or speed-post. As record/registration (via TIN) of the movement of these goods is done voluntarily by suppliers, there exists a possibility of tax leakage, a significant cost to state tax authorities.
Digitisation	Although government departments are fast evolving to have online presence, several of them are still not digitised and operate on paper due to high costs and resistance to change. This could limit their understanding of the industry nitty-gritty.
Tracking road and rail transport	A robust transportation system is crucial for the e-commerce industry to thrive. Limitations in tracking transportation on road and rail, along with border crossing, payment of toll, octroi etc. could in turn make tax collections inefficient

Source: CRISIL Research

11.3 Need for open e-commerce network and role of open protocols

Implementation of innovative technology can further boost e-commerce growth

Over the last one decade there has been major transformation in the way commerce has been carried out. In present era online purchases are experiencing strong growth owing to rising income level, rising number of smartphone users, change in lifestyle and preferences, and improved logistics services. Advancement in IT infrastructure has been the backbone supporting robust growth in e-commerce. However, the e-commerce industry is still under growth phase and certain concerns which exist in the current scenario such as malpractices followed by players, barriers in launching new products, and limited reach to audience need to be addressed. Open Network for Digital Commerce (ONDC) is one such solution government is planning to implement to make the overall e-commerce market more efficient and inclusive.

ONDC can expand overall e-commerce market and can curb existing malpractices

The ONDC is a digital project of the government to redefine the e-commerce landscape in the wake of a large number of complaints of malpractices by existing e-commerce companies. To standardise the process of on-boarding retailers on e-marketplaces, and supply and delivery of products through online channels, the Department for Promotion of Industry and Internal Trade (DPIIT) plans to develop ONDC to set protocols. The protocol for digital commerce would be similar to what UPI is for online payments or what HTTP is for communication over the internet. These will be open standards and the effort is to create protocols for digital e-commerce for creating an enabling e-commerce ecosystem.

The DPIIT has set up a steering committee to formulate, implement and provide policy oversight ONDC. The committee is headed by a senior DPIIT official and includes representatives from the Department of Commerce, the Ministry of Electronics and IT, the Ministry of MSME, the NITI Aayog, Quality Council of India, NPCI Technology, and Protean eGov Technologies Ltd.

Concerning practices followed by e-commerce players
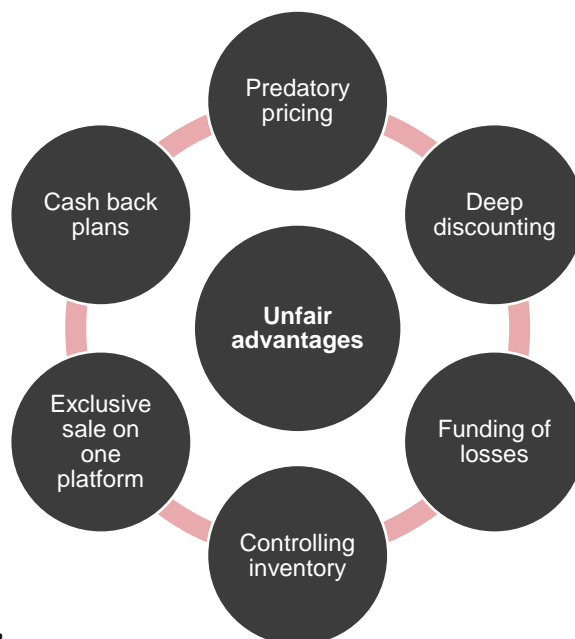
Source: CRISIL Research

Currently, market players have concerns over the manner in which activities such as predatory pricing, deep discounting, and funding the losses are carried out. Such unfair advantages makes the task difficult for small players to compete in the marketplace. Other practices which are cause of concerns are having arrangement with brand companies for selling certain products exclusively on e-commerce platforms, controlling inventory, and nexus of the banks with e-commerce companies for giving cashbacks.

ONDC aims to provide equal opportunities to all traders by providing an easy and fair access to e-commerce. It will facilitate small businesses with opportunities to adopt and accept the online market as an additional business avenue for them. The consumers will also be equally benefitted by getting the option to choose a better product, coupled with reasonable price and with efficient and responsible delivery system.

Apart from putting a control on malpractices, ONDC can improve the agility of market players by letting them implement more lightweight, agile digital commerce solutions to improve the customer experience and lower total cost of ownership. With faster execution, market players can integrate newer ideas to open new functionalities and creating new markets along with keeping a check on cost-to-market.

Beckn is an attempt to create an open network economy

Beckn is an open protocol that enables location-aware local commerce across industries. The protocol is a set of recommendations and rules that outline specific technical standards that can be adopted for an industry, in a region or a market among its participants to enable open interoperable interactions between them. The specifications allow Beckn to act as a transaction protocol that allows discovery, ordering, fulfilment and payment between buyers and sellers (consumers and providers) in the digital marketplace. It is a common way that allows basic interoperability of commerce interactions on a digital medium. Beckn protocol allows one user to communicate to other user anywhere on the internet by exchanging open, standardised, machine-readable information.

Currently, most marketplaces are platform-centric. Beckn is an open digital infrastructure that allows creation of an unbundled and decentralised digital market that is free to use, and more inclusive in nature. Beckn specifically caters to location-aware local commerce businesses that are small and severally available within a region, like a city. Examples of such businesses include e-commerce, mobility, and final-mile delivery.

With the help of Beckn, any consumer can have a choice to access a merchant from any consumer app or of buyer platform. Similarly, any merchant or business provider can use any provider app to put up their inventory to make and start receiving order, make themselves discoverable without the existence of any intermediary in the centre.

Ecosystem model for e-commerce open network through Beckn

E-commerce open network can be implemented as an open network that adopts open APIs of Beckn protocol to integrate the consumer applications on one hand and the merchant business provider side on the other hand, to enable end-to-end 'search, order, payment and delivery' cycle.

- A consumer can use any Beckn e-commerce enabled application to search for neighbourhood stores

- All the neighbourhood stores, that are brought online using their respective online platform providers built on Beckn e-commerce protocol, can be discovered by the consumer end application

- The consumer can select, order, and optionally pay for items from the selected store and the orders will be received and confirmed by the selected store using their own application

- The store-provider platform, if it chooses to use third-party delivery partners on the e-commerce network,

can then use the same e-commerce network APIs to search for final-mile delivery service providers and place an order for pickup and delivery to the consumer

The e-commerce open-network APIs also provide online visibility on the orders, payment receipts, tracking and confirmation of deliveries.

Illustration of open network e-commerce model: Beckn
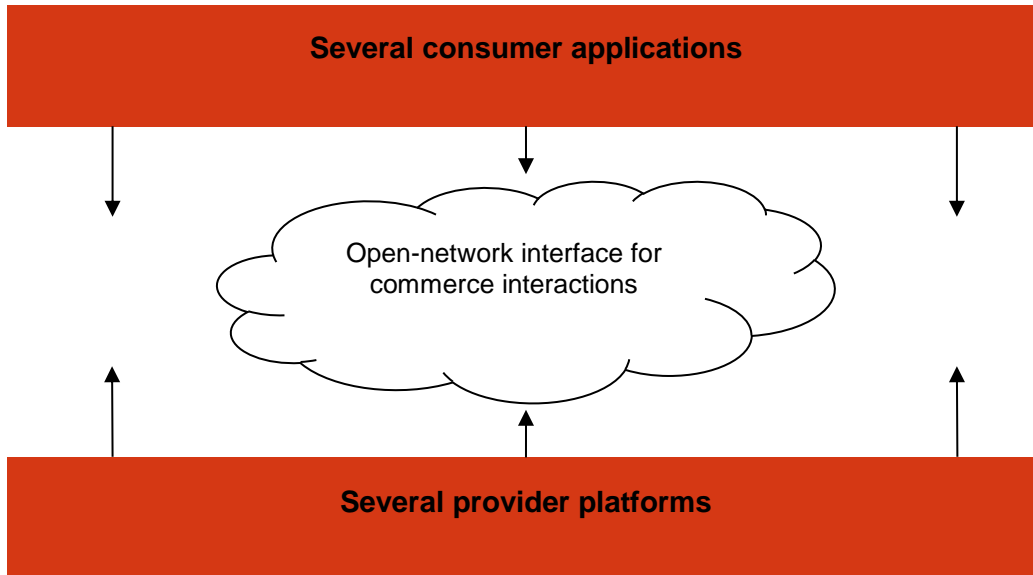
Source: CRISIL Research

11.4 Benefits of open network in e-commerce
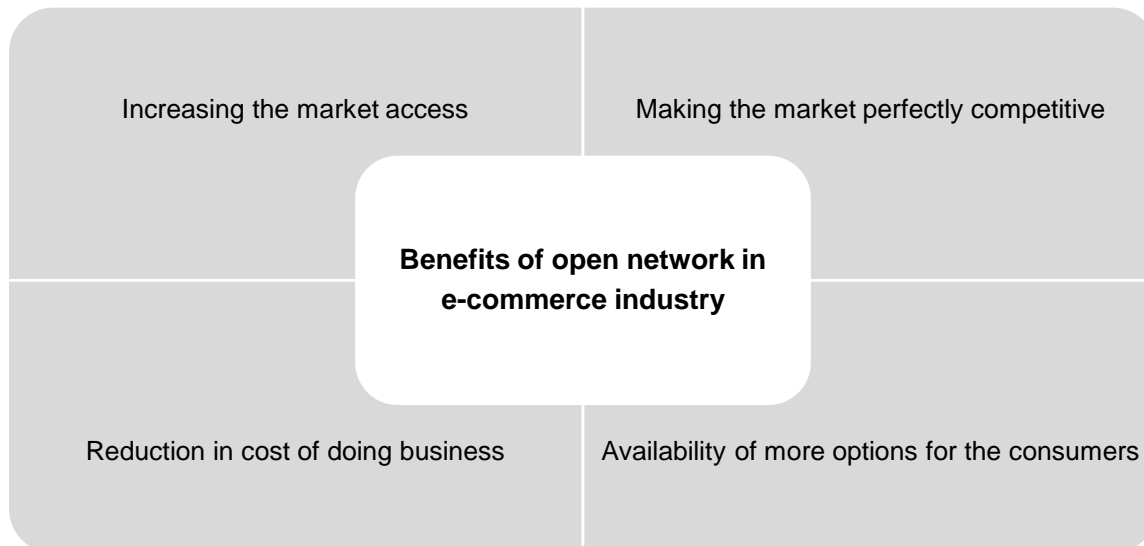
Source: CRISIL Research

Increasing the market access

With the help of an open network, small businesses can display their products on the network and make themselves discoverable, which currently is a difficult task. Open network can wipe out the perennial dependency on a central marketplace as a platform, making the decentralised open-network platform more inclusive for merchants of all sizes.

Reduction in the cost of doing business

To operate on centralised platforms, merchants need to market their offerings to make themselves visible. On open networks, businesses save on additional advertising cost, bringing down the overall cost-to-market. Marketing cost poses a hindrance for innovation to scale up the business. Open network can help new businesses to ramp up the operations with more visibility at lesser cost. Along with that, merchants can also see a reduction in customer-acquisition cost and cost to retain customers.

Making the market perfectly competitive

Open network got the potential to add more merchants to the ecosystem. Currently, the market is an oligopoly. Decentralisation of e-commerce platform can make it easier for small businesses to launch their products on online platforms. With the addition of merchants, the market structure will change to become perfectly competitive.

Availability of more options for the consumers

For a consumer, with an open network, it will become easier to access the increased number of choices online on a single consumer platform. The neighbourhood stores – which are brought online using their respective online platform providers built on an open network – can be discovered by consumers, adding tangibility to the e-commerce transaction.

Summing up all the benefits, open network in e-commerce can be the next big event that can expand the overall industry's pie, bring efficiency to operations, and make the marketplace perfectly competitive with a check on existing malpractices.

12 Overview of e-health industry in India

12.1 Healthcare industry in India

Healthcare is one of India's largest sectors, in terms of revenue and employment. As per estimates by the National Skill Development Corporation (NSDC), healthcare has potential to annually generate 0.5 million additional jobs.

Healthcare comprises hospitals, medical devices, clinical trials, outsourcing, telemedicine, medical tourism, health insurance and medical equipment. India is behind the global benchmarks in terms of healthcare infrastructure, both in terms of physical as well as personnel infrastructure.

Hospitals industry in India
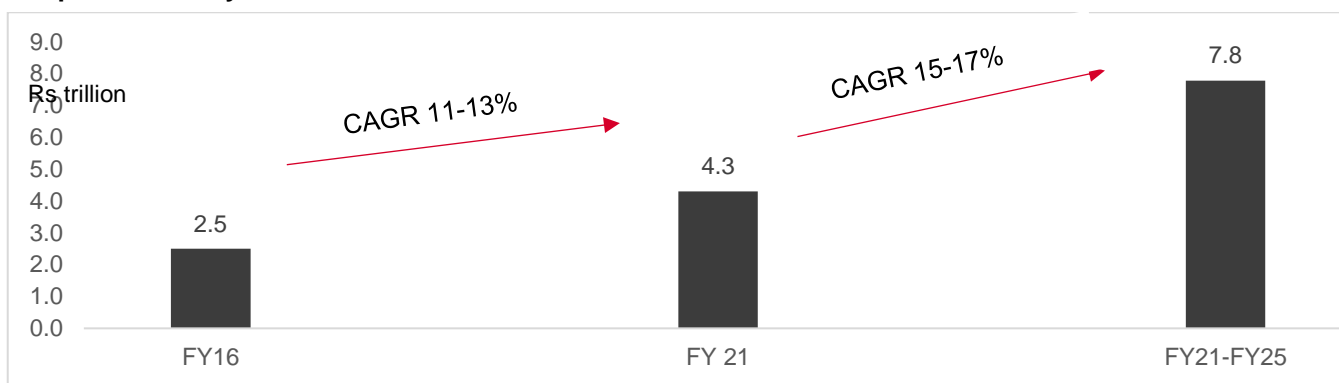
Note sizing for healthcare industry does not include clinics
Source: CRISIL Research

Hospitals are the largest segment with a market size of Rs 4.3 trillion in fiscal 2021; it is expected to clock 15-17% CAGR between fiscals 2021 and 2025, aided by rising domestic demand for healthcare as well as medical tourism.

Pharmaceuticals industry in India
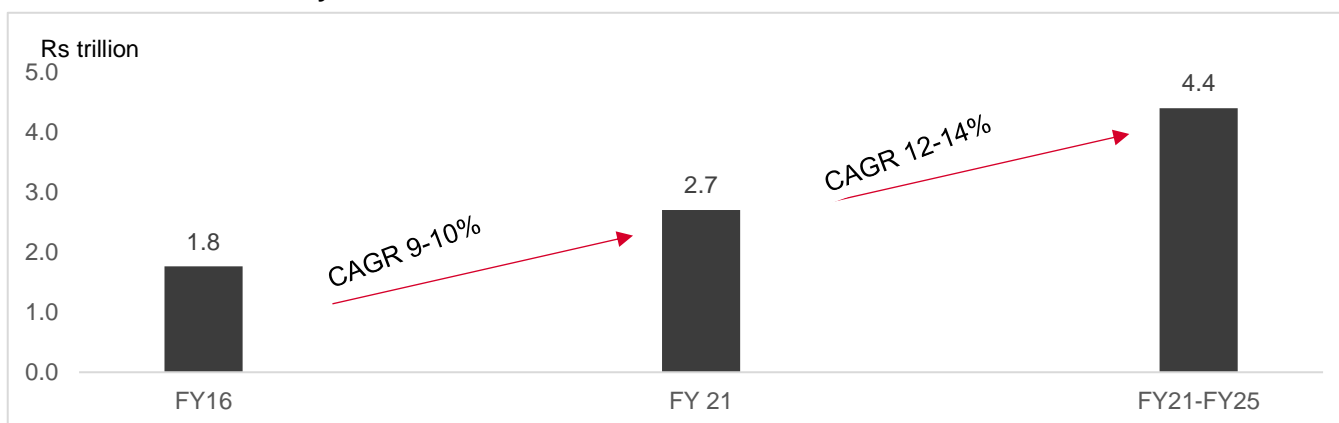
Note: The pharmaceutical market includes domestic manufacturing industry (Domestic consumption – Imports + Exports)
Source:CRISIL Research

The pharmaceuticals sector with a market size of Rs 1.5 trillion in fiscal 2021; it is expected to clock 12-14% CAGR between fiscals 2021 and 2025 supported by growth in generics exports and domestic demand for formulation. The major categories within India's pharmaceutical sector include generic drugs, Active Pharmaceutical Ingredients

(APIs)/bulk drugs, over-the-counter drugs, vaccines, contract research and manufacturing, as well as biosimilars and biologics.

Diagnostics industry in India

Rs. trillion

	FY16	FY 21	FY21-FY25
	0.4	0.7	1.1-1.3

CAGR 11-12%

CAGR 14-16%
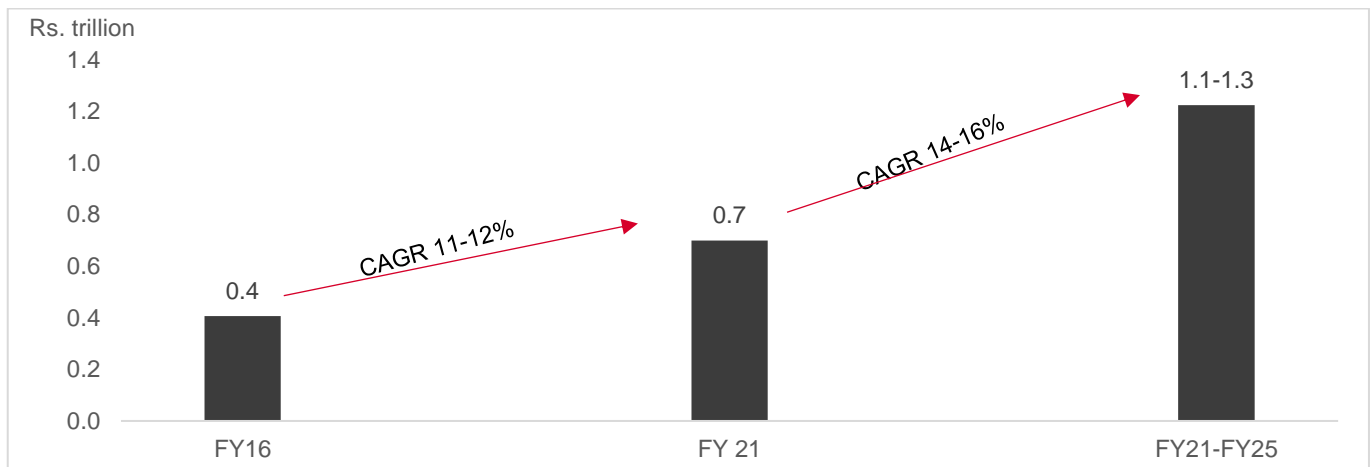
Source: CRISIL Research

Medical devices industry in India

Rs. trillion

	FY16	FY 21	FY21-FY25
	0.4	0.6	1.0

CAGR 9-10%

CAGR 12-13%
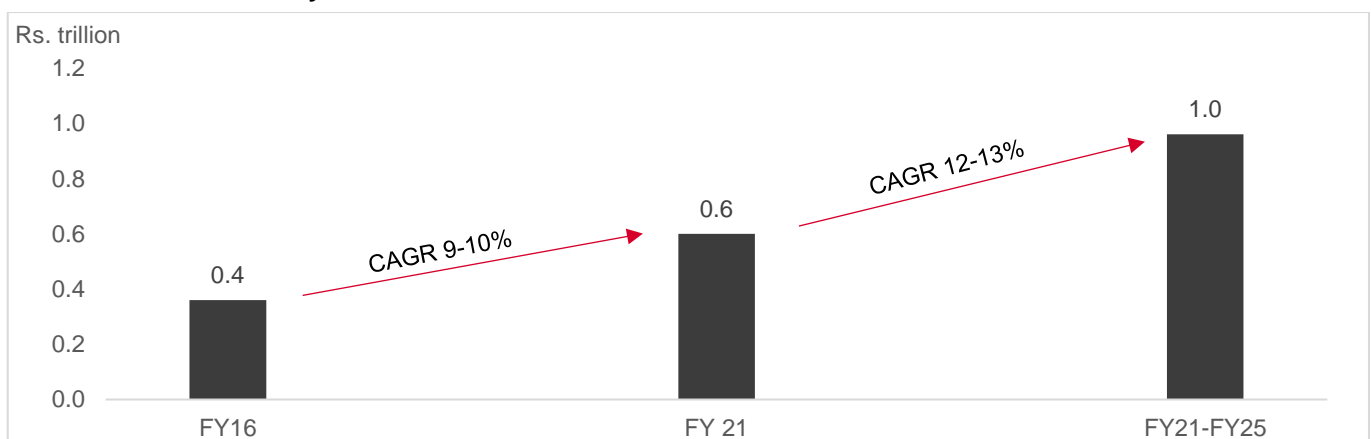
Source: CRISIL Research

Diagnostics centers and medical devices in fiscal 2021 are valued at Rs 0.7 trillion and Rs 0.6 trillion, and are expected to clock a CAGR of 14-16% and 12-13% between fiscals 2021 and 2025, respectively. The growth in the industry is supported by increased demand due to the Covid-19 pandemic and government initiatives like access-free drugs and diagnostics under the Ayushman Bharat programme, increased spending under healthcare, and increased penetration of insurance and increased awareness about regular health check-ups.

Medical insurance industry
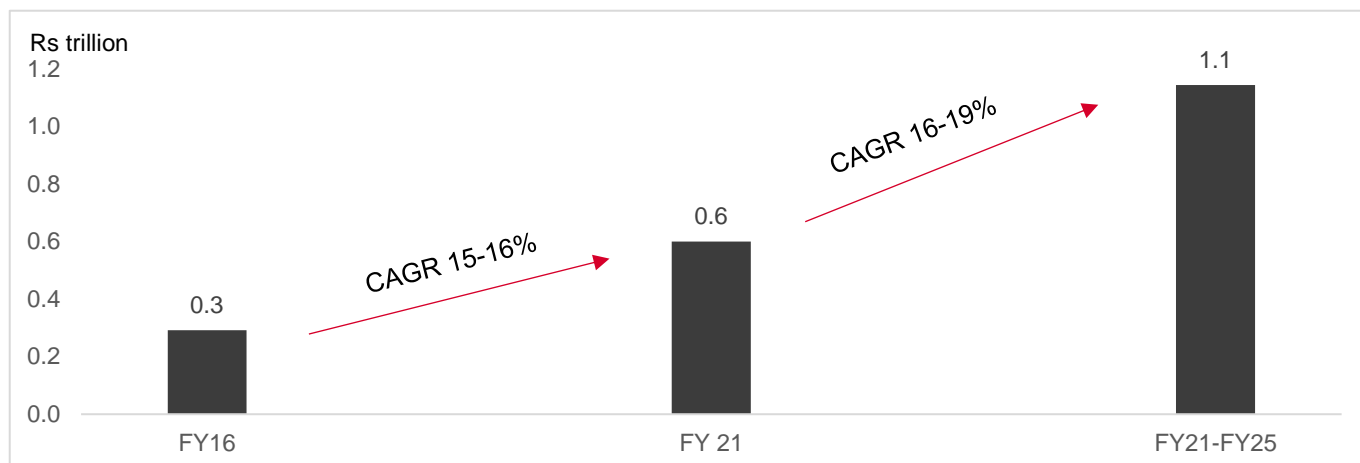
Note: Underwritten premium is considered

Source: CRISIL Research

The medical insurance sector is expected to clock 16-19% CAGR between fiscals 2021 and 2025, aided by rising income levels, increasing awareness in urban areas, growing lifestyle-related health demands and government initiatives like Pradhan Mantri Jan Arogya Yojana (PM-JAY).

Cumulative FDI inflows in healthcare (FY2000 to FY2021)

	FDI inflows April 2000 - March 2021 (USD billion)	Share in total FDI
Drugs & pharmaceuticals	17.9	3.4%
Hospitals & diagnostic centers	7.2	1.4%
Medical and surgical appliances	2.2	0.4%

Source: DIPP, CRISIL Research

Cumulative FDI inflows in healthcare (FY2000 to FY2016)

	FDI inflows April 2000 - March 2016 (USD billion)	Share in total FDI
Drugs & pharmaceuticals	13.8	4.8%
Hospitals & diagnostic centers	3.6	1.25%
Medical and surgical appliances	1.1	0.38%

Source: DIPP, CRISIL Research

India has emerged as one of the fastest-growing emerging economies over the last two decades, receiving large overall foreign direct investment (FDI) inflows that have grown from $2.5 billion in 2000-2001 to $81.7 billion in 2020-2021. The healthcare sector, in particular, has received heightened interest from investors over the last few years leading to rise in FDI inflows.

The Indian government is undertaking deep structural and sustained reforms to strengthen the healthcare sector; it has also announced conducive policies to encourage FDI. In fact, India's FDI regime has been liberalised extensively. Currently, FDI is permitted up to 100% under the automatic route (i.e., the non-resident investor or Indian company does not require approval from the Government of India for the investment) in the hospital sector and in the manufacture of medical devices. In the pharmaceuticals sector, FDI is permitted up to 100% in greenfield projects and 74% in brownfield projects under the automatic route.

Within the hospital sector, the expansion of private players to tier-II and tier-III cities offers an attractive investment opportunity for investors. With respect to pharmaceuticals, India is focusing on boost domestic manufacturing which is supported by recent performance-linked incentives of Government as part of the Aatmanirbhar Bharat package. In the medical devices segment, expansion of diagnostic and pathology centres as well as miniaturized diagnostics have high potential for growth. Further, medical tourism, especially wellness tourism, has bright prospects, given India's strengths in alternative systems of medicine. Technology advancements such as Artificial Intelligence (AI), wearables and other mobile technologies, along with Internet of Things, also offer numerous avenues for investors

Indian hospitals poised for robust medium-term growth

Barring momentary hiccups in fiscal 2021, CRISIL Research estimates the Indian hospital industry to post a healthy 15-17% CAGR between fiscals 2021 and 2025, driven by pent-up demand, strong fundamentals, increasing affordability and the Ayushman Bharat scheme.

Hospital industry estimated to touch Rs 5 trillion in fiscal 2022

The Indian hospital industry is categorised into two major components- public and private. The government, i.e., the public healthcare system comprises limited secondary and tertiary care institutions in key cities and focuses on providing basic healthcare facilities in the form of primary healthcare centres (PHCs) in rural areas. The private sector provides the majority of secondary, tertiary, and quaternary care institutions, majorly concentrated in metros and tier I and tier II cities.

CRISIL Research estimates the Indian hospital market to touch ~ Rs 5 trillion in value terms by the end of fiscal 2022, with growth driven by a low base and pent-up demand from deferred treatments in fiscal 2021. A potential upside is also expected from Covid-19 treatment, especially for hospitals where occupancies were typically on the lower side. Within the overall healthcare delivery market, the inpatient department (IPD) is expected to account for nearly 70% (in value terms), with the outpatient department (OPD) accounting for the remainder. Though OPD volumes outweigh IPD volumes, the latter contributes to the bulk of revenue for healthcare facilities.

As opposed to fiscal 2021, when government investments in the sector to combat the pandemic via temporary establishments had gained prominence, and private hospitals saw a revenue erosion owing to postponement of surgeries and travel restrictions, the private sector is expected to complement the role of the government in fiscal 2022.

Overall hospital market in the medium term
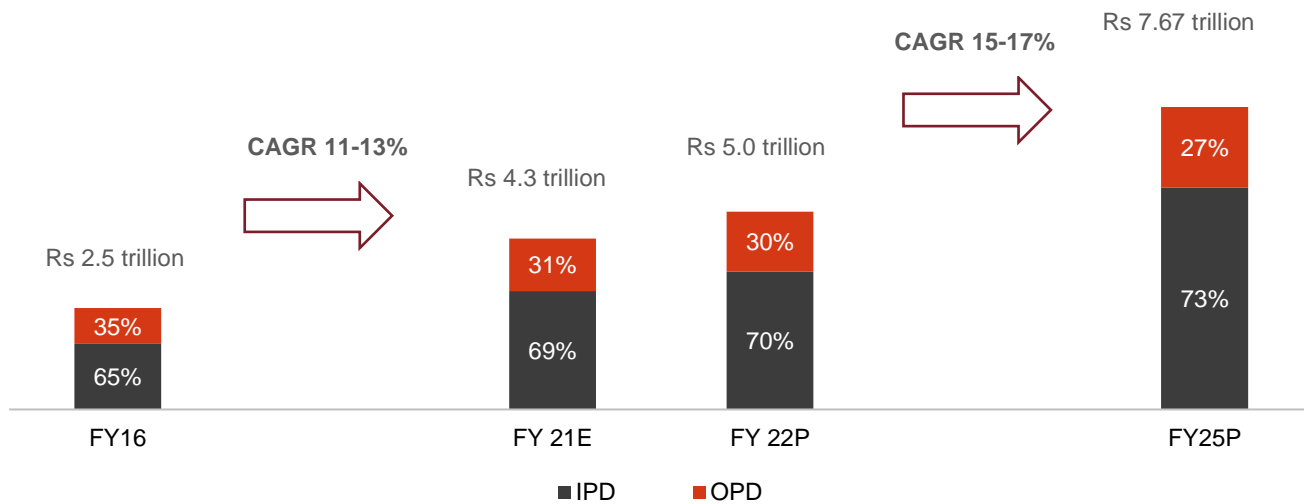
Source: CRISIL research

Hospital industry to grow 15-17% over next four years

With renewed impetus from **PMJAY and government focus shifting to the healthcare sector**, the healthcare delivery market is expected to clock 15-17% CAGR to Rs 7.67 trillion in fiscal 2025.

Over the last four years, major hospital chains have added supply (~70% of their incremental supply during the period) in tier II and III locations, in order to create a referral network into their main centre by tapping into underserved creamy tier II areas. The government is also expected to augment this via a scheme in the pipeline (**PM AtmaNirbhar Swasth Bharat**) to strengthen primary, secondary & tertiary healthcare infrastructure in the country.

The other demand contributors are more structural in nature, like increase in lifestyle-related ailments, increasing medical tourism, rising incomes and changing demographics.

In India, healthcare services are provided by government and private players, and these entities provide both IPD and OPD services. However, the provision of healthcare services in India is skewed towards private players (for both IPD and OPD). This is mainly due to the lack of healthcare spending by the government and the high burden on existing state health infrastructure. The share of treatments (in value terms) by private players is expected to increase from 58% in fiscal 2021 to nearly 73% in fiscal 2025, although the share witnessed a slight dip in fiscal 2021.

The skew is more towards private players owing to the expansion plans of private players being centered on hospitals, further buttressed by increasing reliance on private facilities till adequate government infrastructure is put in place.

Share of treatments (government hospitals vs. private hospitals/clinics)

Private hospitals/clinics   Government hospitals
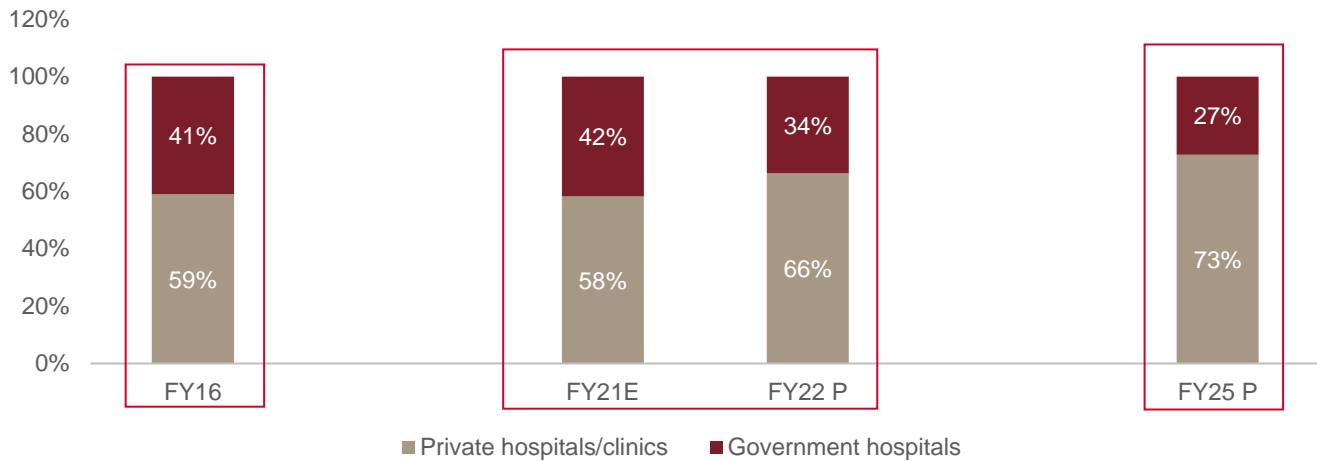
Source: CRISIL Research

The additional demand to be unleashed by PMJAY can be only be catered to by private participation since government facilities are already overburdened, and hence, going forward as well, a major share of treatments would be inclined towards the private sector.

India's health infrastructure has large potential for improvement

The adequacy of a country's healthcare infrastructure and personnel is a barometer of its quality of healthcare. This, in turn, can be assessed from bed density (bed count per 10,000 population) and availability of physicians and nurses (per 10,000 population).

For India, that's where the concern begins. The country comprises nearly a fifth of the world's population, but has an overall bed density of merely 13, with the situation being far worse in rural than urban areas. India's bed density not only falls far behind the global median of 29 beds, it also lags that of other developing nations, such as Brazil (21 beds), Malaysia (19 beds), and Vietnam (26 beds).

Bed density across countries – hospital beds per 10,000 people (2017-18)
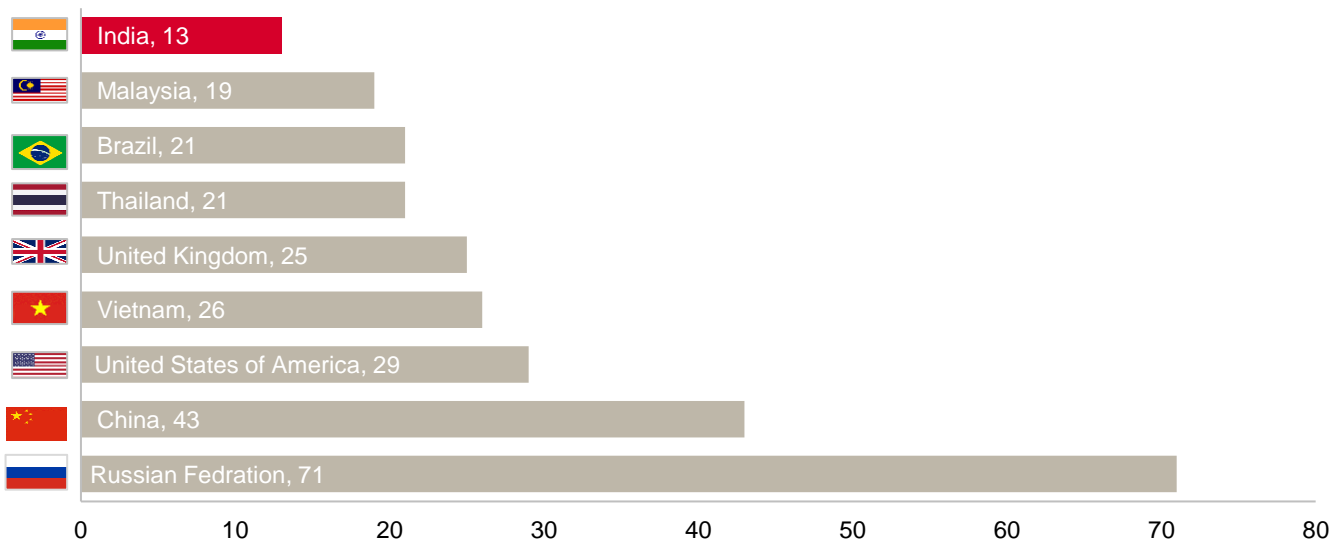
Note: India's bed density is estimated by CRISIL Research

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The total number of government beds in India are estimated at 0.8 million. An estimated population of 1.34 billion implies that 1,632 people on average are served per government bed in the country. Sikkim (34), Mizoram (17), Arunachal Pradesh (16) and Himachal Pradesh (20) have the highest government bed density per 10,000 people. Telangana (1), Bihar (2), Maharashtra, Chhattisgarh and Uttar Pradesh (3 each), and Madhya Pradesh and Jharkhand, (4 each) have the lowest.

Availability of government beds (per 10,000 people) in India
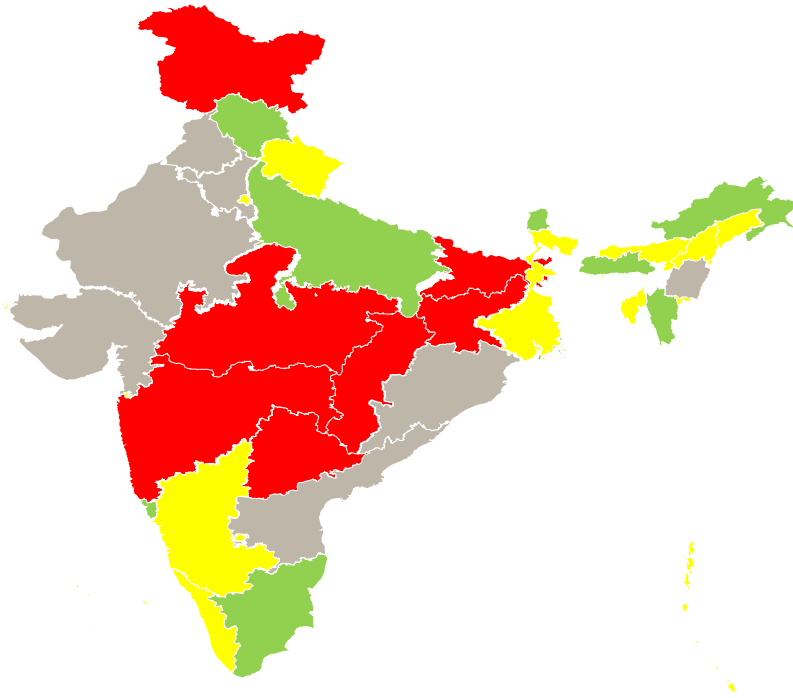
Note: <4 beds indicates very low density (red)
>4 and <7 beds indicate low density (pink)
<13 beds indicate medium density (yellow)
>13 beds indicate high density (green)
Source: National health profile 2020

Healthcare personnel: India versus other countries (2017-18)

Legend: ■ Physicians (per 10,000 population) ■ Nurses (per 10,000 population)
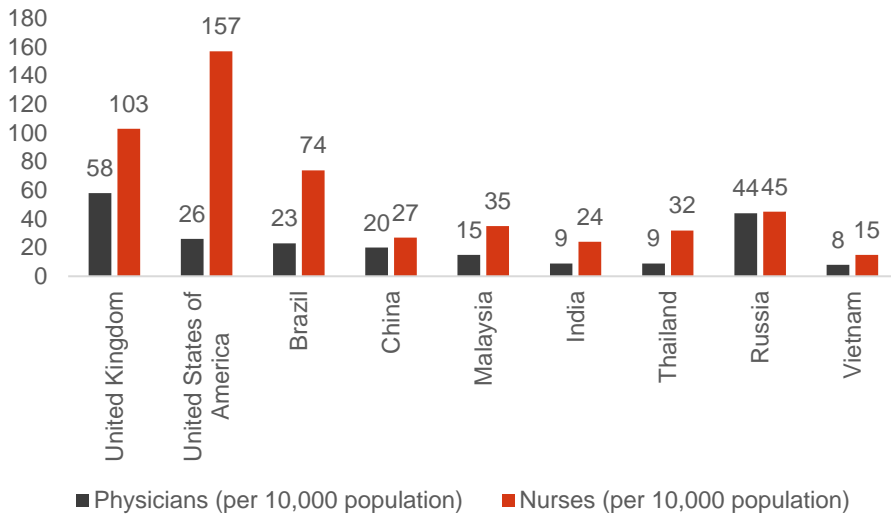
The paucity of healthcare personnel compounds the problem. At nine physicians and 24 nursing personnel per 10,000 population,

India trails the global median of 17 physicians and 39 nursing personnel. Even on this parameter, India lags behind Brazil (23 physicians, 74 nurses), Malaysia (15 physicians, 35 nurses).

Physicians (per 10,000 population)		Nurses (per 10,000 population)	
World average	India	World average	India
	17	**9**	**24**
		39	

Source: WHO World Health Statistics 2021

The pandemic has further strained the healthcare sector with the sheer paucity in the number of doctors and healthcare professionals available. As a developing country with the world's second largest population, India needs to heavily invest in its healthcare system. It needs to completely revolutionise its healthcare delivery ecosystem and make way for cutting-edge medical technology. Hospitals and healthcare organisations are focusing on the use of digital platforms in enhancing patient-care delivery, remote care monitoring and improving the overall efficiency of medical system.

The pandemic exposed gaps in primary care delivery where physical OPDs and doctor consultations were the only channels. This brought virtual consultations to the fore for both primary and secondary care across all hospitals. The future will see the growth of telemedicine, remote patient monitoring, home healthcare, e-pharmacy, e-diagnostics, tele-ICU services and more. Newer technology-enabled options for patients and providers in terms of preventive care and better healthcare access need to be developed.

Healthcare expenditure

Global healthcare spending has been rising along the growth in the economy. As the economy grows, public and private spending on health grows too. Also, an increase in sedentary work is giving rise to chronic diseases, pushing up healthcare spending. Fast growing economies with low spending on health are seeing healthcare spends increase dramatically as they move up the income ladder.

India lags peers in healthcare expenditure

Total healthcare expenditure as a percentage of GDP (2018)

Country	%
Indonesia	2.9%
India	3.5%
Malaysia	3.8%
Sri Lanka	3.8%
Thailand	3.8%
Singapore	4.5%
Nepal	5.8%
Vietnam	5.9%
Brazil	9.5%
United Kingdom	10.0%
United States of America	16.9%
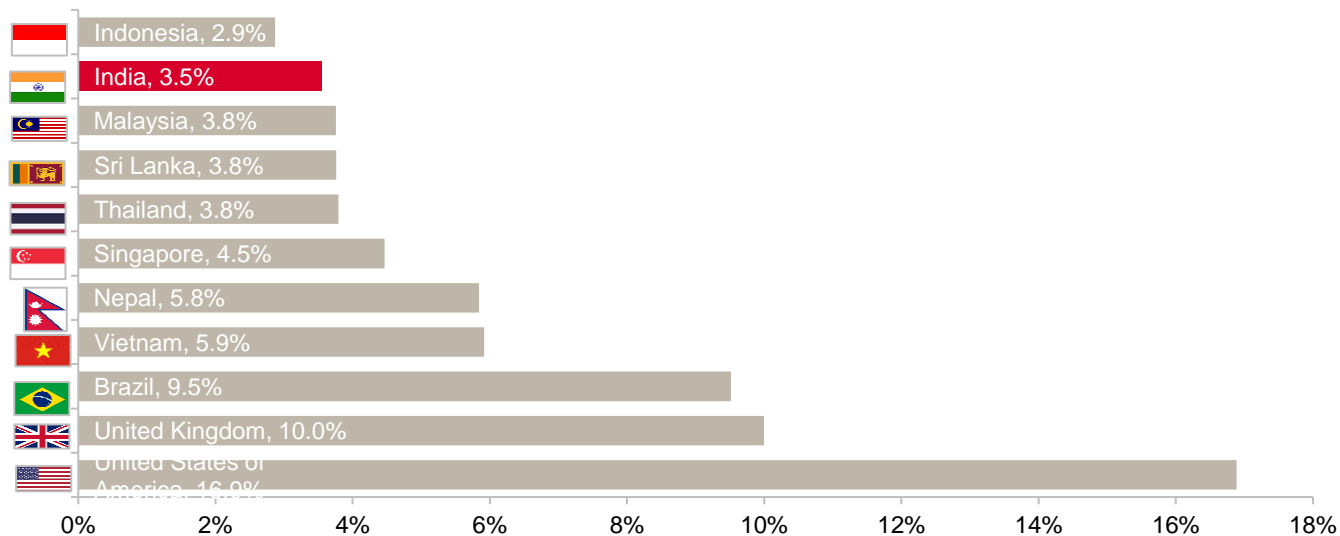
Source: Global Health Expenditure Database, World Health Organization; CRISIL Research

According to the Global Health Expenditure Database compiled by the World Health Organization (WHO), in 2018, India's expenditure on healthcare was 3.5% of GDP. In fiscal 2019, India's real GDP was Rs 139.8 trillion (constant fiscal 2012 prices) and healthcare expenditure was estimated at Rs 4.9 trillion. As of 2018, India's healthcare spending as a percentage of GDP trails not just developed countries, such as the US and the UK, but also developing countries such as Brazil, Nepal, Vietnam, Singapore, Sri Lanka, Malaysia and Thailand.

India needs to ramp up its healthcare spending

India's current healthcare expenditure has decreased over 2013-2018. Private healthcare expenditure in India exceeds public expenditure. The country's low healthcare expenditure is primarily due to under-penetration of healthcare services and lower consumer spending on healthcare.

Further, India's public spending on healthcare services remains much lower than its global peers. For example, India's per-capita total expenditure on healthcare (at an international dollar rate, adjusted for purchasing power parity) was only $73 in 2018 versus the $10,624 for the US, $4,315 for the UK and $2,824 for Singapore.

Current healthcare expenditure (CHE) as percentage of GDP in India (2010-2018)
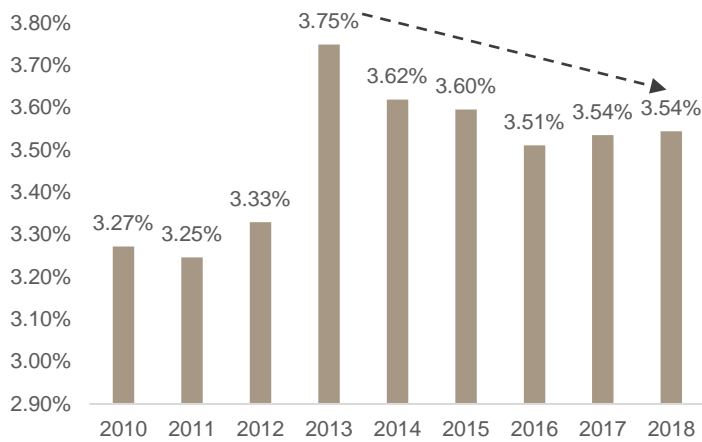
Per capita current expenditure on health in USD (2018)
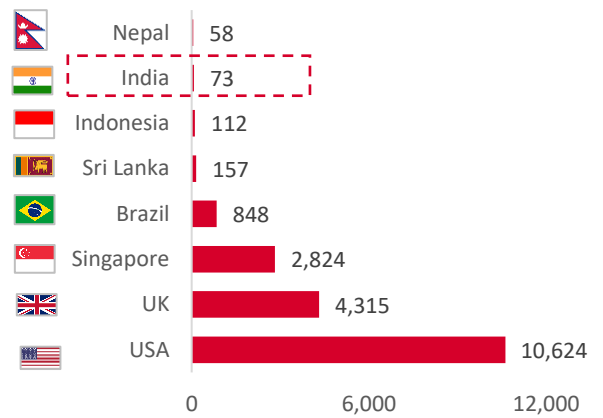
Source: Global Health Expenditure Database- World Health Organisation, CRISIL Research

Public healthcare expenditure is low; private sector accounts for the majority of expenditure

General expenditure on health as percentage of CHE (2018)
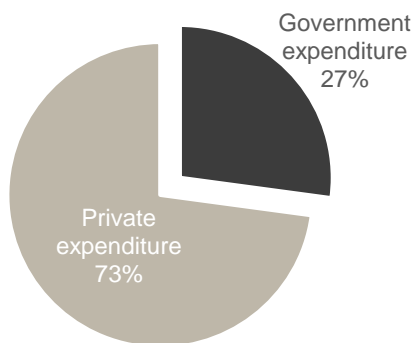
India's CHE is skewed towards private expenditure, as compared with public expenditure. Government expenditure on healthcare has been range-bound at 20-30% of CHE over 2010-2018. The rest of the expenditure is private in nature – expenditure from resources with no government control (voluntary health insurance), and direct payments for health by corporations (profit, non-for-profit and non-government organisations) and households. However, the government aims to increase public healthcare expenditure to 2.5% of GDP from the current 1.2%, according to the National Health Policy 2017.

Source: Global Health Expenditure Database – WHO, CRISIL Research

Out-of-pocket (OOP) as percentage of CHE (2018)

Country	Value
India	62.7%
Nepal	50.8%
Sri Lanka	50.7%
Viet Nam	44.9%
Malaysia	35.1%
Indonesia	34.9%
Singapore	31.0%
Brazil	27.5%
United Kingdom	16.7%
Thailand	11.0%
USA	10.8%
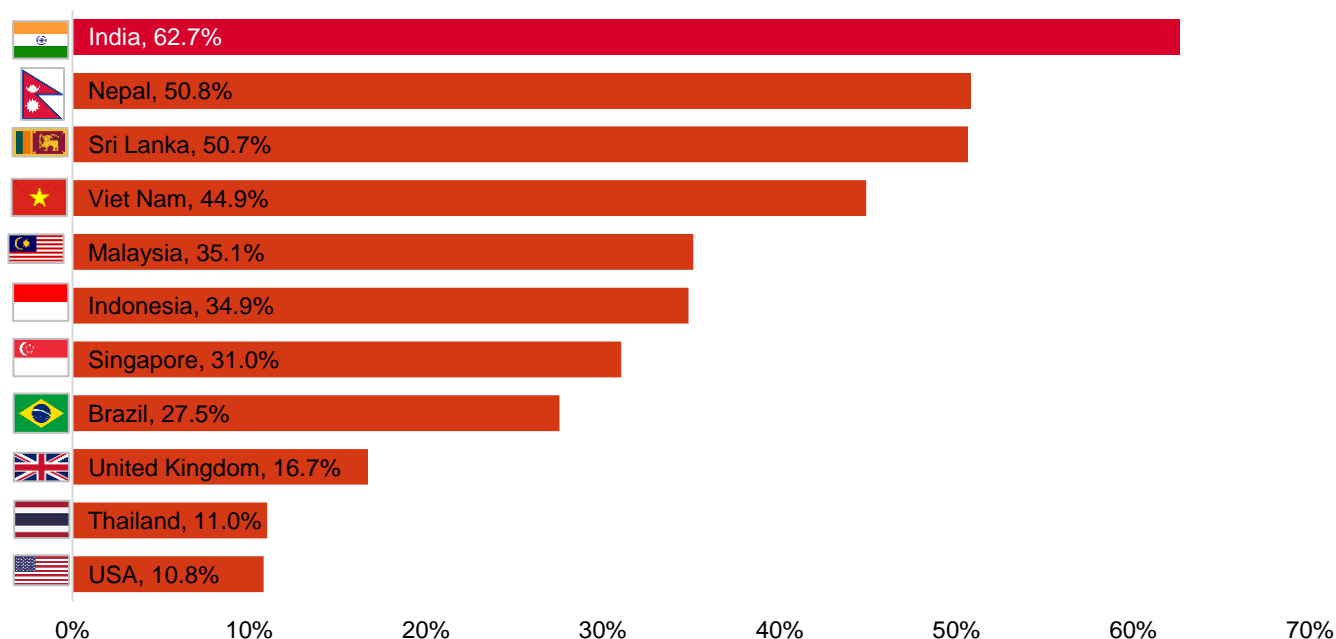
Source: Global Health Expenditure Database – WHO, CRISIL Research

In India, OOP expenditure on health was nearly 63% of total health expenditure in 2018 (highest among all the countries compared above). Insurance cover in India does not cover outpatient treatments (only recently has an insurance company started covering outpatient treatment under its health insurance), which makes OOP expenditure for outpatient treatments higher than for inpatient treatments.

Nearly 25% of the rural population and 18% of the urban population are dependent on borrowings to fund their healthcare expenditure. Almost 68% of the rural population and 75% of the urban population use their household savings on healthcare-related expenditure. Health expenditure contributes to nearly 3.6% and 2.9% of rural and urban poverty, respectively. Annually, 60 to 80 million people fall into poverty due to healthcare-related expenditure. However, PMJAY is expected to take care of the affordability aspect of healthcare expenditure to some degree, especially for the poor.

Though low healthcare spending represents a pain point in healthcare financing, it also means that there exists a substantial potential for those involved in provision of auxiliary healthcare services.

India non-life penetration is low and has potential for growth

Insurance density

Years	2015	2016	2017	2018	2019	CAGR 2015-2019
Countries						
United States	2377	2449.2	2542	2672	5580	24%
Germany	1381	1397.1	1519	1747	1712	6%
France	1129	1167.5	1224	1296	1306	4%
United Kingdom	1067	1030.5	938	971	978	-2%
World	**276**	**285.3**	**297**	**312**	**439**	**12%**

Years	2015	2016	2017	2018	2019	CAGR 2015-2019
PR China	128	147.2	159	185	201	12%
Brazil	154	150.8	174	159	155	0%
India	**12**	**13.2**	**18**	**19**	**19**	**12%**

Note: Insurance density is measured as ratio of premium (in US Dollar) to total population.

Source: IRDAI, CRISIL Research

India's non-life insurance density of 19 is one of the lowest, as compared with the world average of 439 in fiscal 2019.

Growing health insurance penetration to propel demand

Low health-insurance penetration is one of the major impediments to the growth of the healthcare delivery industry in India, as affordability of quality healthcare facilities by the lower income groups continues to remain an issue. As per the Insurance Regulatory and Development Authority (IRDA), nearly 499 million people have health insurance coverage in India (as of fiscal 2020), as against 288 million (as of fiscal 2015), but despite this robust growth, the penetration in fiscal 2020 stood at only 37%.

Number of lives covered through various insurance business
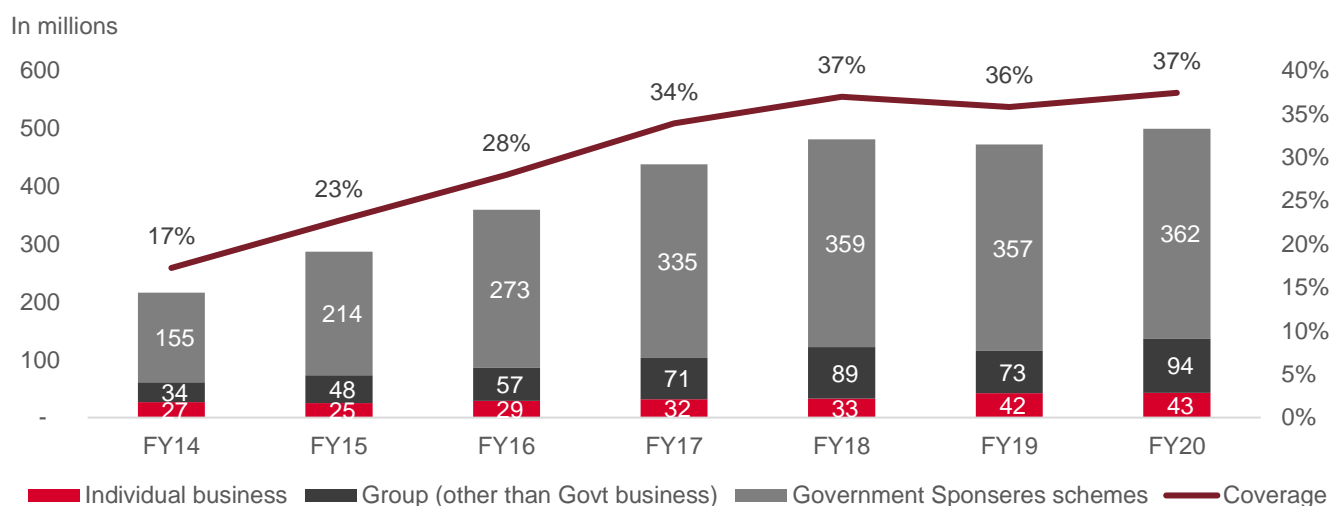
Source: IRDA Annual report 2019-20, CRISIL Research

As is evident, the share of government-provided insurance is greater than the other groups due to insurance policies availed by individuals not covered under any schemes. Government or government-sponsored schemes such as the Central Government Health Scheme (CGHS), Employee State Insurance Scheme (ESIS), Rashtriya Swasthya Bima Yojana (RSBY), Rajiv Arogyasri (Andhra Pradesh government) and the Kalaignar (Tamil Nadu government) account for 75% of health insurance coverage provided. The remaining is through commercial insurance providers, both government (Oriental Insurance, New India Assurance, etc.) and private (ICICI Lombard, Bajaj Allianz, etc.).

Robust growth in gross direct premium health
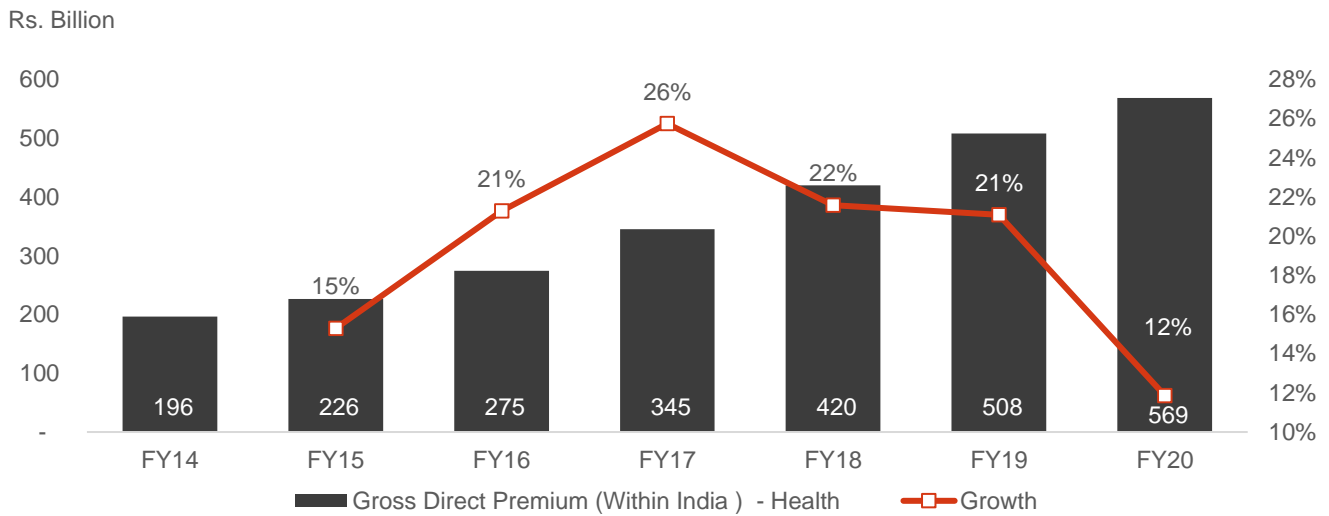
Rs. Billion

Source: IRDA, CRISIL Research

Gross direct premium for health insurance rose from Rs 196 billion in fiscal 2014 to Rs 569 billion in fiscal 2020. The gross direct premium clocked a CARG of 19% from fiscal 2014 to 2020.

CRISIL Research believes that while low penetration is a key concern, it also presents a huge opportunity for the growth of the healthcare delivery industry in India. There has been an increase in the number of people opting for health insurance over time. New products that cover certain ailments that were previously not covered are also seeing heightened demand among buyers of insurance policies. And with the PMJAY scheme, the insurance coverage in the country is expected increase.

Furthermore, with health insurance coverage in India set to increase, hospitalisation rates are likely to go up. In addition, health check-ups, which form a mandatory part of health insurance coverage, are also expected to increase, boosting demand for a robust healthcare delivery platform.

Expansion of health insurance coverage supported by Ayushman Bharat

Ayushman Bharat aims to provide health risk coverage through health insurance and improve access to primary healthcare through health and wellness centres. With the operationalisation of Ayushman Bharat and its scale-up, healthcare establishments across the country are being empanelled for provision of healthcare services under this scheme.

Ayushman Bharat will further provide volume momentum to the sector, with full-scale implementation providing healthcare assurance of Rs 0.5 million per family (on floater basis) to nearly 107.4 million families (the actual coverage would be greater on account of states extending the scheme to some sections of the uncovered populace). As on November 2020, nearly 14 million treatments had taken place under Ayushman Bharat since the inception of the scheme in September 2018. More recently, nearly 32,000 patients have received treatment for Covid under the scheme (as on September 2020).

12.2 E-health is the future of healthcare service

E-health refers to the use of information and communications technology in healthcare. Based on different approaches to e-health, its types can include the following: services provided via the Internet (such as telemedicine

and video consultation); electronic health record; and health monitoring and research via mobile applications (also referred to as m-health).

E-health initiatives have a vision to delivery better health outcomes in terms of

- access,

- quality,

- affordability,

- lowering of disease burden, and

- efficient monitoring of health entitlements to citizens

The aim of these initiatives is to make all medical facilities available all time from any part of the world through web services, mobile services, SMS or call centre services. Broadly, the intent is to cover online medical consultation, online medical records, online medicine supply management, pan-India exchange for patient information, and so on.

The MoHFW has started various e-governance initiatives in the healthcare sector in India mainly for eHealth. It will make a world of difference in India, where mobile technologies have been penetrating rapidly. As India has a strong presence in IT, the integrated health information system serves the needs of all stakeholders.

Below is a chart depicting the normal flow of patient experience with health worker using the e-health application

Patient schedules consultation with mobile app or over phone	→	Patient visits centre and is checked in by health extension worker	→	On-site medic records vital signs and symptoms in an electronic health record (EHR)

↓

Patient receives the prescribed course of treatment on paper and via mobile app	←	Doctor joins call and oers advice based on patient's symptoms and EHR	←	Health extension worker leads patient to teleconsultation centre with screen and microphone

↓

Prescription medication is dispersed directly from clinic	→	Patient follows course of treatment, tracking progress and adherence in mobile application	→	Clinic follows up through application and schedules next appointment

Source: Industry reports, CRISIL Research

Online spends during covid-19 towards healthcare

On account of the series of lockdowns owing to Covid-19 pandemic in India there has been higher dependence on the internet in order to serve basic healthcare needs of individuals. Convenient, affordable and personalised treatments have been preferred as opposed to traditional hospital based treatments. Increasing use of e-pharmacy websites/apps have been evident as the number of users using e-pharmacy website/apps shot up nearly 2.5-3 times between March and June 2020. E-consultation/tele-medicine also gained impetus as they omitted the need to visit hospitals. The number of people using online health consultations increased 3 times between March to November 2020 as per a recent report published by Telemedicine Society of India named 'Rise of Telemedicine - 2020'.

The advent of 5G, artificial intelligence and machine learning is expected to accelerate online spending towards healthcare further.

12.3 Emerging technologies in healthcare

Electronic Health Records

Artificial Intelligence, Blockchain

Radiology information system

Clinical decision support system

Mobile-based applications

Telemedicine

Robotic surgery

Wearables and sensors
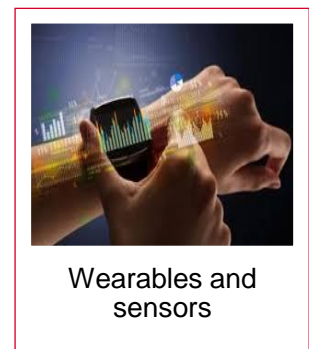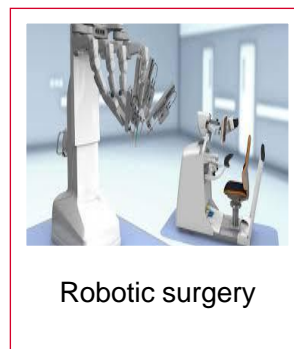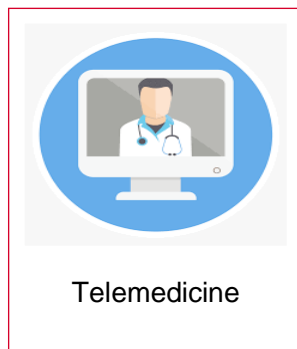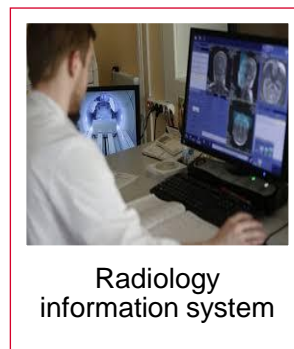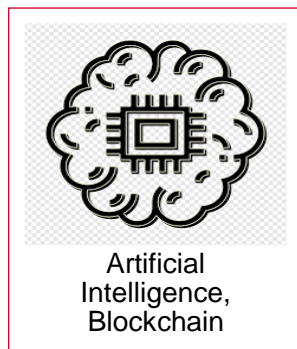
The healthcare industry, like other industries, is constantly evolving in terms of technology. Developments in information technology have helped create systems which ensure faster and reliable services. While, on one hand, these systems help increase the reach and quality of healthcare delivery systems across the country, on the other, they also enable healthcare delivery providers to improve efficiency by helping them in resource planning, maintaining patient records, etc. CRISIL Research believes that with the advent of 5G, smartphone penetration and increasing health conscious population, digital healthcare penetration will grow significantly.

Electronic health records (EHRs)

EHRs are designed to manage detailed medical profile and history of patients such as medication and allergies, immunisation status, laboratory test results and radiology images. Information stored in EHRs can be in a

combination of various formats including picture, voice, images, graphs and videos. Besides storing information, EHRs have the capability of analysing data with respect to a specific ailment, generating customised reports, setting alarms and remainders, providing diagnostic decision support, etc.

EHRs can be shared between multiple systems allowing doctors from various specialties and hospitals to share the same set of patient data. This feature helps improve coordination between doctors, saves time and prevents redundancy of recreating medical records. EHRs allow medical histories to be transferred quickly and accurately thereby ensuring effective and timely treatment. They can be secured with various privacy settings.

Artificial Intelligence (AI) and blockchain

Healthcare establishments like hospitals are looking at opportunities to deploy AI or/and blockchain in improving their operating efficiency – scheduling appointments depending on the gravity of the issue, healthcare monitoring, etc., thereby minimising human error through technological intervention. For e.g., NITI Aayog has extended its support to an AI based project - Radiomics, which is also supported by Tata Memorial Centre Imaging Biobank.

Hospitals like Apollo have partnered with global giants like Microsoft to create a cardiovascular disease risk score application programme interface (API) for assigning risk scores to cardiac patients in India. Max Healthcare is also in the process of piloting AI and Machine Learning (ML) algorithms for prediction of readmission of myocardial infractions, along with being involved in a project concerning speech to text technology for accurately capturing clinical and radiology information in the systems.

The partnership is beneficial not just for the hospitals, but also for the tech companies which test these technologies on hospital patient data, like Google trying to use AI for detecting diabetic retinopathy at Aravind Eye Care hospitals.

Radiology information system (RIS)

RIS is a tool that allows managing digital copies of medical imagery such as X-ray, MRI, ultrasound, and associated data on a network. RIS is used by doctors to access medical imagery data from multiple locations. It is connected to medical equipment such as X-ray, MRI and ultrasound machines, which generate diagnosis results in the form of images and graphs.

The RIS directly captures results and feeds them to EHRs, central databases or remote databases. RIS systems are integrated with a dedicated picture archiving and communication modules which ensures that the pictures are stored in a systematic manner and transferred accurately to the intended database or recipient.

Implementation of RIS allows hospitals eliminate the need of generating and maintaining medical imagery on expensive films. RIS enable hospitals to store complete radiology history of patients together. This feature allows generating detailed analytical reports on patient's medical history.

Clinical decision support system (CDSS)

CDSS is a software designed to assist doctors in taking decisions pertaining to the diagnosis and treatment of patients. A CDSS is supported by a large database which has detailed information on ailments with data aspects ranging from symptoms to the diagnosis. The database is supported by a set of rules which help generate accurate results for the query made by the user. It also contains patient specific information such as medical history, allergies, etc., which helps the doctors to make effective decisions on the treatment. CDSS databases are open-ended to allow addition of information on newly discovered diseases, procedure and medications, rectification of erroneous procedures, and updating of patient information.

Mobile-based application

Healthcare delivery is also seeing an influx of mobile-based applications (mobile apps) which assist both doctors as well as patients. These apps typically provide features such as self-diagnosis, drug references, hospital/doctor search and appointment assistance, electronic prescriptions, etc. While certain apps allow doctors to obtain information on drugs, dosage, contradictions, disease and condition references and procedures, there are others which allow patients to locate doctors and fix appointments and also view video consultations. Furthermore, there are apps that help patients save their medical records and keep them updated regularly.

Even the government is looking into adopting these measures with the launch of UMANG (Unified Mobile Application) which offers 242 services across 57 departments in 12 states. It has a feature to book hospital appointments, check blood availability and view medical reports online upon registration.

Telemedicine

Telemedicine is a technology designed to increase accessibility of healthcare services from remote locations. Telemedicine makes extensive use of information technology to create a connection between doctors at the main hospital and patients at the remote / telemedicine centre. The doctor analyses the patient through telephonic conversation or video conferencing. She/he is assisted by a junior doctor or health worker who is physically present at the telemedicine centre. The junior doctors physically examine the patient and convey the information to the doctor. The doctor communicates diagnosis and medication based on the inputs provided by the junior doctors. If the ailment is complex, then the patient is advised to get admitted at the main hospitals to avail of intensive care. This model is useful in healthcare service provision at a time there is a dearth of healthcare professionals in the country.

Robotic surgery

Robotic surgery or robot-assisted surgeries (RAS) is surgery conducted using a robotic arm that is controlled electronically using a control pad which may be located at a local or remote location and is also equipped with high-definition cameras allowing surgeons to take a closer look at the areas being operated. Since RAS can be performed from remote locations, it allows patients to avail of treatment from the desired specialist surgeons across the world without having to travel. Robot assisted surgeries have been used to conduct general surgeries, bypass surgeries, colorectal surgeries, gastrointestinal surgery, neurosurgery, orthopaedic surgeries, etc.

Wearables and sensors

With awareness regarding healthcare increasing, people have started adopting wearables and sensors which keep a track of the vitals of the user. It also has data about the user's historical health records and sends out alerts in case of any irregularities. Some sensors are used solely from a curative healthcare perspective, to lead a healthy life with a proper fitness regimen.

Others

- Some of the other e-health technologies include:
- Robot-Assisted Surgery
- Self-Monitoring Healthcare Devices
- Big Data in healthcare
- e-Pharmacies

- e-Learning in the healthcare sector

Below is a list of digital technologies which will enable seamless care centered on patients

Key areas in healthcare	Digital technology
Consultation	Remote monitoring with IoT
	Telemedicine
	Online doctor comparisons
Automation	Electronic health records (EHR)
	Applications for chronic disease management
	Automation of Claims, scheduling, etc
	Rural doctor accountability tools
Analytics	Evidence based care analysis
	Data driven utilisation management and risk-sharing
	Digitalized insurance underwritting and claims

12.4 Role of electronic health records (EHR) in healthcare

The government has started a National Digital Health Mission on the lines of the proposed **National Health Stack (NHS),** a shared digital framework for both private and public hospitals. NHS is expected to digitise all health records and track all details concerning healthcare enterprises in the country.

India does not have a well-equipped system to maintain electronic health records of the patients. Medical records of patients are not registered/digitalised, which leads to no patient history. Due to unavailability of medical records, the patients themselves are the only source of information. Considering all the above factors, the healthcare service provided is not up to mark as the doctors may not know the full past history of the patient, which is very critical for accurate diagnosis.

Presently, some secondary and tertiary health care facilities have started implementing healthcare IT applications in terms of Hospital Information System, Hospital Management Information System, Electronic Medical Records (EMR), etc., to manage patient data in an electronic format. However, these systems are developed by different vendors by using different programming languages and databases. This approach makes the system unique but the patient details remain in the same hospital and cannot be shared with another hospital that the patient might move to for advanced or specialised treatment. This is because the data is not interoperable and semantic.

A standard secure Electronic Health Record (EHR) framework is to be developed using standard medical terminology and coding standards. The use of EHR will help remove inconsistencies in a patient's health management. The data stored digitally will help alert the patient as well as the doctor about the potential risks and what to do next to ensure preventive care. This further reduces the readmission or revisits of patients to clinics as it helps doctors create a preventive care plan to reduce the chances of diseases recurring.

Government of India EHR initiatives:

- Formulated and published an **EHR standard in September 2013**

- Ministry of Health and Family Welfare (MoHFW) has proposed a new bill, the **Digital Information Security in Healthcare Act (DISHA)**

- **Personal Data Protection Bill, 2019**

- National Digital Health Mission on lines of the proposed **NHS**

The adoption of digitisation of patient records would almost certainly improve the quality of care that patients receive. As larger healthcare players make their foray and build their presence in the Indian healthcare landscape, adaption of best practices to streamline quality of healthcare service will push growth for digital initiative such as health records management in future.

National Digital Health Mission (NDHM)

NDHM initiative supports universal health coverage in an efficient, accessible, inclusive, affordable, timely and safe manner leveraging on open, interoperable, standards based digital systems, and ensures the security, confidentiality and privacy of health-related personal information. Citizens and patients in India are served by different stakeholders in the healthcare system – namely, policymakers in central and state governments, healthcare professionals, regulators, allied private entities such as insurers, and providers of healthcare services in hospitals and pharmacies.

The NDHM is envisaged to **create an online platform using data, information and infrastructure services**, while also ensuring the security, confidentiality and privacy of health-related personal information. Some of **the key objectives** envisaged under the NDHM are as follows:

- To establish registries at the appropriate level to create a **single source** of truth in respect of clinical establishments, healthcare professionals, health workers, drugs and pharmacies

- To enforce adoption of **open standards** by all national digital health stakeholders

- To create a system of personal health records, based on international standards, **easily accessible to individuals and healthcare professionals** and service providers, based on the individual's informed consent

- To ensure healthcare institutions and professionals in the **private sector participate actively** with public health authorities in the building of the NDHM, through a combination of prescription and promotion

- To **strengthen existing health information systems** by ensuring their conformity with defined standards and integration with the proposed NDHM

Implementation of the NDHM is expected to significantly **improve the efficiency, effectiveness and transparency of health service delivery**. Patients will be able to securely store and access their medical records (such as prescriptions, diagnostic reports and discharge summaries), and share them with healthcare providers to ensure appropriate treatment and follow-up. They will also have access to more accurate information on health facilities and service providers. Further, they will have the option to access health services remotely through tele-consultation and e-pharmacy. The NDHM will empower individuals with accurate information to enable informed decision-making and increase accountability of healthcare providers.

COVID Vaccine Intelligence Network (CoWIN) platform is jointly developed by the ministry of health and ministry of electronics and IT. It is a comprehensive cloud-based IT solution for planning, implementation, monitoring and evaluation of **COVID-19 vaccination across India**. It provides real time information of vaccine stocks, their storage temperature and individualized tracking of beneficiaries of the COVID-19 vaccine. It assist in automated session allocation for pre-registered beneficiaries, their verification and for generating a digital certificate upon successful

completion of the vaccine schedule. As on June 21, 2021, CoWIN has 308,513,945 total registrations of Indians and 280,094,902 total vaccination doses been given to Indians.

National eHealth Authority (NeHA) was proposed to be set up in 2015 as a promotional, regulatory and standards-setting organization in the health sector. Its vision is attainment of high-quality health services for all Indians through the cost-effective and secure use of information and communication technologies in health and related fields. Its goal is to ensure development and promotion of e-health ecosystem in India for enabling the organization, management and provision of effective people-centred health services to all in an efficient, cost-effective and transparent manner.

Some of the government programmes under e-health are as follows:

Programme	Details	Progress
e-Mamta	It is a citizen-centric service delivery initiative by the Government of Gujarat. It leverages information and communications technology to track the progress of pregnant mothers, and integrates non-recipients of services into the healthcare system	Almost 80% of the total population of Gujarat has been registered in the system e-Mamta received the NASSCOM Social Innovation Honour in 2012 and the 15th National e-Governance Award in 2012 for outstanding contributions in citizen-centric delivery
Accredited Social Health Activist (ASHA)	It is a community health worker instituted by the MoHFW as part of India's National Rural Health Mission	The number of ASHAs as on March 13, 2020, is 1,047,324
e-Aushadhi	The Ministry of Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) in Feb 2019, launched the e-Aushadhi portal for online licensing of Ayurveda, Siddha, Unani and homoeopathy drugs and related matters	As on 20th June, 2021; it has 9,038 approved manufacturers and 55 approved drug testing labs
eSanjeevani	The first of its kind of digital transformation in the delivery of health services at the national scale	eSanjeevani Ayushman Bharat – Health and Wellness Centres (AB-HWC) enables doctor-to-doctor tele-consultations and is being used at around 6,000 health and wellness centres, which are being served by specialists and doctors in around 240 hubs that have been set up by states in district hospitals or medical colleges

Other key initiatives in the healthcare sector

- In the Union Budget 2021-22, investment in health infrastructure expanded 2.37x or 137% year-on-year; the total healthcare sector allocation for fiscal 2022 stood at Rs 2,238.46 billion ($30.70 billion).

- The government announced Rs 641.8 billion ($8.80 billion) outlay for the healthcare sector over the six years to strengthen the existing 'National Health Mission' by developing capacities of primary, secondary and tertiary care, healthcare systems, and institutions for detection and cure of new and emerging diseases.

- The Government of India approved continuation of 'National Health Mission' with a budget of Rs 365.76 billion ($5.10 billion).

- The Ministry of AYUSH was allocated Rs 29.7 billion ($407.84 million), up from Rs 21.22 billion ($291.39 million) earlier.

The Indian healthcare sector has been witnessing a gradual influx of new-age technologies over the past decade. With the onset of the Covid-19 pandemic, the use of technology to facilitate remote healthcare services has accelerated the process of digitisation. Furthermore, healthcare organisations are also addressing the need for

adopting comprehensive and robust digital structures that can meet the futuristic needs of patients. This ensures a promising future for the sector as patients and doctors are accepting the benefits of digital health and medicine.

Digitisation and mobilisation of healthcare resources have transformed the way the industry functions. It has changed the way doctors and patients interact, empowering them to adopt a proactive healthcare management approach. To identify patients' needs and demands, healthcare facilitators are leveraging new-age technologies such as big data and analytics, and gaining actionable insights to deliver better outcomes.

Apart from this, the sector is allowed 100% foreign direct investment through the automatic route. Factors such as the Make in India initiative, government-industry collaboration on device rules and standardisation, and new funding from the government to improve R&D and testing infrastructure will contribute to the sector's growth. The sector has seen a tremendous involvement of the government in speeding up the adoption process of digital health. Schemes such as **Ayushman Bharat Yojana** and many other government policies have accelerated the use of digital tools and mobilisation of resources in healthcare.

The implementation of automation/digitalisation in the healthcare industry also offers the following benefits:

- Reduced human error

- Improved patient monitoring and management

- Enhanced provider-patient communication

- More comprehensive reporting

- Increased decision support for improved patient safety

- Enhanced clinical precision

- Quicker retrieval of data

- More thorough documentation

- Improved staff satisfaction

- Reduced labour cost

Practice management

The goal of healthcare practice management is to enhance practice efficiency, professional satisfaction and delivery of patient care. Organisations deploy practice management to manage registration, scheduling, patient tracking, patient accounting and reporting through a single workflow across all operations. This enables a single platform to collect payments on all patient accounts.

Practice management software is designed to help medical offices of any size run more efficiently. Typically, small and medium-sized practices use this software to manage daily operations such as financial and administrative functions. Some offices use it to connect with electronic medical records.

The most common capabilities of practice management software are as follows:

- Entering and tracking patients

- Recording patient demographics

- Scheduling patient appointments

- Managing charge capture

- Performing billing procedures

- Submitting insurance claims

- Processing payments from patients, insurance providers and third parties

- Generating reports for staff members

Benefits of practice management software

Patients	Doctor
- Electronic health record system integration - Automatic electronic reminders - Automatic medical billing - Customised security access	- Easier access to electronic health records - Faster processing of reimbursements - Saves time and reduces errors for office staff

Future prospects

Using AI in practice management would the help improve efficiencies in future. AI applications could offer opportunities to enhance clinic flow, simplify billing, expedite electronic health record (EHR) input, streamline claims, and enhance cash flow. And with today's high-deductible health plans (HDHPs) becoming more popular with employers-and therefore more common with patients-revenue cycle management is a natural fit for AI as more patients are defaulting on their portion of medical bills.

Future would include, clubbing the innovative cloud-based practice management solutions with the server-based practice management. Cloud-based practice management solutions support increased collaboration in healthcare, allowing multiple stakeholders to share information securely and seamlessly across the network. Cloud-based applications like Helix, built on the Microsoft Azure platform, are also becoming far more secure and sophisticated than on-premises legacy solutions.

Protecting the sensitive patient data and tackling cyber security breaches is of prime importance. For Practice Managers it will become imperative to do future-proofing of their practice management system, strengthening data protection will benefit everyone and help to reduce the risk of regulatory burdens, financial losses, damaged reputation, and loss of patient trust.

Clinical automation

The purpose of automation is to improve the quality of processes, remove human error and variation and ultimately make processes more cost-effective, efficient and rapid.

Automation has dramatically changed both analytic and non-analytic aspects of clinical laboratory operations. Automation of test procedures began more than 50 years ago, whereas non-analytic automation – including conveyor systems, interfaced analysers, and automated specimen processing and storage – began in earnest in the 1990s. Currently, a wide range of automation options are available to improve the quality, throughput and efficiency of laboratory testing. Clinical laboratory automation is crucial to obtain reliable test results and enhance patient safety.

Flow for clinical automation
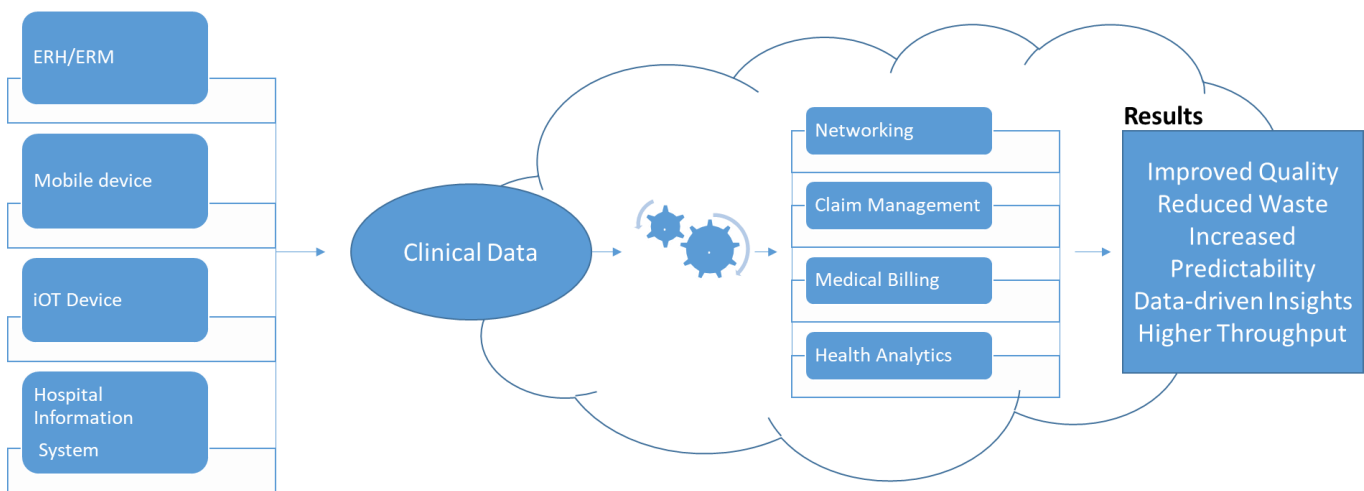
The concept of **total lab automation (TLA)** includes preanalytical, analytical and post analytical components which supports quality control, inventory management, control of autoanalyzers and turnaround time. In **hematology,** integration of autoanalyzers with auto slide makers, autostainers and even automated image analysis system are being introduced to characterize and pre-classify various types of blood cells in peripheral blood smears. Use of **point of care testing (POCT)** is also on the rise for labs especially in critical care setting to monitor blood gas levels, measure electrolytes, glucose, lactate, creatinine, haemoglobin, haematocrit, PT, APTT etc. Many reputed manufacturers are coming up with pocket size, user friendly, cost effective POCT devices which ensure prompt analysis of samples at the bedside of such critically ill patients.

There are some challenges in implementing total automation in clinical laboratories. These laboratories need to ensure continuous high-quality customer service to maintain their quality standards. They also need to strike a fine balance between the cost of automation and their quality goals, and simultaneously address patient safety and demands. However, automation could resolve the dilemma and may be implemented if it does not create new bottlenecks in laboratory workflow.

Future prospects

Machine vision technology is another interesting aspect which is replacing human inspection and automatically check the requirements thereby facilitating better and rational use of laboratory workforce in other skilful tasks. Attempt to interface analyzers and automate pre-analytic sample preparation in highly specialized domains like

mass spectrometry, PCR, next generation sequencing are on the way and going to be the next big thing in clinical automation. With government's focus to increase healthcare service penetration and improving efficiencies in the existing system, clinical automation with see potential for growth in future.

Telemedicine

Telemedicine refers to the provision of remote clinical services via real-time two-way communication between the patient and the healthcare provider using electronic audio and visual means. Consultations and medical prescriptions are also handled through the live digital platform that facilitates the virtual meeting.

Telemedicine in India started with the inauguration of Apollo Aragonda Hospital in Andhra Pradesh in 2000. Since then, the Indian Space Research Organisation (ISRO), the Department of Information Technology, the MoHFW, state governments, and medical institutes in the public and corporate sectors have introduced several telemedicine projects that have showed a promising future for telemedicine, efficiently solving the problems of effective healthcare delivery in a vast country like India.

Telemedicine practices have slowly and steadily gained foothold in India. The spike in need for remote medical facilities has eventually resulted in mushrooming of telemedicine companies.

Benefits of telemedicine software for providers

Improves Patient Engagement
- Communicate with sick persons via email
- Text reminders to sick persons show up for appointments
- Encourage sick persons to monitor their health via Patient Apps
- Use ePrescribe and online prescription renewal requests
- Provide daily medication reminders via text or email

Improves Healthcare Quality
- Collect Data and Analyze Sick Person Outcomes
- Set Goals and Commit to Ongoing Evaluation
- Improve Access to Care
- Focus on Sick Persons Engagement
- Reducing delays in care

Increases Practice Revenue
- Encourage online reviews & manage it easily in Feedback Mgmt.
- Make sure that your marketing metrics are measurable
- Sick person Engagement by Text, Email, Messaging & Video call
- Sick person Campaign mgmt. to generate additional revenue
- Prospect Management takes care of conversion of leads to sale

Reduces Patient No-shows
- Do Appointment Reminders the Right Way
- Allow sick persons to cancel/reschedule by email/text message
- Offer compliant sick persons access to priority scheduling
- Transform Your Scheduling Process
- Try DocEngage Telemedicine Software

Future Prospects

Increasing population and the decreasing number of healthcare workers have emphasised the need for telemedicine. In the wake of the ongoing pandemic, telemedicine proves to be a boon providing added benefits to healthcare providers and patients.

While telemedicine cannot replace traditional medical consultations and hospital visits for emergency conditions and medical procedures, it can certainly reduce the pressure on the healthcare system in a vast and populous country like India with disproportionate healthcare facilities. Hence, the government needs to drive awareness about telemedicine and

Practo had 175 million unique users in November 2020. In 2020, Practo tele-consultations jumped by 3x, and during lockdown, the peak demand was 10x.
On March 17, 2021, the Health Ministry's eSanjeevani telemedicine service crossed 3 million (30 lakh) tele-consultations since its launch.

ensure robust security around patient privacy and their health data. Telemedicine, which is only one component of the much diverse digital health plan, will have a crucial role to play in the success of the NDHM.

Telemedicine will continue to grow and be adopted by more healthcare practitioners and patients in a wide variety of forms, and will be a key enabler in fostering its growth. In March 20220, the Ministry of Health and Family Welfare, India, had released **the "Telemedicine Practice Guidelines"**. The purpose of these guidelines is to give practical advice to doctors so that all services and models of care used by doctors and health workers are encouraged to consider the use of telemedicine as part of their regular practice. These guidelines will assist medical practitioners in pursuing a sound course of action to provide effective and safe medical care founded on current information, available resources and patient needs to ensure patient and provider safety.

Telemedicine healthcare is expected to reach interiors of rural India and provide health access to remotely located areas. Telemedicine helps bring the facilities and medical professionals to remote locations with the help of healthcare centres. Telemedicine is expected to reduce unnecessary hospital visits and spending cost of patients by bringing healthcare facilities close to their homes at an affordable cost. To achieve this, investment and innovation are required across all segments of healthcare, such as medical equipment, IT infrastructure, telecom and diagnostic services.

However, telemedicine cannot be the answer to all problems and surely cannot replace in-person consultation or emergency medicine. However, it can immensely help cope with the current pandemic. Furthermore, its wider acceptance and implementation will help us prepare better for any future pandemics.

Key players in the market

Company	Details	Practice management	Clinical automation	Telemedicine
Practo	Offers an online software platform that provides automated appointment scheduling, billing solutions and storage of medical records	**Yes** **Insta by Practo Ray**		**Pipeline**
KareXpert	Provides services such as advanced Hospital Information Management System, Electronic Health Records, Radiology Information System/Picture Archiving and Communication System, pharmacy, telemedicine, medical IoT, advanced BI, connected ambulance, etc.		**Yes**	**Yes**
DocEngage	An industry-leading EHR co-created with feedback from over 1,000 medical professionals	**Yes**		**Yes**
Adroit Infosystems	Provides eHospital Systems –a customisable, comprehensive and integrated hospital management system designed to manage all hospital operations	**Yes**	**Yes**	**Yes**

Company	Details	Practice management	Clinical automation	Telemedicine
DreamSoft4u	One of the leading custom healthcare software development companies in India, offering healthcare IT services by combining cutting-edge technologies with its strategic expertise	**Yes**		**Yes**

Most of the companies are present in multiple spheres of the sub-segments and try to provide software solutions across the healthcare segment. Many of them are now venturing into telemedicine and e-consultation due to the ongoing pandemic, which provides huge opportunities. Telemedicine, artificial intelligence (AI), mobile and wearable devices, and robotic operations are the key segments with huge growth potential.

There are many players in the market, but penetration is low, providing opportunities to new investors. Though companies such as Practo have the first-mover advantage in India, there are at least 140 start-ups in the doctor discovery, appointment booking and practice management service segment, according to industry source, a start-up tracker. 1 mg, an online pharmacy and digital health care platform has over 160 million customer visits and over 27 million ordered delivered from its platform. It also facilitates patients to buy medicines and make bookings for lab tests or doctor consultations. Some of the established businesses in the practice management segment are Lybrate, Ziffi, Qikwell and HelpingDoc.

As per industry estimates, there are 5,000+ start-ups in India that focus on healthtech. Some of the prominent ones are PharmEasy, CureFit, Practo, MedLife and CallHealth. The main focus of most start-ups is to help provide access to healthcare resources.

Some start-up healthtech portals also allow digitisation of health records, which helps in improving the accuracy of diagnosis, building patient longitudinal history, reducing medical administration errors, and offering timely warnings, alerts to prevent severe medical crises. Understanding the need for IoT devices and their impact, tech giants such as Google, Apple, Samsung and others are also pushing a whole new gamut of digital health applications for monitoring heart rate, blood oxygenation, blood pressure, pulse rate, blood sugar level, etc. Several healthcare organisations and doctors are also embracing the use of AI in adding value to the quality of care delivered to their patients. The tools integrated with AI help transform the healthcare delivery model by automating the everyday processes in the sector and providing improved patient outcomes.

A few noteworthy examples of the successfully established telemedicine services in India include mammography at Sir Ganga Ram Hospital, Delhi; oncology at Regional Cancer Centre, Trivandrum; and surgical services at Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow. The private sector has also shown a keen interest in the field. Some of the major Indian private players in telemedicine include Narayana Hrudayalaya, Apollo Telemedicine Enterprises, Asia Heart Foundation, Escorts Heart Institute, Amrita Institute of Medical Sciences and Aravind Eye Care. They function with support from central and state governments, and from organisations such as ISRO, which guide them with respect to appropriate and updated technologies. Some of the established players in telemedicine include TiaTech, Teladoc, Vivadox and eHealthFlex.

The top established players for software in clinical automation include PerkinElmer, IBM and OSP Labs.

Adopting technologies that strengthen the healthcare delivery channels is now the prime focus of government, something that **healthtech start-ups** have pioneered flawlessly. Technology helps caregivers and medical

professions formulate a more targeted patient care plan, thereby improving the overall health and wellness ecosystem. The role of technology augments access, delivery and outreach of services crucial to human existence.

Protean undertakes e-healthcare projects throughout the components of value chain

Protean has been undertaking Greenfield projects whereby it provides services right from defining a business process to setting up solutions, hosting it, maintaining the solution and providing services to the clients. Protean developed a platform in partnership with the Indian Academy of Paediatrics (IAP). It also possesses products to enable Vaccination programme, which can be used for mass vaccination drives such as Polio, Covid etc. The company is launching a National project to enable digitization in various aspects of health starting outpatient clinic to high tech services to citizens. Given the expertise Protean holds in implementing large scale IT infrastructure projects, it possesses the potential in reaching out its services in the area of Practice Management System (PMS), Patient Health Record Management System, Electronic Health Management System to name a few.

Deals and M&A in healthcare

The healthcare industry is capital-intensive on account of high real estate and medical equipment costs. The private sector accounts for almost 70% of the healthcare spend in the country. After witnessing years of healthy growth in revenue and profit until FY17, the sector recorded diminishing returns in FY18 and FY19 due to pressure on margins after a slew of regulatory actions (including caps on prices of oncology drugs, cardiac stents and knee implants, and the advent of the Goods and Services Tax) led to higher indirect tax burden, and restrictions of Clinical Establishments imposed by the governments of the National Capital Territory of Delhi, West Bengal and Karnataka.

Consolidation is considered a better option for players as the gestation period for investments in hospitals is already high due to large upfront investments and the longer time needed to ramp up asset utilisation. Moreover, the recent regulatory actions have increased the gestation period further, thus increasing the funding requirement of the sector and necessitating consolidation.

Latest deals in healthcare	
June 7, 2021	Carbon Health expands into diabetes care with acquisition of Steady Health
April 19, 2021	Sirona Hygiene raises $3 million in Series A funding from NB Ventures and IAN Fund
April 1, 2021	NIIF Strategic Opportunities Fund to invest Rs 2,100 crore in Manipal Hospitals
February 15, 2021	Wipro Consumer Care Ventures invests in healthcare brand Onelife Nutriscience
January 21, 2021	Apollo TeleHealth partners with TeleHealthcare Malaysia to set up tele-clinics in Malaysia
January 18, 2021	Cure.fit acquires California-based fitness company Onyx
December 14, 2020	Blackstone's acquisition of a majority stake in Ancestry for $4.7 billion
November 2, 2020	Manipal Health Enterprise to acquire Columbia Asia Hospitals
August 5, 2020	Teladoc's acquisition of Livongo Health for $18.5 billion
October 14, 2019	VLCC Group partners with Minor International to foray into wellness and beauty
August 1, 2019	Microsoft partners with Apollo Hospitals as part of its healthcare initiative to combat CVD
June 24, 2019	IIFL India Private Equity Fund buys a controlling stake in eye care chain Infigo Lifesciences
June 20, 2019	HDFC to acquire Apollo Hospitals' stake in Apollo Munich Health Insurance
May 16, 2019	Mahindra Partners buys Matrix's stake in Centre for Sight
October 17, 2016	Tata Trusts and GE Healthcare enter into a collaboration pact to train healthcare staff
October 1, 2016	Apollo Hospitals and Italy's KOS form a JV for a medical rehabilitation hospital
September 16, 2016	Trivitron Healthcare enters into a collaboration agreement with Shimadzu Corporation of Japan for clinical diagnostics in the area of newborn screening
November 16, 2015	Practo and Uber enter into a global partnership to help people reach doctors easily
February 7, 2015	Shalby Hospitals enters into a JV with Dubai-based RAK Hospital UAE

Note: The above list is not exhaustive database and highlights few of major deals in healthcare
Source: Industry reports and news articles, CRISIL Research

M&A deals in hospitals jumped 155% in FY19 to Rs 7,615 crore, as against Rs 2,991 crore in the previous fiscal. The two largest transactions involving the acquisition of stakes were Fortis Healthcare at Rs 4,000 crore and Max Healthcare at Rs 2,351 crore. In both these cases, the deal had been signed at a premium to the then prevailing market price. The premium paid for the acquisitions reflects the healthy appetite of global investors for quality healthcare assets.

Latest PE deals in e-health			
Date	Company	Sector	Investor
Jun-21	PharmEasy	e-commerce (pharmacy and diagnostic)	B Capital group, Tiger Global
Jun-21	Truemeds	e-commerce (pharmacy)	Asha Impact, Info Edge, others
May-21	Breathe well-being	Online services (wellness-diabetes management)	3One4 Capital, others
May-21	Myelin Foundry	Enterprise software (AI)	Beyond Next Ventures, Endiya Partners
Apr-21	Medgenome	bioinformatics	IFC
Apr-21	PharmEasy	e-commerce (pharmacy and diagnostic)	Think Investments, Prosus Ventures, LGT Lightone Aspada, Tpg Capital, Eight Roads Ventures, Temasek
Mar-21	HealthPlix	Enterprise software (EMR)	JSW Ventures,Chiratae Ventures, Lightspeed Ventures, Kalaari Capital, Others
Feb-21	InnerHour	Consumer App-mental health	Lightbox
Feb-21	THB	Enterprise software (data analytics-healthcare)	HealthQuad
Jan-21	Mfine	Consumer App-healthcare-consultation	Beenext, Stellaris Venture Partners, SBI ven capital, Prime Venture Partners
Jan-21	Habbit Health	Wellness	3One4 Capital, others
Dec-20	Healthi	e-commerce (diagnostic tests)	Pureland Group
Dec-20	Loop Health	Online services(insurance)	Soma Apital, Sierra Ventures, others
Dec-20	PharmEasy	e-commerce (pharmacy and diagnostic)	TPG Capital
Nov-20	Smiles.ai	Clinics (dental	Chiratae Ventures, Sequoia Capital India, others
Oct-20	Wysa	Consumer App-Bots-mental health	Pi Ventures, CapitalG
Sep-20	BestDoc	Enterprise software (SaaS-CRM-hospitals & clinics)	SEA Fund, Arkam Ventures, Accel India
Sep-20	Dozee	Medical devices (monitoring & diagnostics)	3One4 Capital, Prime Ventures Partners, YourNest

Note: The above list is not exhaustive database and highlights few of major deals in e-health segment
Source: Industry reports and news articles, CRISIL Research

Also e-health is gaining traction after the covid-19 pandemic. Companies in the digital health space were actively expanding their scale and size as technological percolation was boosting virtual heath care. Many companies have attracted interest of the investors. As IPOs and new start-ups are coming-up, e-health companies and other healthcare companies are also gaining traction.

12.5 Importance of reliable and robust e-health ecosystem in India

Healthcare in India faces several challenges, including economic burdens associated with rising costs, inadequate access, low insurance penetration, and a growing chronic disease burden. At the same time, traditional business models find it difficult to show attractive returns on investment, except for a few large providers. Technology infusion, along with expanded infrastructure and efficiencies from process improvements, could help improve healthcare accessibility and affordability.

Despite its shortcomings, India's healthcare sector has a lot going for it on several fronts. A government-led push to get healthcare providers to embrace electronic medical records is enabling AI to extract insights from patient data to deliver better treatment. The availability of telecom bandwidth is making medical expertise reach underserved rural markets through telemedicine and tele-consulting programmes, delivered over mobile phones.

The government's **Make in India** initiative is encouraging domestic manufacture of medical devices and helping lower the prices patients pay for products such as stents and implants, which in the past were imported. At the same time, in India, the policy environment and regulators need to accommodate technological interventions such as the growth of online pharmacies with the requisite controls in place. Healthcare innovation in India could serve as a global model for a shift from treating the sick to preventive care and wellness, given the size of its underserved population.

Prior to Covid-19, the healthtech industry was primarily focussed on developing wearable gadgets, diagnostics and drug delivery solutions; facilitating early diagnosis of genetic conditions; treating lifestyle-related problems such as stress and anxiety through remote therapy; and alleviating post-procedure pain. After the pandemic recedes, new opportunities are likely to emerge in the healthtech space, including development of tools for facilitating emergency care, and improvements in medical infrastructure through technology-based optimisation. For instance, the scope of wearable devices could be expanded to track health conditions. Patient-facing mobile health applications could also be developed, along with enabling greater integration of AI, robotics and blockchain technologies – e.g., surgical robots, sensors, remote diagnostics, electronic records and monitoring systems.

Technology, data and digital health solutions are expected to address the concerns of the healthcare system, from a doctor consultation, pharmacy delivery, diagnostics and home healthcare to remote patient monitoring. The past couple of years have seen digital transformation and access to the mobile internet as game changers, especially in the healthtech space. Both are being widely used to cater to every possible patient-care need, from portals that notify vaccination slots and use of social media to help with medical resources such as oxygen concentrators and hospital beds, to virtual medical consultations, e-pharmacy services, and even tracking of oxygen and other health parameters sitting at home.

India's healthcare industry is becoming increasingly attractive for global and domestic investors, with technology-led innovations helping penetrate the second- and third-tier markets. The government's plans to increase budgetary allocation for public health spending to 2.5% of the country's GDP by 2025 will benefit the hospital sector as well.

Indian healthcare is experiencing a new wave of opportunity. Providers are reinventing existing delivery models to bring healthcare closer to the patient. The following emerging trends are changing the course of the industry:

- Change in the government's role from provider to payer has expanded the financial risk protection coverage to the marginalised.

- Private-sector partnerships (through health PPPs) are gradually gaining acceptance, thereby improving access to care.

- The significant demand-supply gap has led healthcare to emerge as an attractive sector for private equity investments.

The world is rapidly becoming more digital, and any business not realising and incorporating this trend will fall behind. India has the potential for digital growth, given its current technology penetration, advancing economy, growing population and accelerating healthcare industry. The rise of digital technology is pushing India to achieve Health for All, putting the country at the forefront for foreign investments. With these opportunities, India is expected to witness large investments and heighted focus in digital health.

13 Overview of mobility industry

13.1 Overview of mobility market in India

Technological advancements expected to disrupt mobility industry

Mobility services allow customers to choose their travel mode from a wide range of available options and service providers. As new inventions and discoveries were applied to transport problems, travel time decreased while the ability to move more and larger loads increased. Innovation continues as transport researchers are working to find new ways to reduce costs and increase transport efficiency. 19th and 20th saw expansion of the public transport system and with advancement in technology, 21st century has started converging the industry with technology and digitalization

India is the second populous nation globally and one of the fastest growing economies. Given the size and growth of the nation, the demand for mobility services has been following an upward trajectory. Smartphones and lower data charges have ensured a sharp increase in internet penetration. The number of internet subscribers per 100 people increased to 58.5 in December 2020 from only 20.3 in fiscal 2014. Increasing internet penetration has been disrupting the mobility services market since the past few years. Rapidly evolving technologies and business models for delivering mobility services, such as shared mobility, have potential to dramatically transform mobility services in the years ahead.

Evolution in mobility industry

Shared mobility services; Enhanced focus on Mobility-as-a-Service over vehicle ownership; Autonomus driving — **21st Century**

Expansion of road and air transports; Motorization with individual cars; Cars were considered the backbone of mobility — **20th Century**

Expansion of rail network along with local public transport; Horses substituted with bicycles; Sailing ships substituted with steam ships — **19th Century**

Waterways considered as most important and convenient mode of transportation; Horses and carriages — **18th Century**

Source: CRISIL Research

Trains and flights are the preferred modes of transport for long-distance travel in India. The other major preferred modes within cities, depending on travel distance and availability, are buses, metros, ride-hailing, car rentals, and car and bike-sharing. Since the early 1990s, India's growing economy has witnessed a rise in demand for transport

infrastructure and services. The consumption expenditure on transport services has grown at a CAGR of 12% from FY15 to FY19. The Covid-19 pandemic presented the world with an unprecedented economic challenge, significantly impacting the mobility market globally. However, the demand for mobility services is poised to increase with improvement in economic conditions.

Private final consumption expenditure on transport services (Rs billion)
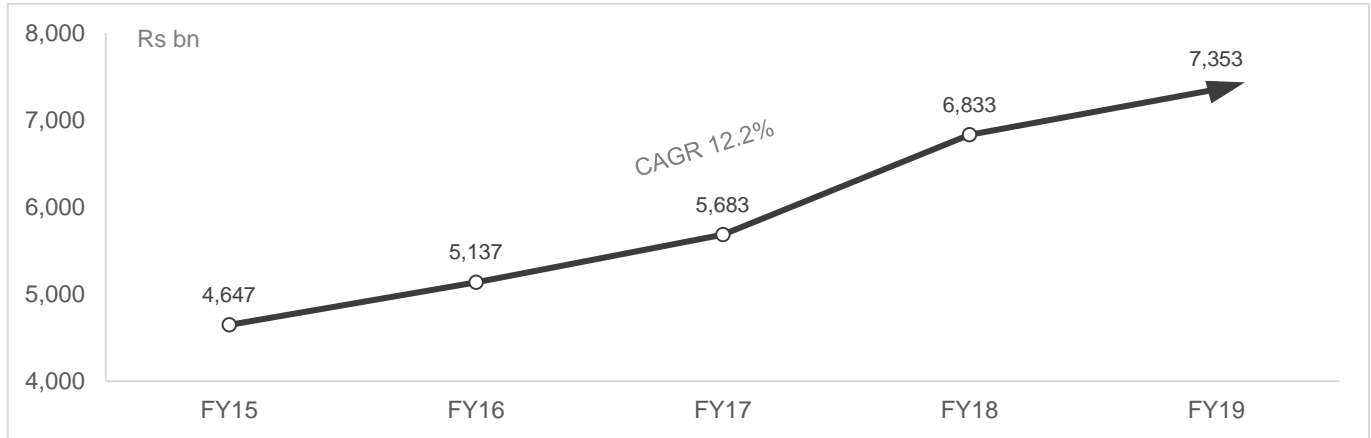
Source: MOSPI, CRISIL Research

Railways are an important mode of conveyance of people and goods. Indian Railways (IR) is the only long distance rail operator throughout the country. The Indian rail network traverses throughout the length and breadth of the country, making it is one of the largest and busiest rail networks in the world.

Ticketing revenue from various modes of transportation (in Rs billion)
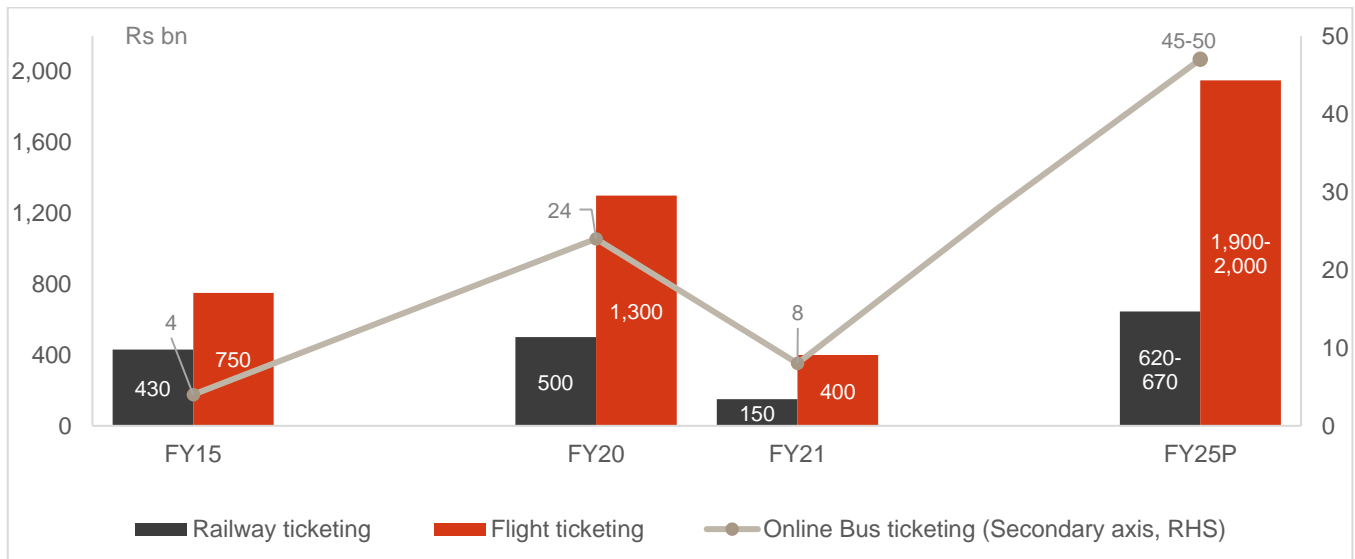
Source: CRISIL Research

The total ticketing revenue for the operator was expected to be a little over Rs 500 billion in fiscal 2020, growing at a CAGR ~6% in the last five years. Lockdown measures due to Covid-19 from the last week of March 2020 cut ticketing revenue in fiscal 2021 by ~70% of the previous fiscal. Due to the rise in Covid-19 cases in the second wave and the looming uncertainty regarding the pandemic, we expect rail transport to remain negatively impacted in the medium term.

Air transport is the fastest means of transport. The Airport Authority of India is responsible for providing safe and efficient air traffic and aeronautical communication services in the Indian airspace. Civil aviation in India is one of the fastest growing aviation markets globally. In fiscal 2020, the civil aviation ticketing revenue, domestic and international, stood at around Rs 1,300 billion. The revenue collection posted a strong CAGR of 11-12% in the last five years. Lockdown restrictions put the brakes on travelling, plummeting ticketing collection by ~70% in fiscal 2021. Given an increasing preference for air transport and growth in international travel, air ticketing collection is likely to soar. Also, the government is planning to develop 100 more airports in tier 2 and 3 towns and cities across the country under the Regional Connectivity Scheme (RCS) by providing financial support and infrastructure development, which will lead to more travellers opting for air transport. We expect airline ticketing revenue to post a strong CAGR of 45-50% for the next four years from fiscal 2021 levels.

Buses are another important means of public transport in India. Urban bus transport is often owned and operated by public agencies, and most state governments operate bus services through a state road transport corporation. These corporations have proven extremely useful in connecting villages and towns across the country. Alongside the public companies there are many private bus fleets. With the penetration of internet, online bus ticketing, especially for long-distance inter-city travel, grew at a CAGR of ~40% from fiscal 2015 till fiscal 2020. That said, the majority of bus ticketing transactions, especially for intra-city movement, still happens through offline channels or through cash. However, with an increase in mobile application-based services for mobility, online ticketing in city commuting is gaining traction. After a dip of ~67% online bus ticketing collection in fiscal 2021 from previous fiscal, we expect the online ticketing collection will show a sharp rebound and will grow at a CAGR of 50%-55% in next four fiscals.

Urban Rail, popularly referred to as Metro Rail, has seen substantial growth in India in the recent years. More cities are experiencing the need for metro rail to meet their day-today mobility requirements. Metro rail in urban areas not only facilitate easy and quick movement of people but also have a positive impact on the economic growth and quality of life. This result in increased income and various benefits to the society like reduced external cost due to reduction in traffic congestion, road and parking cost, transport cost and per-capita traffic accidents. There are currently 14 operational metro lines in India total till May 2020 with total operation metro rail length of ~700km. Half of the operation length (348 km) is spread in Delhi and NCR. Considering the rapid urbanization and the imminent need for enhancing mobility in cities, government is increasing its focus on construction of more metro lines. ~900 km length of metro rail was under construction across India as of May 2020.

Taxicab is another prevalent mode of transportation in the country. With development in technology, the taxi services business in India has seen dramatic disruptions in the recent past in India. In 2010, Ola Cabs, an online cab aggregator, started its operations and emerged as a pre-eminent mobile app for personal transportation. The business model of Ola was later followed by TaxiForSure and Uber India. In 2015, BlaBlaCar, a French online marketplace for carpooling, introduced its cab sharing model in India by acting as a facilitator between two parties travelling on the same route. This platform allows private vehicle owners and other travellers to inform each other about their travel plans. Around the same time, Zoomcar started working towards popularising self-drive car rentals. The taxi service market can be categorised as organised and unorganised market, with the unorganised segment accounts for over four-fifths of the market. Under the organised segment, Ola and Uber India hold a market share of more than 90%, providing ride-hailing and ride-sharing services.

Shared mobility, an emerging mobility solution, gaining traction in Indian market I

India is at an inflection point in the development of its mobility system. Increasing vehicle ownership, pollution concerns, and traffic congestions necessitate novel mobility solutions. A transition to shared mobility can be one of the solutions to help address these growing challenges. Shared mobility includes numerous forms of transportation.

Sharing includes both the simultaneous use of an asset and the independent use of shared assets, irrespective of asset (e.g. vehicle) ownership. In the simultaneous use, multiple consumers use the same asset at the same time along a common route. In the independent use of shared assets, users get personal but temporary access to an asset to meet their mobility needs.

New shared mobility solutions like peer-to-peer sharing (P2P), dynamic shuttles, and bike sharing are in the early stages of development in India. These along with increased use of traditional car sharing and ride sharing services are few of the shared mobility solutions expected to gain popularity in the near future.

Key players operating under respective mobility modes

Flights	Railway	Ride hailing	Buses	Car rentals	Car sharing	Bike sharing
IndiGo	Indian Railway	OLA	MSRTC	Zoomcar	BlaBlaCar	Quick Ride
FLY SMART go		UBER	KSRTC	OLA	SRIDE	SRIDE
AIR INDIA		MERU	UPSRTC	AVIS	OLA	ePoolers
SpiceJet		SAVAARI	S.R.S. travels	MYLES	UBER	rPool
vistara		carzonrent	Parveen Travels	UBER		
AirAsia			PURPLE	METRO CAR		
trujet						
ALLIANCE AIR						

Source: CRISIL Research

13.2 Need for open mobility network and role of open protocols

Open mobility network can help make urban mobility system more efficient

India is rapidly becoming more urban and will witness a staggering increase in urban mobility demand soon. The increasing urban population continues to add stress on the infrastructure, environment, and economy of cities. Public mass-transit systems today find themselves competing not just with personal vehicles, but also with new forms of shared mobility. Private shared mobility is continuously evolving in form and scale. But despite the increase in available choices, personal vehicles remain the primary mode of transport for many.

The networks of public and private shared mobility operators do not seem to offer a compelling alternative for city travellers. While public transport, especially the rail systems and buses on dedicated lanes, seems to cover the distance faster, its accessibility and availability is a challenge in many cities. Private shared mobility networks, on

the other hand, do not always cater to all customer segments. Mobility systems and other travel options in cities thus remain isolated, offering no effective solutions for a seamless door-to-door journey.

Big shifts happening in electrification, autonomous and connected vehicle technologies could expand the gap between shared mobility operators further, especially between on-demand mobility service providers and mass transit systems.

The concern that needs to be addressed is whether or not these technological advancements in the mobility industry will help reduce traffic congestion by any significant measure.

The way mobility services are designed, no one agency or one form of mobility can solve the mobility problems of the city. The scale and complexity of urban mobility call for a wider ecosystem approach. Cities increasingly need a convergent mobility system that offers integrated mobility services with diverse forms, giving more choices for urban travellers.

Mobility service providers have designed their businesses and technology systems to be self-contained and independent. Every provider strives to be individually customer-centric, using their independent monolithic systems. They have built their own access channels, payment options, and trip-fulfilment capabilities, which are not naturally designed to work with other mobility service providers. Lack of such interoperability hinders a seamless intermodal travel experience.

Further, an ideal solution would require authorities to provide an environment of trust and inclusiveness, fair and transparent policies that enable collaboration, and promote voluntary participation on the integrated mobility agenda. All this while allowing operators to remain competitive as independent networks in offering better value to customers.

Integrating all mobility services onto a platform to make the services interoperable might offer more rides to service providers, thereby incentivising them to join the platform. However, platforms need to be controlled, warranting governance mechanisms. That said, centralised platforms could curtail the autonomy of service providers, and that may not inspire confidence among participants.

The key is to create a public digital infrastructure that is fundamentally non-exclusive by design and promoted healthy competition. The commercial platforms built over the internet are not open or at least not as open as those built on the web itself. The key difference that separates platform thinking from the public digital infrastructure one is the intent behind its design. The web and GPS are examples of how open specifications can supercharge innovation for societal good. A similar open network for mobility service providers would encourage participants to voluntarily join the network for their own benefit and for the collective benefit of all.

Creating an open network economy

Beckn is an open protocol that enables location-aware local commerce across industries. With initial support from Beckn Foundation, an active open source community has published an open protocol specification that can help fostering better integration and improved usability by connecting various applications together in a collaborative and coherent digital ecosystem. Once implemented widely, it will allow businesses to be discoverable by consumers through commonly used applications. The Beckn act as a transaction protocol that allows discovery, ordering, fulfilment and payment between buyers and sellers (consumers and providers) in the digital marketplace. It is a common way that allows basic interoperability of the transactions on a digital medium. Beckn protocol allows one user to communicate to other user anywhere on the internet by exchanging open, standardised, machine-readable information.

Currently, most marketplaces are platform-centric. Beckn is an open digital infrastructure that allows creation of an unbundled and decentralised digital market that is free to use, and more inclusive in nature. It specifically caters to location-aware local commerce businesses that are small and severally available within a region like a city. Examples of such business include mobility, e-commerce, and last mile delivery.

With Beckn, any consumer can have access to any service provider from any consumer app or buyer platform. Similarly, any service provider can use any provider app to put up their inventory for sale and start receiving orders, make themselves discoverable without the need for any intermediary.

Beckn ecosystem in the mobility market
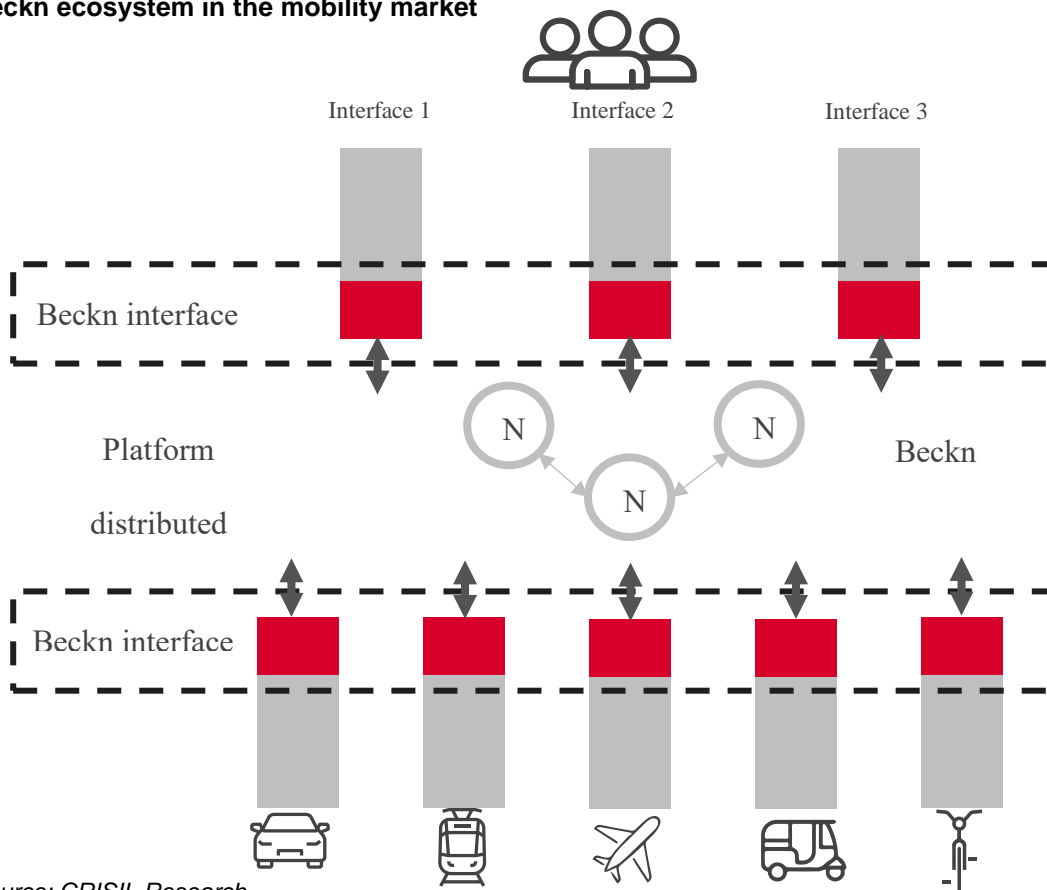
Source: CRISIL Research

13.3 Mobility-as-a-service and open protocols

The concept of mobility-as-a-service (MaaS) is a shift away from private car ownership and combines access to different mobility providers by presenting them on a single platform with simple access to all of them. It combines public transportation, taxi, car, and ride sharing as well as bike sharing to provide a seamless journey. The user enters a start location and destination into the app, which then presents different travel options. The user then chooses the preferred travel mode and books the services online. All the combined services can then be used on the go, without further reservation or needing to be a member of different mobility service providers.

Furthermore, payment system to mobility services can also be integrated on the MaaS ecosystem, providing various payment modes to facilitate smooth and fast transactions, unlike the conventional transportation system. The user pays either for each of the services separately or with a fixed monthly plan.

MaaS simplifies travel by making the various mobility offers more clear and easy to access, thus increasing the convenience of travelling with public transport, buses, trains, or shared cars, instead of using and owning a private car. Also, MaaS apps assess the mobility behaviour of users and present the most suitable transport solution. By analysing the data of current users and their mobility choices, previously underserved areas can be recognised and integrated into the transport system, and frequently used routes can be avoided or improved. After understanding travel patterns and dynamics, MaaS can offer improved and customised services.

Such a MaaS app when integrated with Beckn network would offer seamless booking for the entire journey across many modes along with a smooth payment experience. This offers an opportunity to make mobility services more accessible.

Services offered through MaaS

Source: CRISIL Research

225
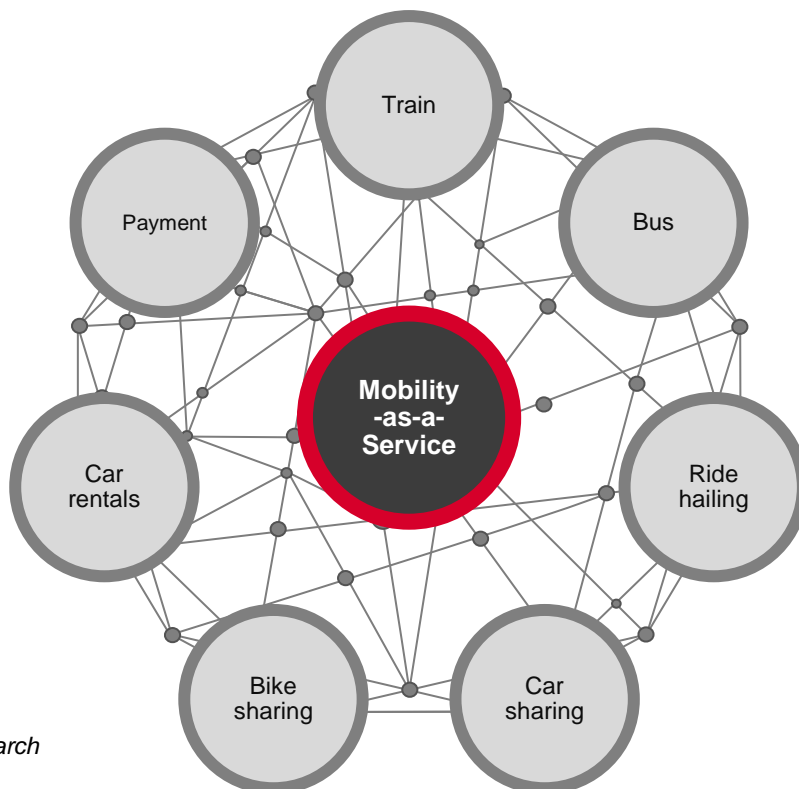
MaaS ecosystem comprises numerous participants working in sync

Entities that provide services and technologies for the efficient working of the MaaS ecosystem are platform providers. Data analytics and data storage service providers analyse data, which helps the companies to identify and track the consumer behaviour and needs. Transaction gateways are designed with integrated security levels and encrypted data communication that provide seamless travel experience by enabling payment and ticket-booking solutions. Application programming interface (API) allows applications to access data and interact with external software components, and operating systems. Open network Beckn protocol APIs would make the mobility services more inclusive, interoperable, and approachable.

MaaS supply chain

Platform Providers	Transport	MaaS service	Customers
-Information technology -Transactions -API -Data analytics	-OEMs -Public transport -Taxi aggregators -Mobility providers	-On-demand transportation -Multi-modal -Payment service -Logistics service	-End users -Businesses -Industrial requirements -Government
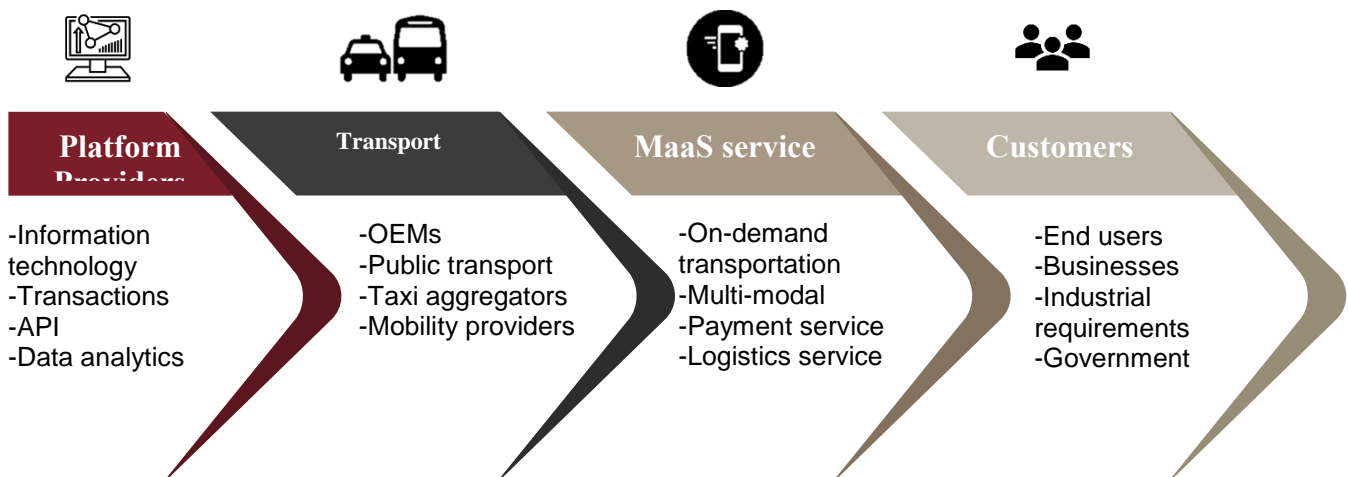
Source: CRISIL Research

Transport service providers are the companies that provide different types of vehicles to MaaS providers. These comprise private service providers, public transportation system, individual drivers, and automotive OEMs, among others. MaaS service providers are the companies that deal with the customers since they provide the customers with multimodal transportation solutions. MaaS customers, both individuals and companies, vary according to the business models adopted by the service providers. Moreover, MaaS provides multimodal solutions for freight transport.

Protean functions as infrastructure provider in open network mobility solutions

With initial support from Beckn Foundation, an active open source community has designed open protocol that enables implementation of open network mobility solutions. Protean eGov Technologies Ltd. plays a role of interpreting and implementing Beckn protocol to ensure large scale execution of open network mobility solution. The services offered by Protean range throughout the open network mobility solution value chain making it a holistic infrastructure provider in the space. In July 2021, Kerela Government launched Kochi Open Mobility Network (KOMN) which could be considered the first of its kind globally.

13.4 Benefits to payment aggregators in open network mobility ecosystem

A payment aggregator is a service provider that aggregates and provides various payment acceptance services to merchants. A payment aggregator facilitates any transaction, including recording of cash and cheque as well as digital payment modes across all online or offline touch points. It enables merchants to accept all payment modes, without having to set up separate accounts with banks or with each payment service providers or card companies.

Essentially, a payment aggregator takes the heavy load of integrating with all payment providers to provide a single solution for all payment modes. A payment aggregator offers multiple payment options, and the following are some of the most common payment modes provided by account aggregators:

Payment modes through account aggregators

```
                              Payment
                               modes
   ┌──────┬──────────┬──────┬─────┴──────┬──────────┬──────────┬──────────┐
 Cash   Credit/Debit  UPI  Net-banking  E-wallets  QR codes   Bank    Aadhaar pay
          cards                                              transfer
```
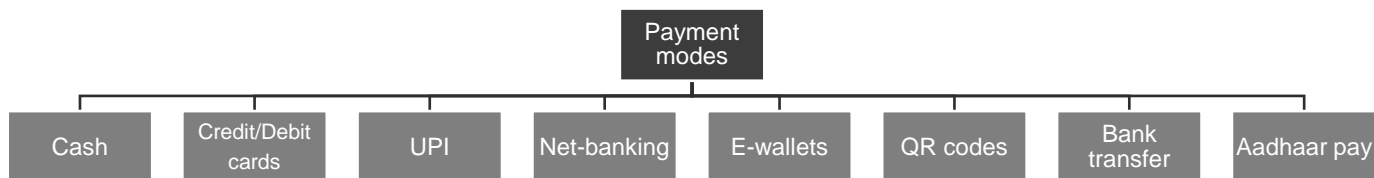
Source: CRISIL Research

Currently, mobility services are not integrated, and most ticketing transactions are completed using cash or through a designated payment gateway. For instance, over four-fifths of the taxi service market in India is unorganised, a quarter of IR ticketing happens through offline channels, and a large portion of intra-city bus ticketing is through cash transactions.

With integrated e-mobility solutions, payment aggregators will have the opportunity to expand their reach into the mobility market to increase the number of transactions on their platform. Intermodal mobility is central to the design of MaaS. Following integration with the network, payment aggregators can attract new customers by enabling users to make one transaction to set off a sequence of multiple transactions across different services—across several modes of transport with added ancillary services. This sequence could be managed via one defined interaction. Developing this capacity and integrating it to a MaaS app or to Beckn network, while surmounting regulatory and anti-fraud barriers, could give a head start to payment aggregators.

Razorpay, PayPal, SBI, Paytm, HDFC, CCAvenue, Billdesk, Cashfree, Atom, Citrus Pay, Instamojo, JusPay, and PayU are few of the prominent payment gateways operating in India. JusPay partnered with Beckn foundation and Protean eGov Technologies Ltd. for the recent launch of Kochi Open Mobility Network (KOMN).

14 Overview of large-scale IT infrastructure solutions for nations

Governments and the public sector (composed of both public services and public enterprises), worldwide, work in tandem to deliver effective and efficient services to their citizens and businesses, keep their systems and data secure and comply with regulations. Government offers many services to its citizens like– issuance of national identity documents, records updates, passport, governments scheme benefits, etc. Technology plays a vital role in achieving these goals. However, the government agencies need powerful, flexible, and cost-effective IT solutions to maintain a delicate balance between budget constraints and growing demands for IT services.

E-Governance also provides a mechanism of direct delivery of public services to the marginal segments of the society in the remotest corners, without having to deal with intermediaries. Increased accessibility to information will empower the citizens and enhance their participation by giving them the opportunity to share information and contribution implementation of initiatives. E-Governance is implemented by government in almost every field. From urban states to rural areas and from politics to teaching-Governance has spread its root everywhere. Either its public or private sector, common man or businessman all is largely dependent on e-governance. E- Governance projects across sectors:

Transportation: Services provided by e-governance in this area are issuance of time table of buses, provision of booking facility for interstate transport, transportation improvement program, regional transport plans, congestion management process, and transportation demand management.

Online payment of bills and taxes: Services provided by e-governance in this area's: online transaction, payment of bill, payment of taxes, payment of house EMIs.

Municipal services: Services provided are as house tax assessment, billing and collection, maintain records of land & property, issue of death certificates, registration & attorneys of properties, review and approval authority for site plans

Agriculture: local information such as prices of seeds, fertilizers, loan rates etc. government can provide e-governance service in this area also.

Land record management: By facilitating e-governance service in this area, millions of land records can be maintain in a very short time span.

Health service provided by these projects are availability of medicines, special health camps, e-health records, online vaccine registration.

Education: providing basic education (elementary, primary, secondary) to children, providing computer education to children, e-books, scholarship programs, etc.

The role of government has role to play in other sectors also like employment, production, public transport, water management, corruption prevention, regulatory oversight, public safety and security, climate change adaptation and resource management.

Data analysis holds virtually boundless potential. Therefore, big data, social media, analytics and a wide range of digital technologies can be leveraged to develop cost-effective and efficient policy solutions in all development sectors. Governments are steadily integrating unconventional data sources such as big data, real-time data and geospatial data into their operations.

According to the 2020 United Nations (UN) E-Government Survey more than 92% of the countries assessed (177 countries) use some types of social networking tools in their portals

Some of the major social networking platforms used by governments across the globe

Countries using AI-enabled chat applications (chatbots) in their national portals
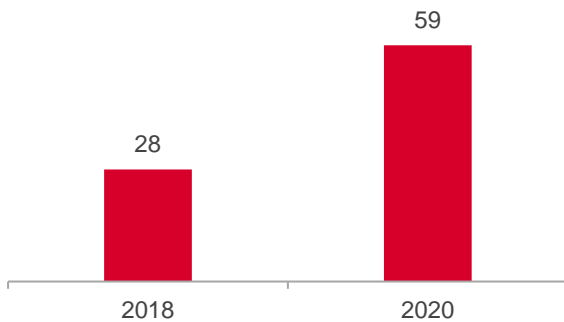
Source: 2020 United Nations (UN) E-Government Survey

Number of countries using AI-enabled chat applications (chatbots) in their national portals more than doubled to 59 in 2020 from 28 in 2018.

About 53% of the UN member states (122 countries) also provide geospatial open data through their national/data portals. Geospatial data refers to all the data regarding natural or man-made, imaginary or physical features, whether they are above or below the ground. It also includes location information, and information relating to boundaries, points of interest, mobility data, etc. This is the data that helps governments in mapping, whether it be of different physical features, or places to visit, or even live location tracking.

Infrastructure necessary for developing e-governance

E-governance is a holistic initiative having four key pillars: people, process, technology, and resources.
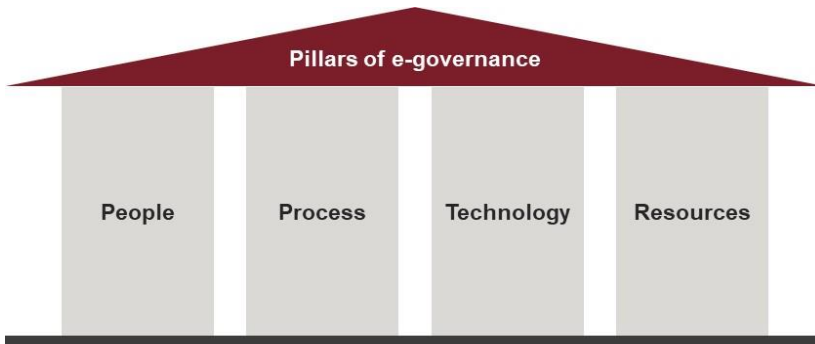
Basic e-governance structure:

- **Leadership/Vision**: A clear vision and commitment at the leadership level of the government is needed
- **Governance/Administration**: A clearly defined e-governance policy along with its implementation plan should be in place
- **Integration/Collaboration**: An efficient and effective collaboration among key players (government entities, private sector, academic institutions, businesses, Non-governmental Organisations (NGOs) etc.) is required
- **Technology/Infrastructure**: Appropriate infrastructure and technological developments should be made available and accessible to all citizens

According to the UN Public Administration Network, an appropriate infrastructure is required for e-government; for example, an information-related infrastructure is essential to implement the e-government's info-structure. Following are the four info-structure requirements for developing e-government in any country:

- e-Records
- Authentication and digital signature
- e-Payment
- Government portals

Benefits of an information and communication technology (ICT)-enabled government

ICT-enabled government leads to

Externally
- Greater efficacy
- Innovation in service delivery
- Faster service delivery
- Greater participation
- Citizen participation
- Citizen empowerment
- Increased flexibility of service

Internally
- Reduced transaction cost
- Avoidance of duplication
- Simplified bureaucratic process
- Greater efficiency
- More transparency
- Security of information management
- Information sharing
- Greater communication and coordination

Benefits/Outcomes of e-governance

- Faster access to services

- Enhanced transparency and accountability

- Expanded reach of governance

- Improved public administration and efficiency

- Helps in promoting economic development

- Improved service delivery in the form of better access to information and quality services to citizens

Data as a key resource for governments: varied approaches

Approach	Description
ICT-driven	Where governments are influenced by the use of new and existing ICT
Data-informed	Where governments are guided by a set of data that plays an inferential role in policymaking. In this context, we understand that data should inform rather than drive the decision-making process, as there are rational, political and moral elements of decision-making in addition to data
Data-driven	Where governments use analytics and algorithms in the decision-making process (elaborated in a recent Organisation for Economic Co-operation and Development (OECD) working paper on a data-driven public sector)
Evidence-based	Where policy approaches reflect the practical application of the findings from the best and the latest research available (e.g., the Foundations of Evidence-Based Policymaking Act in the United States (US))
Data-centric	Where governments place data and data science at the core of public administration. Here, data is treated as a primary asset and pivotal to government functions and is leveraged for providing, evaluating, and modifying people-centric services

Open government data (OGD) and access with national portals saw rise from 2018 to 2020

OGD, which is available to all, promotes transparency, accountability and value creation. Among numerous benefits, the data made available by governments can stimulate innovation through analytics and applications. This may lead to a customised provision of services for particular groups, including vulnerable populations. Providing open data through an online portal can eliminate redundancies and red tape and improve efficiencies associated with public requests for information.

OGD: development trends

Number of countries having instituted open government data portals
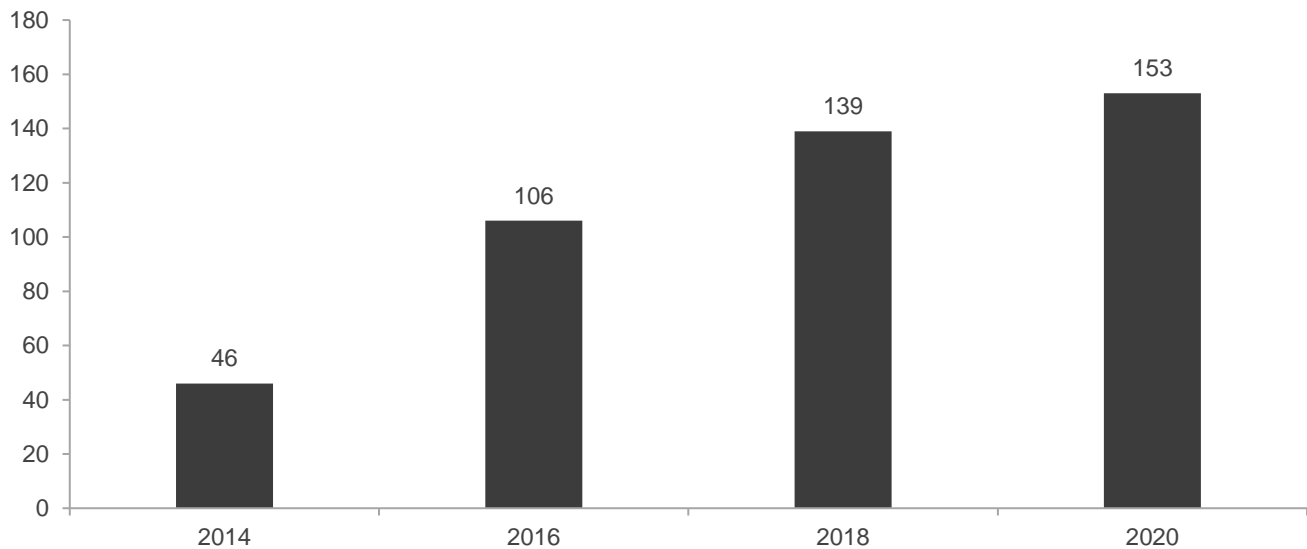
Source: 2020 United Nations (UN) E-Government Survey

Percentage of countries with associated features of open government data (OGD) portals
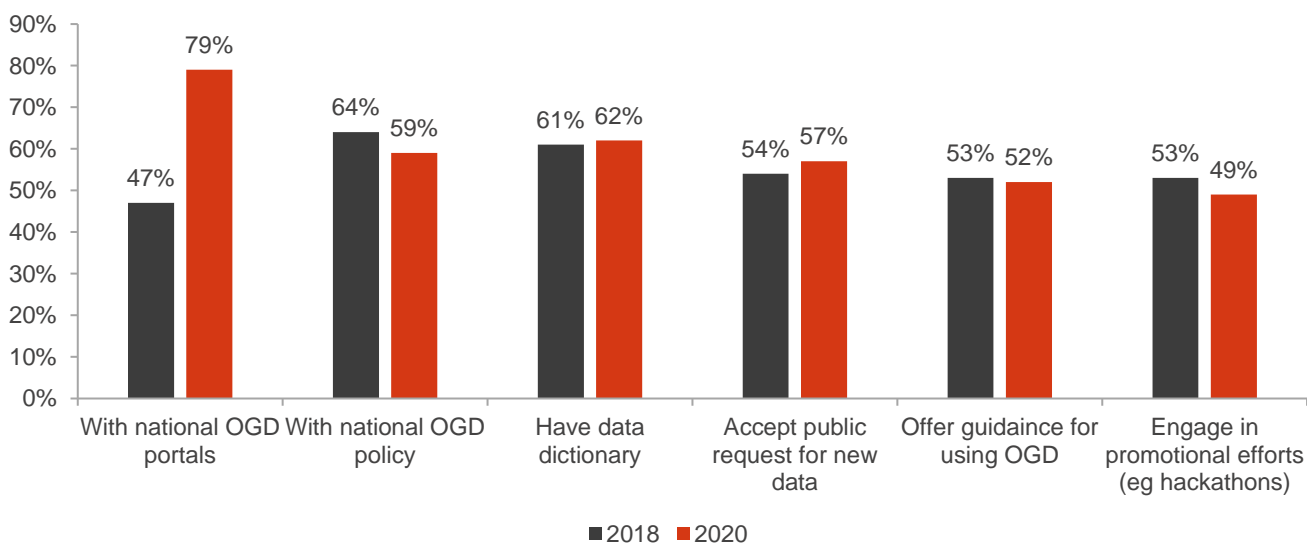
Source: 2020 United Nations (UN) E-Government Survey

The number of UN member countries having OGD portals increased to 153 in 2020 (80%) from 46 in 2014 (24%), according to the 2020 Survey. It is interesting to note that out of the total 193 nations surveyed, only 114 countries

have an OGD policy in place. Besides, there have been enhancements in associated features too; among the UN member states surveyed, 59% have an OGD policy, 62% have data dictionary, 57% accept public requests for new data sets, 52% offer guidance on using OGD, and 49% engage in promotional activities (such as data hackathons).

Challenges to e-governance

- **Infrastructure**
  - Lack of basic infrastructural facilities such as electricity, internet, etc.
    - Initiatives such as **BharatNet** and **Saubhagya** are steps taken in this regard by the Indian Government
  - Low literacy level, lack of content with regional relevance, and lack of appropriate access devices

- **Cost**
  - E-governance measures are expensive and require huge public expenditure
  - The cost of project is one of the major impediments in implementing e-governance initiative in a developing country like India and Africa

- **Privacy and security**
  - Recent spark in data breach cases has threatened people's faith in e-Governance. Therefore, implementing e-Governance projects must have robust security standards and protocols to safeguard the interests of all people

- **Digital divide**
  - Huge gap between users and non-users of e-government services
  - The digital divide takes the form of rich-poor, male-female, and urban-rural among various other segments of the population
    - The gap needs to be bridged to get the benefits of e-Governance fully

14.1 Overview of the development and opportunities of e-governance

Global IT spending worldwide reached $4.0-4.5 trillion in 2020

According to industry interactions, global IT spending is expected to reach $4.0-4.5 trillion in 2021 led by continued public safety measures and vaccination programmes. Government spending forms a share of 10-12% in the overall IT spending resulting in total spending of $ 0.4-0.5 trillion in 2020

The government IT segments are expected to exceed the overall market growth in 2021 on account of lessons learned from the pandemic responses and inherent weakness of the system. Government IT spending will have to address recovery and growth needs of corporates and society. Digital equity and access to remote government services will be one of the key focus areas pushing IT spending.

E-governance projects across World

Below is the list of e-governance project undertaken in different countries and the approx. cost incurred for them.

- In 2003, the Russian Federation launched a federal budget of 1.43 billion rubles (~US$ 46 million) for financing the e-Russia programme (Mimicopoulos, 2004).

- In Asia, Singapore has been leading in e-Government initiatives with its e-Government Action Plan I and II (eGAP I & II) to bring as many services online as possible. In 2003, Singapore approved a US$ 1.3 billion plan to upgrade its government services resulting in about 1600 public services being provided online.

- Similarly, the e-Taiwan project launched in China earmarked NT$ 36.2 billion (US$ 1.0 billion) for its e-Government initiative to build a fully computerised society.

- In India, computerisation of irrigation department, the total cost estimated for the project was Rs 1,470 million (USD 30 million), including the capital expenditure of Rs 1,090 million (US$ 22 million) and operational costs for two years estimated at Rs 380 million (US$ 8 million). While that for computerisation of public works department, the total project cost included the cost of the pilot phase of Rs 86 million (US$ 1.8 million) and scale up costs were estimated at Rs 779 million (US$ 17.3 million).

- Indian government has developed its e-governance infrastructure reaching down to the remotest of villages and large-scale digitization of records is taking place to enable easy, reliable access over the internet. Some of the major initiatives under e-governance infrastructure are as below:

e-Governance infrastructure in India

E-governance infrastructure	Main purpose
Aadhaar-Digital Biometric Identity Infrastructure	Aadhaar System is built on a sound strategy and a strong technology backbone and has evolved into a vital digital identity infrastructure. Aadhaar, being a unique digital ID – provides a powerful platform for authenticating a resident anytime and anywhere which is in line with the vision of the UIDAI.
Digital Locker	DigiLocker is a key initiative under Digital India, GOI's flagship program aimed at transforming India into a digitally empowered society and knowledge economy. It provides citizens a shareable private space on a public cloud and making all documents / certificates available on this cloud.
e-taal	Ministry of Electronics and Information Technology (MeitY) along with National Informatics Centre (NIC), have developed Electronic Transaction Aggregation & Analysis Layer (eTaal). It provides an aggregated view of eTransactions performed through e-Governance applications implemented including, but not limited to, the national-level mission mode projects (MMPs) under the National e-Governance Plan (NeGP). eTaal automatically pulls the e-transaction count, but not the personal details, from the applications using web service technology. The dashboard also facilitates quick analysis of data of various applications in tabular as well as graphical form enabling users to drill down to the lowest level of detail without compromising security and integrity of the servers from where data has been captured.
Open Data	MeitY through NIC has set up the Open Government Data (OGD) platform India to provide open access by proactive release of the data available with various ministries/ departments/ organizations of Government of India.
Government Procurement - Government e-Marketplace (GeM)	Government created one stop government e-marketplace (GeM) to facilitate on line procurement of common use goods & services required by various government departments / organizations / PSUs. GeM will enhance transparency, efficiency and speed in public procurement.

Source: MEITY, CRISIL Research

In future, it is expected that India and China will help drive the growth in IT spending in the Asia Pacific region.

IT spends on digital services rising

Global IT spends are expected to record 3-5% CAGR over fiscals 2020-2024, primarily driven by increased adoption of cloud and digital services. COVID-19 has been the greatest challenge the world has seen in decades

but it has also led to acceleration of digital adoption across industries. With an increasing focus on remote enablement, companies are also reporting an increase in the digital dexterity of their employees and are actively reviewing processes to identify opportunities for automation and digitization. Enterprises and CIOs are rebalancing their technology spend to prioritize digitization especially in the area of enterprise software which is expected to take the biggest leap on the back of remote working and other virtual services. Enterprises and CIOs are rebalancing their technology spend to prioritize digitization especially in the area of enterprise software which is expected to take the biggest leap on the back of remote working and other virtual services. According to NASSCOM, digital services are forecasted to account for ~80% of all incremental IT spending, providing opportunities to Indian players in this space.

Revenue break-up of Indian tech service industry*
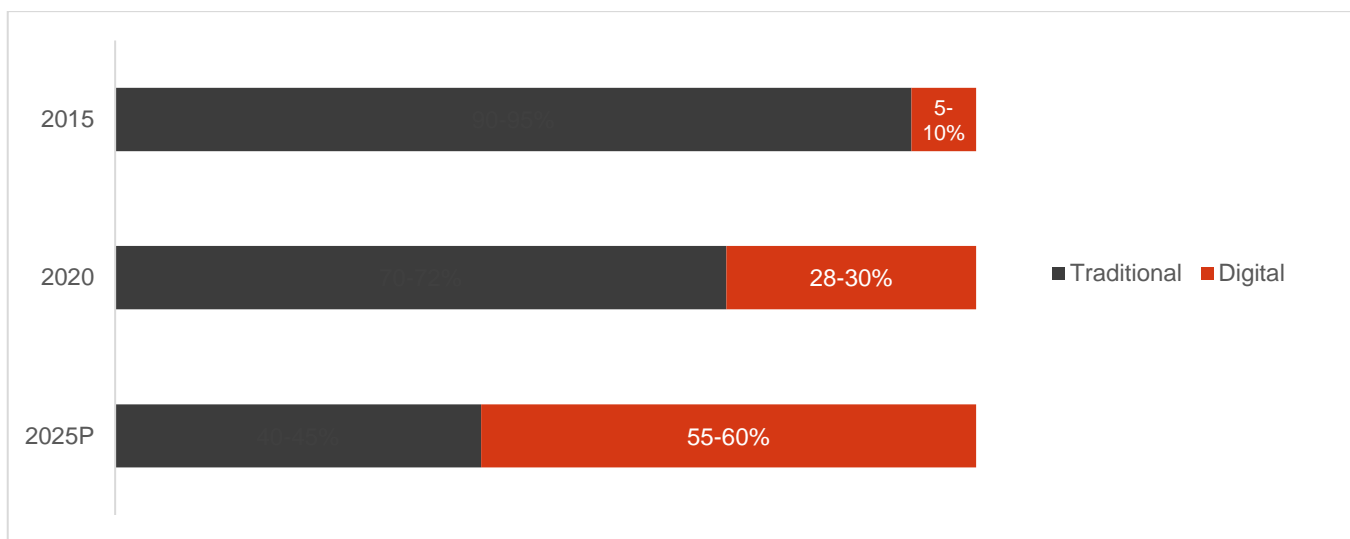
* Does not include e-commerce revenue
Source: NASSCOM

Indian IT and ITeS industry

The Indian IT and ITeS industry is divided into four major segments – IT services, Business Process Management (BPM), software products and engineering services, and hardware. Indian IT & ITeS companies have set up over 1,000 global delivery centres in over 200 cities around the world. The IT industry has also created significant demand in the Indian education sector, especially for engineering and computer science.

More importantly, the industry has led the economic transformation of the country and altered the perception of India in the global economy. India's cost competitiveness in providing IT services, which is approximately 3-4 times cheaper than the US, continues to be the mainstay of its Unique Selling Proposition (USP) in the global sourcing market. However, India is also gaining prominence in terms of intellectual capital with several global IT firms setting up their innovation centres in India.

Strong demand environment and deal wins to aid double digit growth in fiscal 2022

The revenues of Indian IT services' players grew 2% in dollar terms in fiscal 2021. In fiscal 2022, the **Indian IT services is set to grow 9-11% year-on-year in dollar terms to reach ~$108 billion on account of:**

- Economies around the world are expected to show positive growth in 2021 with world GDP expected to grow 5.5% as per S&P Global. Bright outlook for key export economies such as US, UK, and EU (account

for over 60% of revenues) is also expected to aid rebound in 2021 leading to a growth in the Indian IT services' exports of 10-12% year-on-year in dollar terms.

- Clients, especially in manufacturing, retail and logistics (constitute more than 10% of total revenue) that took serious hit last fiscal, are expected to improve their spends in the current fiscal and revive deferred projects. Increased focus on automation to reduce repetitive tasks and improve supply chain along low base of fiscal 2021 should also aid recovery in the sectors

- Digital momentum to continue with a strong demand in areas such as cloud led front to back digitization, customer experience, data analytics, work place transformation, omni-channel & supply chain automation, remote plant operation and 5G network based modernization

In fiscal 2023, CRISIL Research estimates the Indian IT services to grow 6-8% year-on-year in dollar terms to reach ~$116 billion. The growth will be driven by continuing core digital transformation along with need for enterprises shifting to digital to differentiate themselves using technology.

Over the medium term, revenues of Indian IT services are projected to grow at 6-8% compound annual growth rate (CAGR) from fiscals 2021-26 vis-a-vis ~6% in the previous five years. Traditional non-digital services are likely to moderate driven by volume as billing rates remain pressured, healthy digital growth will help stabilise realisation.

Domestic market to recover in fiscal 2022; Digital India initiative to support the growth

The Domestic market faced with a tough fiscal last year. This fiscal, CRISIL research expects the market to rebound despite battling with the on-going second wave of pandemic. The domestic IT services market is expected to register 8-10% growth year-on-year in rupee terms to reach ~Rs. 1,250-1,300 billion on account of the following reasons:

- Funds allocated to Digital India for FY21-22 BE rose over 50% year-on-year. Major focus continues to be on promotion of IT hardware, software and digital payments (together account over 60% share). With this and the largest Digital Census in 2021, we expect the government to continue being the growth driver. BFSI, retail and manufacturing are expected to recover while healthcare is expected to gain share.

- With increased in consumption of internet penetration and cost benefits, India destined to be the next Global Data Center hub and thus spends on services such as cloud are expected to increase across all segments

- Digital transformation journey will continue to maintain its momentum as enterprises digitize from back to front to achieve efficiencies

In fiscal 2023, CRISIL Research estimates the Domestic IT services to grow 5-7% year-on-year in rupee terms to reach Rs. 1350-1400 billion. Core digital transformation along with need for enterprises shifting to digital to differentiate themselves using technology will be the leading growth drivers.

Over the medium term, the domestic IT services industry is expected to clock 6.5-7.5% CAGR in rupee terms over the next five years to ~Rs 1,650-1,700 billion in fiscal 2026 lead by rise in digital share.

Domestic IT services market
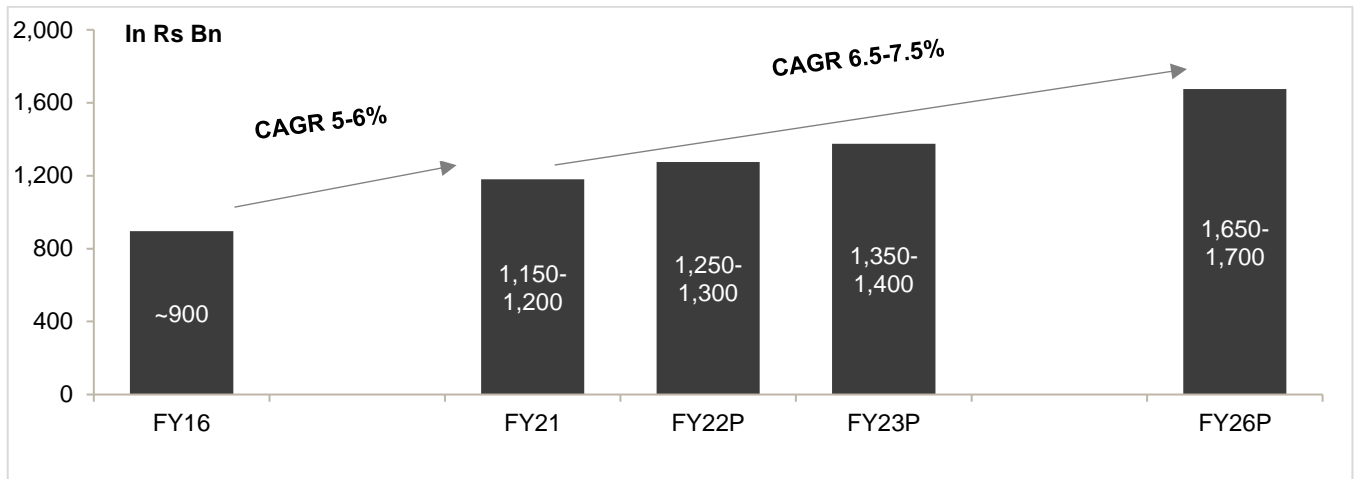
Source: CRISIL Research

India improves its global ranking in e-governance; number of online transactions witnessing rapid growth

Government spending on promotion of digital payment and e-governance

(Rs billion)

	2017-2018	2018-2019	2019-2020	2020-2021 RE	2021-2022 BE
Promotion of Digital payment	0.2	7.7	5.1	3.0	15.0
Electronic Governance	2.8	4.2	4.0	4.2	4.3

■ Promotion of Digital payment ■ Electronic Governance
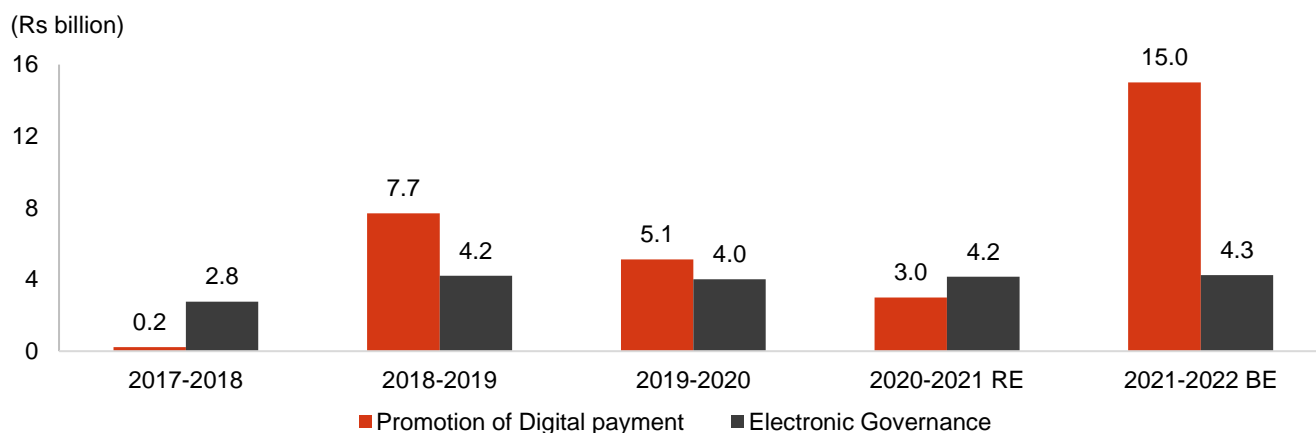
Source: Union Budget, CRISIL research

As can be seen in the chart, there has been increase in the government spending on electronic governance as well as for the promotion of digital payments. For 2021-22, the electronic governance spending and digital payment promotion is budgeted at Rs 4.3 billion and Rs 15 billion, respectively.

Uses of government web portals are on the rise, according to the government's Electronic Transaction Aggregation and Analysis Layer (**eTaal)**, portal. The number of transactions per day increased exponentially to 213.9 million in May 2021 from 9.7 million in 2014. The spike in transactions is expected to translate into newer opportunities for domestic players.

TCS, for instance, has successfully implemented a scalable technology **platform for passport services** in India for 1.3+ billion Indian citizens, including 32 million citizens living overseas. The company also implemented the **tax-filing system** for smooth online filing and processing of taxes.

Another company Protean eGov Technologies Ltd. has played a pioneering role in laying down the basic infrastructure for e-Governance in the country by enabling the government to unleash the untapped area. It has helped government in implementation of multiple projects such as Permanent account number (PAN) card, Tax information network (TIN), Unique identification numbers (UID) enrolment, National pension scheme (NPS), e-sign, etc.

Daily average web traffic on government portals on the rise

in millions

Chart: Daily average web traffic (in millions):
- 2014: 9.7
- 2015: 20.8
- 2016: 29.7
- 2017: 84.3
- 2018: 116.7
- 2019: 145.1
- 2020: 196.6
- 2021: 213.9

CAGR 55.6%
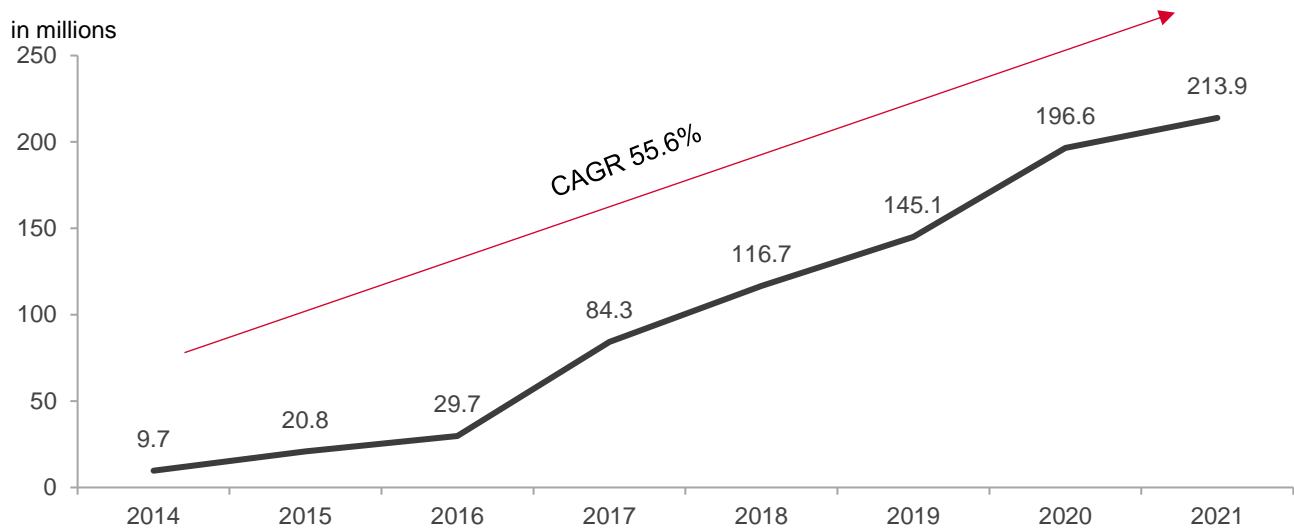
Note: 2021 data is as of May 2021

Source: Government of India (GoI), eTaal portal

Qualitative overview of e-governance and scope for IT solutions in this space

E-governance is the use of ICT to conduct government business and provide public services. The strategic objective of e-governance is to support and simplify governance for all parties: government, citizens and businesses. The use of ICTs can connect all three parties and support processes and activities to stimulate good governance. Therefore, the objectives of e-governance are similar to the objectives of good governance.

E-governance aims to make interactions between government and citizens (G2C), government and business enterprises (G2B), and inter-agency relationships (G2G) more friendly, convenient, transparent, and economical. The goals of e-governance are:

- Providing better service delivery to citizens
- Increasing transparency and accountability
- Empowering people through information
- Improving efficiency within governments
- Improving the interface with business and industry

E-governance facilitates interaction between different stakeholders in governance using ICT (indicated by block arrows in the diagram below):
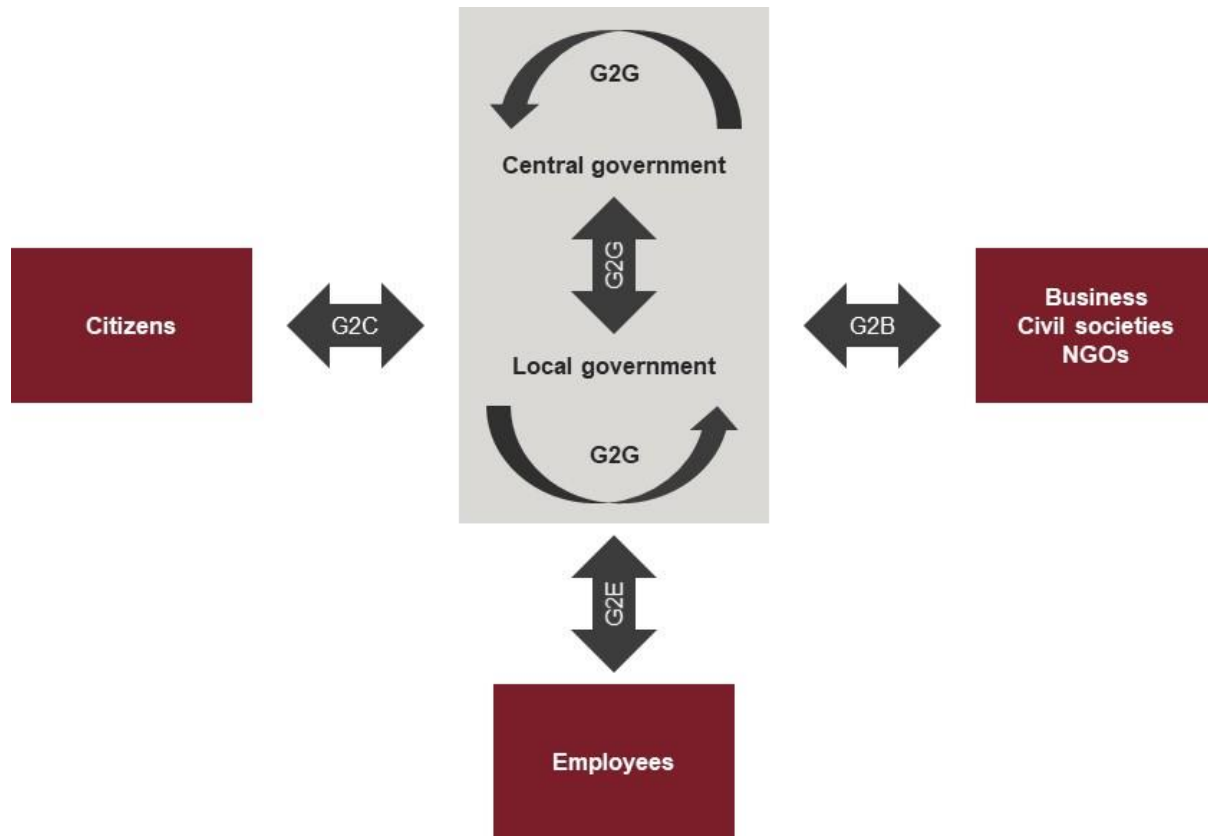
Interactions between the major e-Governance groups

These interactions are described as follows:

Government to Government (G2G) – In this case, ICT is used not only to restructure the governmental processes involved in the functioning of government entities but also to enhance the flow of information and services within and between different government entities. This kind of interaction happens only within the sphere of government and can be both horizontal i.e. between different government agencies as well as between different functional areas within an organization, or vertical i.e. between national, provincial and local government agencies as well as between different levels within an organisation. The primary objective is to improve efficiency, performance and output.

Government to Citizens (G2C) – In this case, an interface is created between the government and citizens, which enables the citizens to benefit from efficient delivery of a large range of public services. This expands the availability and accessibility of public services on one hand and improves the quality of services on the other. It gives citizens the choice of when to interact, from where to interact (e.g. service centre, unattended kiosk or from one's home/workplace) and how to interact (e.g. through internet, fax, telephone, email, face-to-face, etc.) with the government. The primary purpose is to make government, citizen friendly.

Government to Business (G2B) – Here, various e-governance tools are used to support the business community–i.e., providers of goods and services – to interact with the government seamlessly. The objective is to cut red tape, save time, reduce operational costs and to create a more transparent business environment when dealing with the government. The G2B initiative can be transactional (such as in licensing, permits, procurement and revenue collection) or can also be promotional and facilitative (such as in trade, tourism and investment). These measures help to provide a congenial environment to businesses to enable them perform more efficiently.

Government to Employees (G2E) – Government is by far the biggest employer and like any organisation, it has to interact with its employees regularly. This interaction is a two-way process and use of ICT tools helps in making this interaction fast and efficient on one hand and improve the satisfaction levels of employees on the other.

E-government initiatives taken by the current government and their progress

The government has initiated several programmes that, together, will help realise its vision of a digitalised nation. These programmes aim to create technology-enabled solutions and facilitate their adoption by:

- Creating a platform through infrastructure growth, such as laying optical fibre cables;

- Making devices available in an affordable manner by encouraging research & development and manufacturing of electronic devices;

- Incentivising their adoption by linking basic services and facilities (such as subsidies) to these initiatives and

- Imparting relevant skills to ensure that citizens not only adopt these technologies, but also contribute to them, through various skill development programmes. Some of these schemes have already given encouraging results, while others are yet to see significant traction, as depicted below:

E-governance initiatives in India

Program	Details
Jan-Dhan-Aadhar-Mobile (JAM) Trinity	The JAM trinity aims to integrate the three identification numbers to allow citizens to avail several government benefits. It is supposed to be a game-changing reform that will allow transfer of benefits in a targeted, leakage-proof and cashless manner
Passport	Passport Seva Project was launched by the Ministry of External Affairs with the objective of delivering Passport Services to the citizens in a comfortable environment with wider accessibility and reliability. Various e-services being offered under the MMP include issue / re-issue of Passport, issue of duplicate Passport, issue of Tatkal Passport, change in name, address, ECNR/ ECR suspensions, passport status enquiry etc.
Income Tax	Various important e-services being offered under this MMP includes facility for downloading of various forms, online submission of applications for PAN and TAN, query-based services for allotment of PAN and TAN, e-filing of Income Tax Returns, e-filing of TDS returns, online payment of Taxes, issue of refunds through Electronic Clearance Scheme (ECS) and Refund Banker, etc
National Citizen Database/UID	The aim is towards creating a central database of resident information and assign a Unique Identification number to each such resident in the country, to facilitate efficient delivery of social and welfare services.
Bhoomi Project (Karnataka): Online Delivery of Land Records	Bhoomi is a self-sustainable e-governance project for the computerised delivery of 20 million rural land records to 6.7 million farmers of Karnataka.
KHAJANE (Karnataka): End-to-end automation of Government Treasury System	G2G e-governance initiative of the Karnataka state government
	It has been implemented mainly to eliminate systemic deficiencies in the manual treasury system and for the efficient management of state finances.
e-Seva (Andhra Pradesh)	Designed to provide G2C and 'e-Business to Citizen' services.
	All the services are delivered online to consumers /citizens by connecting them to the respective government departments and providing online information at the point of service delivery.

Program	Details
	The project has become very popular among the citizens especially for utility bill payments.
e-Courts	Launched by the Department of Justice, Ministry of Law and Justice.
	The Mission Mode Project (MMP) aims to utilise technology for improved provisioning of judicial services to citizens.
e-District	Launched by the Department of Information Technology.
	The MMP aims to deliver high volume, citizen-centric services at the district level such as the issue of birth/death certificates, income and caste certificates, old age and widow pensions, etc.
MCA21	Launched by the Ministry of Corporate Affairs.
	The project aims to provide electronic services to the Companies registered under the Companies Act.
	Various online facilities offered includes allocation and change of name, incorporation, online payment of registration charges, change in address of registered office, viewing of public records and other related services.
e-Office	Launched by the Department of Administrative Reforms & Public Grievances.
	The MMP aims to improve the operational efficiency of the Government significantly by transitioning to a "Less Paper Office".
Pradhan Mantri Jandhan Yojana (PMJDY)	This scheme has been launched with the aim of providing basic banking amenities to everyone, by providing accounts, debit cards and accidental insurance coverage worth Rs 1 lakh. This is envisioned as a move to empower Indian citizens and head towards inclusive growth.
	The scheme has been very successful, so far, with over 150 million bank accounts being opened. Over 100 million RuPay debit cards have also been issued.
	Use of RuPay debit cards for transactions and extended reach into remote areas with handheld PoS devices will bring about rapid adoption of these cards.
Direct Benefit Transfer (DBT)	Under the DBT scheme, consumers will receive subsidies directly into their bank accounts, while the subsidised goods will be sold at market prices. This will reduce pilferage, adulteration and other malpractices, while ensuring that subsidies reach the needy people.
	Linking of bank accounts, with Aadhar for DBT, will allow efficient tracking and monitoring of benefits transfer. It will also reduce leakages and duplication of beneficiaries.

Source: CRISIL Research

Building blocks of Digital India

The schematic diagram below represents how the initiatives tie in with the nine pillars of the Digital India programme:

Vision areas

Infrastructure as a utility to every citizen	Governance and services on demand	Digital empowerment of citizens

Nine pillars

IT jobs for all	Access to mobile	E-kranti	PIAP	E-governance	Information for all	Early harvest programme	Broadband highway	Electronic manufacturing

Initiatives

E-sign	Skill India	PMJDY	JAM	E-hospital	Wi-Fi hotspots	DBT	NOFN	Smart cities	Digi-locker

Source: Department of telecommunication, International telecommunication union

These initiatives are radical in the manner in which they will change governance, and finally bring to life the vision of inclusive growth. Most of the initiatives have met with success, at least in the initial phase. Their success in the future will depend on how the policymakers, the executive and the citizens, alike, cope with the numerous challenges at various stages.

The proliferation of digital technology and data is moving the world in a positive direction, but it also comes with a whole host of risks and challenges. Security, privacy and ethical issues are the major concerns, and digital & data literacy as well as related institutional capacities remain insufficient in many areas, especially in developing countries, transition economies and countries in special situations.

With the exponential growth in government data and the rising awareness of its enormous potential and attendant challenges, the need for effective data governance and institutions has gained new urgency. Governments are not only among the largest producers and consumers of data in several countries, but they also play a critical role in data regulation.

E-government development across nations, based on the United Nations E-Government Survey

The United Nations E-Government Survey is produced every two years by the Department of Economic and Social Affairs. It is the only report in the world that assesses the e-government development status of all the UN member states. It serves as a tool for e-government decision-makers to identify their strengths and challenges and guides e-government policies and strategies. The publication also highlights emerging trends, issues and innovative practices, as well as challenges and opportunities for e-government development. Each chapter analyses survey data, and highlights strategies, challenges and opportunities to provide policy options. The survey is intended for government officials, academics, intergovernmental institutions, civil society organisations, the private sector and citizens at large.

The **E-Government Development Index (EGDI)** is a weighted average of normalized score of following dimensions of e-government:

1. Online Service Index (OSI) which is scope and quality of online services

2. Telecommunication Infrastructure Index (TII) which is the status of the development of Telecommunication Infrastructure

3. Human Capital Index (HCI) which is the inherent Human Capital

EGDI = 1/3 (OSI+TII+HCI)

Online Service Index (OSI)

OSI uses data collected by UNDESA from an independent questionnaire that assesses national online presence. The data is collected by UN volunteer researchers from member countries. The survey questionnaire assesses a number of features related to online service delivery, including whole-of-government approaches, open government data, e-participation, multi-channel service delivery, mobile services, usage uptake, digital divide as well as innovative partnerships through the use of ICTs.

Some of the major criteria/ indicators are mentioned as under

Technology	Content provision	Service provision	Participation and engagement
Browser compatibility	Contact details	Portal authentication	Real time communication
Ease of finding portal	Organisation structure	Personal data accessibility	Feedback/complaint submission
Navigability	Municipality information	Personal data updating	Online deliberation process
Internet search mechanism	Budget related information	e-procurement service	Social networking features
Alignment with display, mark-up validation standards	Environmental information	Online resident ship	Participatory budgeting
Customisation of display features	Educational information	Online vacancies	Participatory land use plan
Foreign language support	Open data provision	e-payment	Feedback about consultation process

Telecommunication Infrastructure Index (TII)

The TII is indicated is arithmetic average of 5 indicators:

1. Estimated internet users per 100 inhabitants who used internet from any location in last 3 months

2. Number of main fixed telephone lines per 100 inhabitants who have telephone lines connecting a customer's terminal equipment to public switched telecommunication network

3. Number of mobile users per 100 inhabitants which is the number of subscriptions to mobile service in last 3 months

4. Number of wireless broadband subscriptions per 100 inhabitants where subscriptions refer to the sum of satellite broadband, terresterial fixed wireless broadband and active mobile broadband subscriptions to the

public internet.

Number of fixed broadband subscriptions per 100 inhabitants where subscriptions refers to high speed access to the public internet (TCP/ IP connection) at downstream speed equal to greater than 256 kbits/s.

Each of these indicators is standardized through Z-score procedure.

Average of the 5 Z-score indicators (say A) for TII is then normalized by (A-min)/(max-min) where min and max are the lowest and highest composite values

This is the final Telecommunication Infrastructure Index (TII)

Human Capital Index (HCI)

The Human Capital Index (HCI) consists of 4 parameters:

1. **Adult literacy rate:** This is defined as the percentage of people aged above 15 years and above who can read and write short & simple statements

2. Combined primary, secondary and tertiary gross enrolment ratio, which is the total number of students enrolled at primary, secondary, and tertiary level, regardless of age, as a percentage of the population of school age at that level.

3. **Expected years of schooling:** It is the total number of years of schooling that a child can expect to receive in the future. Assumption is that the probability is equal to current enrollment ratio age.

4. Average years of schooling: Mean Years of Schooling (MYS) is average number of year of education completed by country's adult population (25+ years) excluding the years repeating grades.

HCI is weighted average composite of 4 indicators. The human capital composite value for country "x" is the weighted arithmetic mean with one-third weight assigned to adult literacy rate and two-ninth weight assigned to the gross enrolment ratio, estimated years of schooling and mean years of schooling.

UN E-Government Development Index rank for major countries

E-Government Development Index rank	2018	2020
Denmark	1	1
Estonia	16	3
Australia	2	5
UK	4	7
USA	11	9
Japan	10	14
France	9	19
Germany	12	25
Italy	24	37
China	65	45
Malaysia	48	47
Brazil	44	54

E-Government Development Index rank	2018	2020
Thailand	73	57
Mexico	64	61
Mauritius	66	63
South Africa	68	78
Viet Nam	88	86
Indonesia	107	88
India	96	100
Egypt	114	111
Algeria	130	120
Nigeria	143	141

Source: 2020 United Nations (UN) E-Government Survey

Denmark remains the global leader in digital government, according to a new UN survey that captures the scope and quality of online services, the status of telecommunication infrastructure and human capacity. It was followed by South Korea and Estonia, which also fared well, and then Finland, Australia, Sweden, the UK, New Zealand, the US, the Netherlands, Singapore, Iceland, Norway and Japan. African countries did not rank particularly highly, as the relatively affluent island nation of Mauritius was the leading African nation coming in at 66, and 14 of the 16 lowest ranking countries came from Africa.

UN E-Government Development Index rank for India

E-government development index	2010	2012	2014	2016	2018	2020
India (rank)	119	125	118	107	96	100
India (value)	0.35673	0.38287	0.38343	0.46375	0.5669	0.5964

Note: United Nations (UN) E-Government Survey provides EDGI score on the 3 criteria Online Service Index (OSI), Telecommunication Infrastructure Index (TII) and Human Capital Index (HCI). The resultant value is in range of 0-1, where 0 value being lowest while 1 being highest.
Source: 2020 United Nations (UN) E-Government Survey

India ranks 100th in the United Nations E-Government Survey 2020 with value of 0.5964, up from 107th in 2016 with value 0.46375 and 86th in 2004 with value of 0.38789. The rank has decreased but the value has increased due to the governments focus on e-governance and faster adoption of e-governance in other developed and developing nations. India's Aadhaar programme is serving as the basis for interactions with the government at various levels.

UN E-Government Development Index rank for major countries

E-government development index	2003		2012		2020	
	Rank	Value	Rank	Value	Rank	Value
Denmark	4	0.820	4	0.889	1	0.976
Singapore	12	0.746	10	0.847	11	0.915
Brazil	41	0.527	59	0.617	54	0.768
South Africa	45	0.515	101	0.487	78	0.689
Indonesia	70	0.422	97	0.495	88	0.661
China	74	0.416	78	0.536	45	0.716
India	87	0.373	125	0.383	100	0.596
Kenya	118	0.299	119	0.421	116	0.532
Uganda	119	0.296	143	0.319	137	0.450
Gambia	158	0.172	161	0.269	181	0.263
South Sudan	-	-	175	0.224	193	0.088
Top 10 countries range		0.761-0.927		0.847-0.928		0.923-0.976
Bottom 10 countries range		0.009-0.1345		0.064-0.200		0.088-0.258

Note: United Nations (UN) E-Government Survey provides EDGI score on the 3 criteria Online Service Index (OSI), Telecommunication Infrastructure Index (TII) and Human Capital Index (HCI). The resultant value is in range of 0-1, where 0 value being lowest while 1 being highest.

Source: 2020 United Nations (UN) E-Government Survey, CRISIL Research

E-governance has witnessed increased adoption during the past few years. But India's ranking has decreased in the biannual e-governance report published by the UN, to 100 (out of 184 countries) in 2020 from 87 in 2003. Though rank for India has declined over the period, the score has improved from 0.37309 in 2003 to 0.5964 in 2020 mainly due to the government focus on e-governance through flagship initiatives like Digital India, JAM (Jan-Dhan Yojana, Aadhar, mobile), DBT (Direct Benefit Transfer), PM's Bima Yojana, smart cities, etc. From making use of Information and Communications Technology (ICT) for elections, census, computerizing all the government offices, to digital lockers, e-kranthi portals and e-seva kendras, India has paved its way in the world of e-Governance.

There was not much awareness about the e-governance in 2003 but now many countries have started to adopt it which can be seen from the top and bottom 10 range for value of EGDI. Even after Indian government focus and initiatives, the ranking for India has declined as many countries like Bhutan, Bangladesh, Cambodia, Mauritius, the Seychelles and South Africa have started to focus on adoption of e-governance.

There are various challenges for the implementation of e-government in India. These challenges are like low literacy, lack of awareness, lack of system integration within a department, etc. The environment needs to be developed for the effective implementation of e-government in India. But in spite of all challenges India has number of award winning e-governance projects. It is rightly said that, e-Governance is the key to the "Good Governance" for the developing countries like India to minimize corruption, provides efficient and effective or quality services to their citizens. Also considering its current rank and score in UN e-governance survey, is lot of scope for India to improve on its e-governance practices.

Africa is lagging far behind the rest of the world. The EGDI index for Africa's countries like Kenya, Uganda and Gambia is on the rise, but it is still lower than that of all other countries. Only six African countries belong to the group of states with a high level of e-knowhow: Ghana, Mauritius, Morocco, the Seychelles, South Africa and Tunisia. The main problem faced for African countries is that many Africans cannot be part of the progress in IT

since they do not have reliable access to the internet, the price of the service is too high, or they lack the necessary skills. The UN estimates that 22% of the African population has access to the internet; the corresponding figure in Europe is 80%

Countries leading in e-government development

Country	Rating class	Region	OSI value	HCI value	TII value	EGDI value (2020)	EGDI value (2018)
Denmark	VH	Europe	0.9706	0.9588	0.9979	0.9758	0.915
Republic of Korea	VH	Asia	1	0.8997	0.9684	0.956	0.901
Estonia	VH	Europe	0.9941	0.9266	0.9212	0.9473	0.8486
Finland	VH	Europe	0.9706	0.9549	0.9101	0.9452	0.8815
Australia	VH	Oceania	0.9471	1	0.8825	0.9432	0.9053
Sweden	VH	Europe	0.9	0.9471	0.9625	0.9365	0.8882
The UK	VH	Europe	0.9588	0.9292	0.9195	0.9358	0.8999
New Zealand	VH	Oceania	0.9294	0.9516	0.9207	0.9339	0.8806
The US	VH	Americas	0.9471	0.9239	0.9182	0.9297	0.8769
Netherlands	VH	Europe	0.9059	0.9349	0.9276	0.9228	0.8757
Singapore	VH	Asia	0.9647	0.8904	0.8899	0.915	0.8812
Iceland	VH	Europe	0.7941	0.9525	0.9838	0.9101	0.8316
Norway	VH	Europe	0.8765	0.9392	0.9034	0.9064	0.8557
Japan	VH	Asia	0.9059	0.8684	0.9223	0.8989	0.8783

Note: In the 2020 United Nations E-Government Survey, a quartile divides data into three points—a lower quartile, median, and upper quartile—to form four groups of the data set. The lower (or first) quartile in each EGDI group is denoted as L1, M1, H1 or V1 and is the middle number that falls between the smallest value of the data set and the median. The second quartile (L2, M2, H2 or V2) is also the median. The upper (or third) quartile, denoted as L3, M3, H3 or V3, is the central point that lies between the median and the highest number of the distribution. LM, MH, HV and VH are the highest data points in each EGDI group.
OSI- Online Service Index, HCI- Human Capital Index, TII- Telecommunication Infrastructure Index
Source: 2020 United Nations E-Government Survey.

The US, with its VH rating class and improved EGDI value, continues to play a leading role in e-government development in the Americas and globally. The **Republic of Korea** is the global leader in online services provision (OSI) and the top EGDI performer in Asia, followed by Singapore and Japan.

Denmark has the highest EGDI value globally in the second consecutive survey and is one of seven countries in Northern Europe and one of five countries in the EU that are part of the highest (VH) rating class.

The other EU/Northern European countries in this category have registered improvements since the 2018 edition of the survey. Estonia recorded the most significant EGDI increase, and Finland improved in all three sub-indices of the EGDI. Both **Sweden and the UK** achieved a higher overall EGDI value through substantial improvement in the technical infrastructure component (TII). The Netherlands is the final EU member of the VH rating class. **Iceland and Norway**, both in Northern Europe and ranked twelfth and thirteenth overall, respectively, showed improvement in all three EGDI sub-indices.

Australia and New Zealand, the leaders in Oceania, remain in the very high EGDI group (in line with the past two editions of the survey) and are well placed within the highest (VH) rating class. None of the countries in Africa are included in the VH rating class.

Least-developed countries with the highest EGDI values

Country	Rating Class	EGDI Rank	Sub-Region	OSI value	HCI value	TII value	EGDI value (2020)	EGDI value (2018)
Bhutan*	H2	103	Southern Asia	0.6824	0.5139	0.5367	0.5777	0.4274
Bangladesh*	H1	119	Southern Asia	0.6118	0.5731	0.3717	0.5189	0.4862
Cambodia*	H1	124	South-Eastern Asia	0.4529	0.5344	0.5466	0.5113	0.3753
Rwanda	MH	130	Eastern Africa	0.6176	0.5261	0.2931	0.4789	0.459
Nepal	MH	132	Southern Asia	0.4	0.5405	0.4691	0.4699	0.4748
Timor-Leste	MH	134	South-Eastern Asia	0.4412	0.5599	0.3935	0.4649	0.3816
Lesotho	MH	135	Southern Africa	0.3529	0.5753	0.4497	0.4593	0.2968
Uganda	MH	137	Eastern Africa	0.5824	0.5395	0.2278	0.4499	0.4055
Vanuatu	M3	142	Melanesia	0.3353	0.6012	0.3845	0.4403	0.399
Kiribati	M3	145	Micronesia	0.4941	0.6778	0.1241	0.432	0.345
Myanmar	M3	146	South-Eastern Asia	0.2588	0.5125	0.5234	0.4316	0.3328
Togo	M3	147	Western Africa	0.5	0.5373	0.2532	0.4302	0.3989
Zambia	M3	148	Eastern Africa	0.2588	0.6745	0.3394	0.4242	0.4111
Senegal	M3	150	Western Africa	0.4941	0.3332	0.4358	0.421	0.3486
Tuvalu	M3	151	Polynesia	0.3	0.6821	0.2807	0.4209	0.3779
United Republic of Tanzania	M3	152	Eastern Africa	0.5529	0.4659	0.243	0.4206	0.3929
Sao Tome and Principe	M3	155	Middle Africa	0.2471	0.6736	0.3015	0.4074	0.3424
Mauritius	HV	63	Eastern Africa	0.7	0.7911	0.6677	0.7196	0.6678
Bahamas	HV	73	Caribbean	0.6765	0.7546	0.6739	0.7017	0.6552
Seychelles	H3	76	Eastern Africa	0.6176	0.766	0.6925	0.692	0.6163
Maldives	H2	105	Southern Asia	0.4353	0.6886	0.5981	0.574	0.5615

Note: In the 2020 United Nations E-Government Survey, a quartile divides data into three points—a lower quartile, median, and upper quartile—to form four groups of the data set. The lower (or first) quartile in each EGDI group is denoted as L1, M1, H1 or V1 and is the middle number that falls between the smallest value of the data set and the median. The second quartile (L2, M2, H2 or V2) is also the median. The upper (or third) quartile, denoted as L3, M3, H3 or V3, is the central point that lies between the median and the highest number of the distribution. LM, MH, HV and VH are the highest data points in each EGDI group.

OSI- Online Service Index, HCI- Human Capital Index, TII- Telecommunication Infrastructure Index

* Countries that have moved from the middle to the high EGDI group.

Source: 2020 United Nations E-Government Survey.

Among the world's least-developed countries, Bhutan, Bangladesh and Cambodia have become leaders in digital government development, advancing from the middle to the high E-Government Development Index (EGDI) group in 2020.

Mauritius, the Seychelles and South Africa lead e-government rankings in Africa. Overall, 65% of UN member states are at the high or very high EGDI level. Most of the African countries have low score and need to improve on their e-governance penetration by making different types of public services available online. Also African countries' adoption of e-government platforms has not served the majority of their citizens. Services like e-taxation, e-payment and e-billing are useful for the middle class and richer people. But e-government initiatives that would support and cater to poorer people are sorely lacking. Also e-government initiatives designed to enable skills

development for poor citizens and the unemployed, or to promote micro enterprises, are not there in most African countries. Africa needs to improve on their e-governance penetration.

E-government initiatives in Africa need to be redesigned and re-contextualised so they can address the needs of most citizens, rather than relatively few. Some of the ways in which e-government could be used to better suit African countries' are: using e-government platforms for electoral processes, coordinate health care, support small businesses and secure and transparent procurement procedures.

National income and e-government development

The 2020 e-government assessment shows a generally positive relationship between income levels (as measured by gross domestic product per capita) and EGDI values. Higher-income countries tend to have higher EGDI values than lower-income countries. Given the technological advancements in higher-income countries, this trend is in line with the findings of all previous surveys.

Progress in online services delivery

The OSI component of the EGDI is a composite indicator measuring the use of information and communications technology (ICT) by governments for the delivery of public services at the national level. OSI values are based on the results of a comprehensive survey covering multiple aspects of the online presence of all 193 member states. The survey assesses the technical features of national websites, as well as e-government policies and strategies applied in general and by special sectors in delivering services.

Top countries with High OSI in 2020

Country	OSI 2020	EGDI level
Republic of Korea	1	Very high
Estonia	0.9941	Very high
Denmark	0.9706	Very high
Finland	0.9706	Very high
Singapore	0.9647	Very high
India	0.8529	High

Source: 2020 United Nations E-Government Survey

Countries with OSI levels higher than their respective TII and HCI levels are relatively well-placed in terms of online services provision and are in a good position to progress fairly rapidly in e-government development, infrastructure and human capital development permitting. For this group of countries, online services provision should be coupled with investments in improving the telecommunications infrastructure and/or strengthening digital literacy.

Sector-specific online services

The United Nations E-Government Survey has been tracking the development of online services relating to health, education, employment, the environment and social protection since 2016. In 2020, for the first time, the survey also assessed the websites of justice departments and ministries on the availability of and access to public services related to promotion of justice and due process, as a proxy to assess the progress in achieving the SGD 16 objective of access to justice for all.

Sharing public information

Proactively sharing information and government data with the public contributes to the building of effective, accountable and inclusive institutions (in line with SGD 16); hence, the surveys regularly assess if governments provide information on policies related to specific sectors and share government data online in machine-readable/non-readable formats. Denoting a positive trend, it is increasingly common to find sector-specific information on dedicated government websites.

Trends in the sharing of public information online, 2020
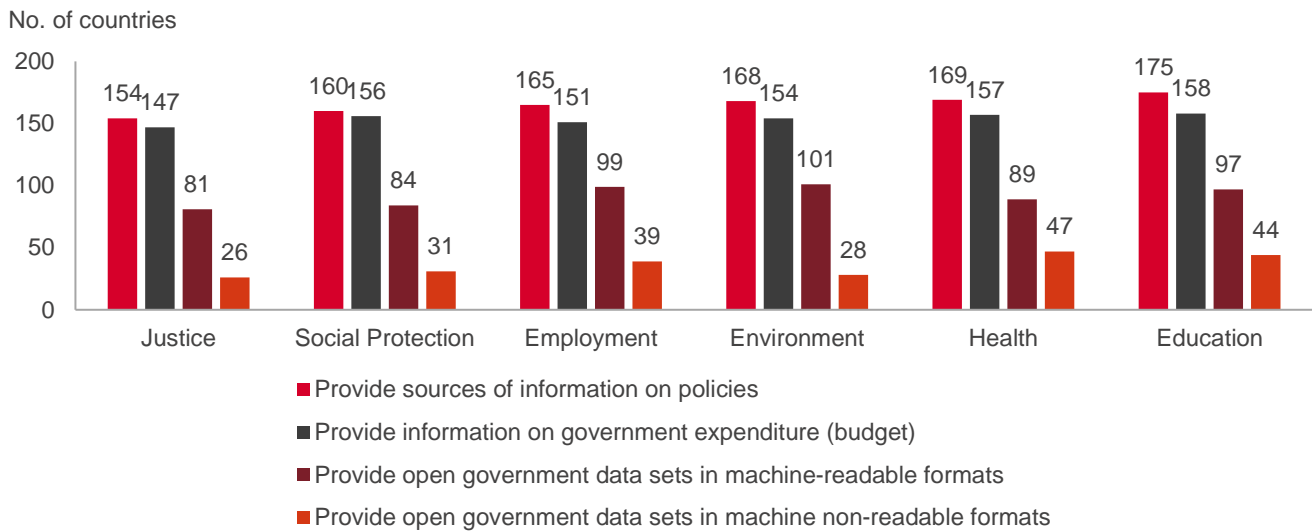
No. of countries

Source: 2020 United Nations E-Government Survey.

In 2020, 80-90% of member states provided information to the public on sector-specific policies and programmes. Many countries also shared government expenditure and budgets with the public, often in open formats.

Importantly, the prevailing trend in data provision on government portals has been to shift from non-machine-readable formats (such as PDF) to machine-readable formats in all sectors.

Compared with 2018, there has been an approximately 50% increase in the number of OGD portals that provide sector-specific information in machine-readable formats. The greatest increase has been in the environment sector, where the number of countries with OGD portals offering machine-readable content rose from 58 to 101 (74%) since 2018.

Mobile services delivery

Percentage of 193 UN member states offering mobile apps or SMS for public information updates, by sector, 2018 and 2020
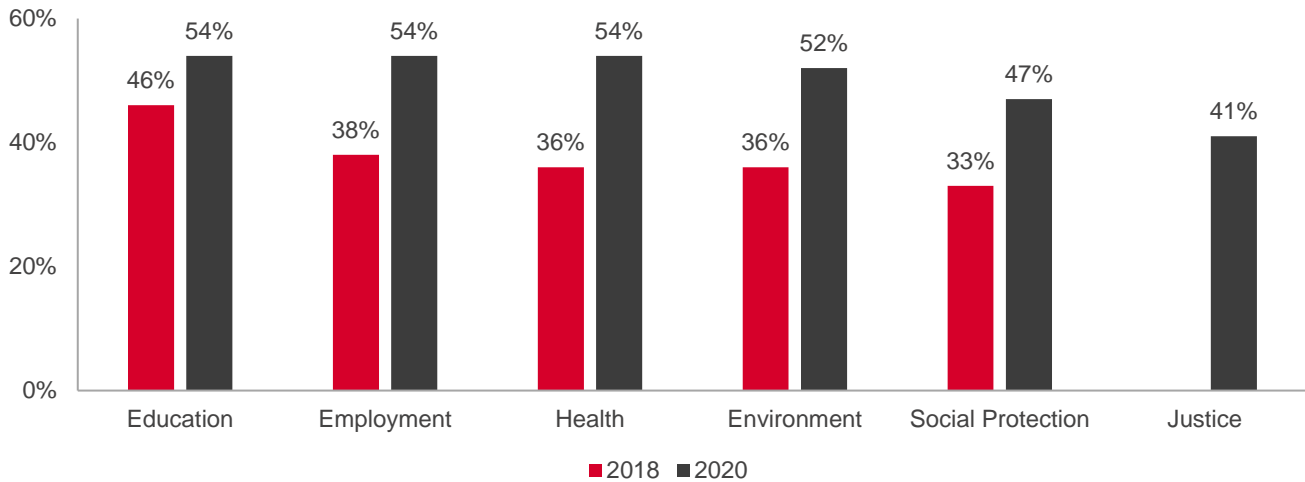
Note: As the justice sector component was added in 2020, no comparative data are available for 2018.
Source: 2018 and 2020 United Nations E-Government Surveys.

As shown in the figure above, the percentage of countries providing updates via mobile apps or SMS increased in all sectors in 2020. The number of countries offering updates via SMS or apps rose by an average of 38% since 2018, double the rate of expansion in the number of countries offering updates via subscriptions (an average of 19%). The most notable expansion in mobile services delivery since 2018 has been in the environment sector, which registered a 20% increase.

The delivery of public information via update subscriptions and apps/SMS, by sector, 2020

No of countries
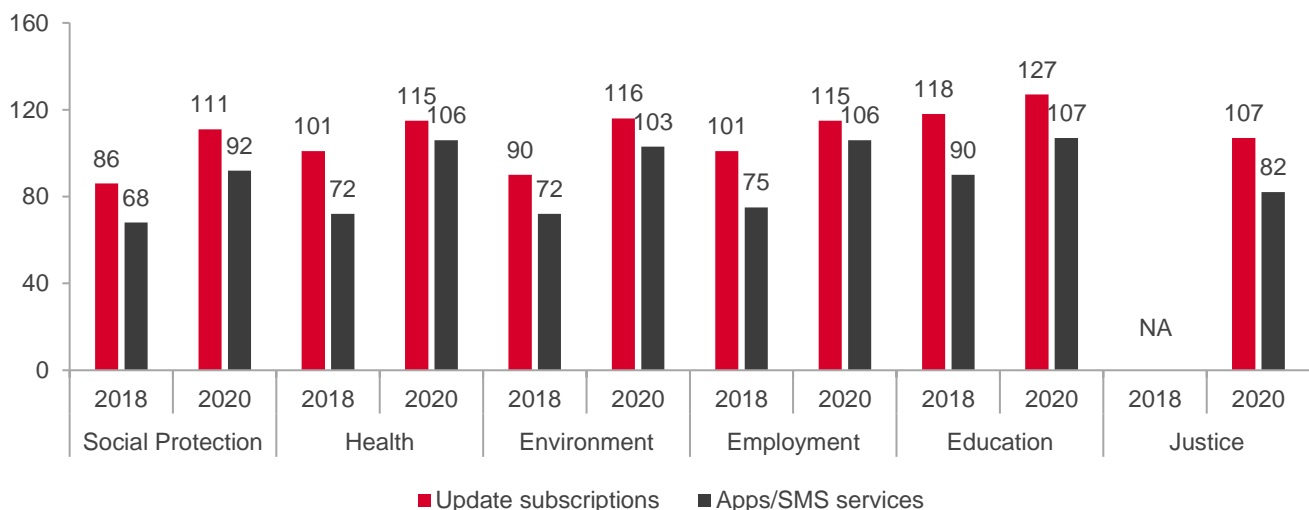
Note: As the justice sector component was added in 2020, no comparative data is available for 2018.
Source: 2018 and 2020 United Nations E-Government Surveys.

For the sharing of public information, both mobile update subscriptions and apps/SMS are expanding across all sectors. In descending order of prevalence, mobile update subscriptions are offered in the education sector (127 countries), environment sector (116 countries), and health and employment sectors (115 countries in each case),

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while apps or SMS are more commonly used for updates in the education sector (107 countries) and the employment and health sectors (106 countries each).

There are many regional challenges as well as opportunities for development for the different regions, which are explained as under:

Regional challenges and opportunities

Africa

- Digitalisation is expanding rapidly in Africa. African countries, their regional organisations, and the African Union are putting in place national and regional policies, strategies and regulations to ensure that the continent's residents can take full advantage of the possibilities offered by digitalisation and digital transformation. A number of African countries like South Africa, Gabon, Algeria and Mauritius have stepped up their efforts to integrate digital technologies in government processes, and many are now offering various e-services to improve government efficiency, transparency, responsiveness, effectiveness, and service delivery. Digital technologies are also being adopted to support government efforts to build and protect the economy; in some areas, for example, these technologies are being used to facilitate direct tax collection, support enterprise creation and development, and reduce illicit financial flows into and out of the region.

Regional challenges and opportunities

Challenges

- Information and communications technology (ICT) infrastructure is under-developed, with many countries lacking the necessary resources and mechanisms to fully address priorities in areas such as cybersecurity, the protection of privacy, power supply (electrification), internet access and connectivity, interoperability and collaboration systems and data infrastructure.

- As per UN e-governance report, Internet penetration in Africa is estimated at only 36% (473 million people online). This is likely to affect the further development of e-government in Africa as the pace of technological innovation accelerates, posing serious challenges to the digital transformation of Africa.

- The low level of domestic resource mobilisation have also led to serious financial constraints. However, the challenges for Africa in digital transformation go beyond infrastructure and finance, and extend to leadership, legal and regulatory frameworks, institutional frameworks, and human and institutional capacities. Illiteracy (including e-illiteracy), language barriers, and internet accessibility and affordability (especially for vulnerable groups) are only a few of the relevant socioeconomic issues that require urgent attention if digitalisation is to move forward.

- Many African countries **lack e-government strategies**. Rather than cobbling together standalone e-government strategies, African government will have to put together e-government strategies that are linked to their country industrialisation plans.

- **Lack of physical, human capital and technical infrastructure** undermines e-government development in Africa. Furthermore, African countries have high levels of illiteracy, and large numbers of citizens are too poor to access technology. African countries even if they have e-government facilities, often do not have special support to make it accessible to the poor, rural areas and women - the most marginalised in society.

- In many African countries with government-wide online government portals, these often **lack security**. Many African e-government initiatives lack feedback mechanisms for citizens to monitor initiatives.

- Access to the internet in most African countries is through mobile devices. However, the software applications, interfaces and products of many e-government systems of many African countries do not have those in mobile devices.

- Some African countries have an online e-government portal, which is not integrated with the whole government. In many cases, the **government departments and agencies are not linked to the online e-governmental portal.**

- African governments will have **to invest in ICT and telecommunications infrastructure**, human resources and systems that can interactively problem-solve users queries.

- Many African e-government projects fail, because it was either donor driven, lack relevant data, human resource capacity and technology.

- Many African governments are not participative, accountable or honest. The challenge is therefore to **make e-government transparent, participative and accountable** given the current lack of democratic governance cultures.

- African governments also need the political will - often absent - to introduce e-governance reforms that will increase public sector efficiencies, citizen participation and slash corruption.

Opportunities

- E-governance platforms should be accessible on mobile phones; this technology is becoming increasingly affordable for most people on the continent. Internet penetration on the continent is also improving.

- Focus more on e-government initiatives designed to enable skills development for poor citizens and the unemployed, or to promote micro enterprises

- Following e-democracy, which involves the use of information and communication technology to facilitate citizens' active participation in democratic processes: for eg, voter registration, actual voting and election monitoring. Governance could be made more inclusive and transparent even beyond election time by providing information and promoting continual engagements with elected representatives.

- E-government platforms can also create empowering spaces for small and informal businesses. African governments could begin to provide open cloud platforms that can support these enterprises with computing infrastructure, software services, and visibility to a larger consumer market. The beneficiaries could be allowed to access these services for free or for a token fee.

- Governments' electronic payment and procurement systems could also be implemented across all sectors of government. This would promote efficiency and reduce corruption to the minimum.

- E-government solutions could embrace additional aspects: informal learning, skills development, and health campaigns.

- A considerable number of African countries have already introduced changes that are contributing to **digital transformation at the national and regional levels**. Some of the example are as below:

Country	Digital transformation
Mauritius	setting up a regional e-governance academy
Nigeria	launched the Government Integrated Financial Management Information System (GIFMIS)
Zimbabwe	has activated a public-sector financial management system; cash registers in Ethiopia are directly connected to the tax authority

Country	Digital transformation
Namibia	has set up a user experience platform (UXP) that allows digital manifestations of various state institutions to be integrated into a single system
Tanzania	E-Government Authority enables companies to pay their taxes online
Rwanda	has seen one of the most remarkable national transformations in recent times, as it emerged from a country devastated by a civil war ending in 1994 but is now considered one of the beacons of digital innovation in Africa. Transformation is due to its adoption of eGovernment services which has redefined the nature in which the government, citizens and businesses interact. Like its Irembo Digital Platform for government services. It is an online platform putting citizens and the government in direct contact, both on tax matters and administrative formalities, such as birth and death certificates, driver's license, land registry, etc.
Kenya and Nigeria	public e-vouchers give small farmers access to agricultural inputs though a startup called Cellulant.

About half of the countries in Africa have digital identification (ID) card systems designed to facilitate digital, financial and social inclusion.

Opportunities for development: Regional initiatives and partnerships

- **Smart Africa initiative:** In 2013, 30 African countries came together, in partnership with international and regional organisations and the private sector, to innovate digital transformation in Africa. Smart Africa has been leading regional digitalisation efforts with the highest levels of political support.

- **Policy and Regulation Initiative for Digital Africa (PRIDA):** It was launched in 2019 to address broadband supply and demand and to build the capacities of African stakeholders in the Internet governance space, thereby enabling the African continent to reap the benefits of digitalisation.

- Various initiatives have been undertaken to move digital identification efforts forward. In 2019, the **United Nations Economic Commission for Africa (ECA)** agreed to collaborate with the African Union Commission, Smart Africa, and others on the development of a digital ID and digital economy strategy. The ECA **Centre of Excellence for Digital Identity, Trade and Economy** was established in 2018 to provide technical support and capacity-building assistance to countries requesting help with challenges linked to, among other things, digital ID and the digital economy, broadband expansion, e-government, and taxation systems. Opportunities for e-governance in Africa

Africa as the next frontier for e-Government

Despite the various challenges and low UN e-governance rankings, Africa is in a prime position to utilize eGovernment services.

Estonia is the best example for successful implementation of eGovernment. Estonia became independent in 1991 after the fall of Soviet Union, and was severely lacking in terms of infrastructure and public services. As the country's infrastructure was so weak, the country started to launch many government services from inception to on internet. Combined with high mobile usage, the market was ripe for eGovernment services, and saw very fast

growth. Currently Estonia offers 99% of all government services online, has 30% of its citizens voting online and claims it saves 800 years of working time per year as a result of this digital transformation.

As per World Bank's World development report 2016, Estonia's X-Road is an e-government system that offers nearly 3,000 services from 900 government and private sector agencies to the citizens online. The number of queries made through X-Road increased from half a million in 2003 to 340 million by 2014. As a result, each citizen saves about five working days per year, adding up to 7 million workdays overall.

Building blocks of e-estonia

Areas	Service/offerings
e-identity	• ID-card • Mobile-ID • e-residency • Smart-ID
E-governance	• Government cloud • Data embassy • i-voting • e-cabinet
Interoperability services	• X-road • e-land register • Population registry
Healthcare	• e-health records • e-ambulance • e-prescription
Mobility services	• Keyless signature infrastructure (KSI) blockchain • e-law • e-justice • e-police
Business and finance	• e-tax • e-banking • e-business register
Education and research	• Estonian education information system • Estonian research information system • e-schoolbag • Other e-school solutions

Many of the African countries are in a similar position currently as compared to where Estonia was when it became independent. While the digital divide remains strong in many countries, internet, smartphone, social media and even e-payment technologies are being quickly adopted which could create a smooth transition to eGovernment service introduction. Also, there are many African countries that have already made significant progress with respect to eGovernment service introduction which are discussed below:

eGovernment platform innovation in Rwanda

The East African country of Rwanda has seen one of the most remarkable national transformations in recent times, as it emerged from a country devastated by a civil war ending in 1994 but is now considered one of the beacons of

digital innovation in Africa. Much of this transformation is due to its adoption of eGovernment services which has redefined the nature in which the government, citizens and businesses interact. Central to this transformation was the introduction of the Irembo Digital Platform for government services.

The Irembo Digital Platform is a web portal which offers government services to Rwandan citizens via the Internet. The platform was launched in 2015 and allows Rwandans to access 85 government services online such as applying for a birth certificate, registering for a driver's license and land title transfers. The service has been so successful that the government plans to add 100 more eGovernment services over the next three years. So far the platform has processed over 2.7 million transactions from 2.4 million unique users, which is a relatively high number given the country's population of 11 million people.

The introduction of the Irembo platform has had many benefits to the local economy. Immediate benefits have manifested in the form of less paperwork in government offices and less travel expenses and waiting times for Rwandan citizens. Rwanda has also seen a significant reduction in corruption. It is now the third least-corrupt country in Africa according to Transparency International, and local sources have cited activities like using the Irembo platform to document and process traffic violations as being a significant factor in this improvement. Finally having a strong eGovernment platform has led to a large boom in start-up activity in the country, and Rwanda is now emerging as a major start-up hub in Africa. Many new companies have emerged which are using the platform in areas such as e-payments, remittances, e-learning and e-tourism that are creating widespread benefits across the entire economy. As such, neighbouring countries have a strong incentive to duplicate Rwanda's eGovernment strategy.

Mauritius

Mauritius has consistently been the African country with the most advances in e-governance. The UN e-Government has since 2016 regularly ranked Mauritius as the African country with the most developed e-governance.

Mauritius is also sharing its knowledge with other African countries, such as Ghana. Mauritius has prioritised turning the island into a Cyber Island, with e-Government as the driving force.

The government is focusing on delivering quality public services 24/7. It has established a government web portal as a central point for government services, information and consultation. It has also focused on creating a "joined-up government" in which departments and public services are integrated online. Mauritius has scaled up e-learning programmes for public servants.

Mauritius is working on creating an online performance monitoring system through which public servants can be held accountable by both government and citizens.

South Africa ID system

South Africa's approach to identification offers valuable lessons for countries looking to increase the coverage, robustness, and use of their ID systems. Since the end of apartheid, South Africa's national identification system has been transformed from a tool of oppression to one for inclusion and the delivery of social services. The ID system is now closely integrated with civil registration, boasts high coverage among all segments of the population, and has been instrumental for effective service delivery and a costeffective electoral process.

A key factor in South Africa's successful civil registration performance has been the link between social protection and civil registration. The collaboration with the Department of Social Development (responsible for policy) and the South Africa Social Security Agency (responsible for implementation) is crucial, and while there is a clear element

of interoperability, the more important aspect is that this link has provided a strong incentive to register births (for beneficiary children) and avail of the national ID (for caregivers). Citizens who otherwise would have been most likely excluded from civil registration were now included.

- South Africa was able to leverage its robust and high-coverage civil registration and ID system for elections, which has generated estimated savings of $ 314 million over the three election cycles from 2000 through 2014.

- Linking ID to the delivery of social protection programs has generated substantial indirect savings by the boost it gave to the coverage of birth registration and the national ID. The reregistration of beneficiaries of social grants cost $24 million, while generating savings of $173 million annually.

- High quality vital statistics, underpinned by South Africa's close to universal civil registration system, enabled authorities to conduct evidence-based policy making and improve development outcomes in public health and beyond. The availability of robust administrative data made it possible to skip the planned census of 2016. The census, if it had been held, was estimated to have a cost of ZAR 3 billion ($203 million).

- The use of online verification of identity by banks and insurance companies is believed to have reduced administrative costs and staff time spent on identification and contributed to a reduction in identity fraud.

Leveraging Biometrics for Citizen Services in Africa

Biometrics services will play a large role in the implementation of eGovernment services in Africa. According to the United Nations Children's Fund as of 2017 only 43% of child births for children under five years of age are registered in Sub-Saharan Africa, which makes proving the identity of citizens very difficult. Some African countries are already using biometrics to tackle this issue, with South Africa being a market leader. The South African Department of Home Affairs worked with NEC to implement its Automatic Fingerprint Identification System (AFIS) in order to quickly and accurately be able to identify its citizens for immigration control, passport registration, election registration, pension payment verification and other services. As a result there has been significantly less paperwork involved in these processes and less chance for error.

Other countries

Morocco has an online government portal. Citizens can access government information, as well as post their views on government performance through the portal. In 2010, Morocco introduced a requirement that corporate taxes be paid online. The Moroccan parliament has introduced e-petitions, through online petitioning on bills, policies and regulations.

The Tunisian government is transitioning government from paper-based system to a paperless one. Public auditors are increasingly auditing information, data and services online. In 2011, the Tunisian government launched the beginning of an e-public procurement system for selected public procurement transactions, which would include purchasing and payments.

Seychelles have gradually turned core government documents into electronic form. In Seychelles, citizens can make online tax payments, register their companies and verify their voter details. Seychelles has an almost 100% mobile usage. Internet speed is relatively high and broadband cost lower than in many African countries. A number of the e-government public services are available for citizens through mobile phones. Seychelles have introduced a voter verification through mobile phones.

Future

Africa is in a unique position in terms of implementing eGovernment services as there is a large chance to catapult the existing technologies and start digital services from the beginning. Countries like Rwanda and South Africa are already showing that this is possible. IT platforms will be a key technology going forward, as governments strive to put almost all government services into the cloud, and capabilities such as e-payments will become more important, but at the same time will require robust cybersecurity and cloud computing capabilities. Countries like Estonia have shown that this is a very achievable goal even for a country with relatively little infrastructure, and have also shown that implementing eGovernment services can save money, reduce corruption and lead to an increase in start-up activity in the country. Given that most Africans are accessing internet via mobile broadband, eGovernment services in Africa must also be increasingly accessible via smartphones. Biometrics will also likely play a larger role in eGovernment in Africa as technologies such as facial, iris and palm recognition will prove a cost-effective and accurate method of citizen identification.

New technologies are helping governments improve e-services delivery and adapt to evolving needs, but their full potential has not yet been exploited in Africa. The possibilities deriving from the increased uptake of frontier technologies such as the Internet of Things (IoT), big data and blockchain are virtually limitless; in Africa, such technologies can be employed to address needs in multiple areas, including agriculture, health care, education and social protection.

Asia

- Asian countries have widely diverse political, cultural, economic and social contexts and are characterised by different levels of economic and social development. Some countries in the region are actively engaged in the development and application of frontier technologies such as artificial intelligence (AI), IoT and robotics and are already front-runners in technology development, usage and innovation; however, a large number of countries in the region are on the other side of the digital divide, and until well-developed ICT infrastructure, sufficient human capital, and adequate resources are in place to mobilise large-scale digitalisation efforts, it is unlikely that these countries will be able to transform technological innovation into sustainable development dividends.

Challenges

- **The connectivity gap**: Accessible, affordable and reliable connectivity, especially to broadband Internet, plays a crucial role in enabling digital transformation. While broadband penetration has increased in the region, there is a widening gap among countries. The gender digital divide is another concern in the region, as women and girls in many countries have less access than men and boys to broadband Internet and knowledge-enhancing applications and services.

- **The digital skills gap:** E-government mainly benefits the literate. ICT and e-government applications are most effective when public sector entities and users have appropriate digital skills. Education access and quality remain a challenge in Asia, although relevant indicators vary considerably among countries. Low levels of human capital development and public spending on education may effectively undermine e-government development, as generic skills and education tend to be positively correlated with successful e-government implementation.

- **Gaps in the legal and policy framework:** Regulatory and policy priorities for digital transformation have been mixed across countries in Asia. Some countries have been proactive in developing strategies across the full range of government policies and legal frameworks to leverage the benefits of digital transformation and e-government applications.

  - Many countries in the Pacific still face challenges in the **adoption of digital technologies**, especially in government and public administration. These countries are widely separated by the vastness of the Pacific Ocean, which makes infrastructure development and the provision of broadband access a relatively

complex and often expensive undertaking—and this affects the development and adoption of e-government applications and services.

–   The **affordability of broadband access** is an issue for many living in the Pacific Islands. Small island developing States (SIDS) are prone to natural disasters, making their **ICT infrastructure highly vulnerable to damage and disruption**. Between 2000 and 2019, the Pacific region—where most SIDS are located—experienced more than 200 natural disasters that caused thousands of fatalities, affected millions of people, and resulted in losses exceeding several billion US dollars.

–   Many Pacific Island countries still **lack adequate, up-to-date legislation and regulations for ICT** and digitalisation.

Opportunities

Despite the challenges, the countries in the region are making progress towards digital transformation.

Country	Digital transformation
Indonesia and the Philippines	Digital social registry systems serve as gateways for social protection programmes, with cash transfers and emergency assistance delivered straight to the intended households in need.
Bhutan	Has introduced a point/score-based online evaluation tool (e-tool) that helps expedite the government's procurement processes, standardise project appraisals, and promote efficient and transparent selection of public investment projects.
Vietnam	Tax authority has implemented e-filing, e-payment and e-customs initiatives that have helped to improve tax collection and management and lowered taxpayers' compliance costs.
Afghanistan	With efforts underway to promote increased reliance on cashless financial transactions, the government has partnered with mobile operator Roshan to establish mobile money services through which funds can be quickly transferred over the operator's network to rural parts of the country.
Fiji, Papua New Guinea, Samoa, the Solomon Islands, Tonga and Vanuatu	Have introduced measures and policies aimed at encouraging greater competition in the sector; other countries are still in the process of establishing new sectoral policies and reforms for the purpose of ICT and digitalisation.

Opportunities for development: Regional initiatives and partnerships

●   In 2009, Bangladesh adopted the national **Digital Bangladesh strategy**, which aims to transform the country into a digitally developed nation by 2021 through ICT integration, in support of good governance, law enforcement, employment and growth. In 2015, the Government of India launched the **Digital India programme** with the objective of bridging the gap between urban and rural areas by promoting investments in digital infrastructure, fostering digital literacy, and expanding the provision of online services provision. In 2012, **Digital Malaysia** was officially unveiled as the nation's transformational programme, to drive the country's transition towards a developed digital economy. Initiated by the Government for implementation from 2018-2022, **Digital Kazakhstan** aims to accelerate the country's economic development, improve the quality of life of the population, and create the necessary conditions for the transition to a digital economy.

–   **Asia-Pacific Information Superhighway:** United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) launched the Asia-Pacific Information Superhighway (AP-IS) initiative to complement national initiatives. This initiative promotes the development of seamless regional broadband networks that will improve the affordability, reliability, resilience and coverage of broadband Internet and thus address the digital divide within and between countries in Asia and the Pacific. Through this initiative, ESCAP is also promoting the Belt and Road Initiative among countries in the region.

–   **Digital Silk Road:** The Digital Silk Road is an important component of the Belt and Road Initiative (BRI), which was introduced by China in 2013 to enhance connectivity and collaboration among nearly 70 countries in Asia, Africa and Europe. Thus far, China has signed cooperation agreements with 16 countries

for the construction of the Digital Silk Road. The most recent version of the implementation mechanism is the Action Plan on Belt and Road Standard Connectivity (2018-2020). The Digital Silk Road initiative has expanded in scope from its early focus on fibre-optic cable installation to include elements such as smart city projects, cloud computing and big data.

– **SAMOA Pathway:** The Small Island Developing States Accelerated Modalities of Action (SAMOA) Pathway—a regional initiative adopted at the Third International Conference on Small Island Developing States in September 2014, and endorsed by the General Assembly of the United Nations in resolution 69/15 of 14 November 2014, officially recognises the need for concrete measures to advance the sustainable development of SIDS and move the international sustainable development agenda forward. The action-oriented programmes undertaken within this framework are to be implemented through genuine and durable partnerships across a wide variety of stakeholders.

Europe

- There is considerable political, cultural, social and economic diversity among the member countries, and levels of development – including digital development – vary widely. The region includes a large group of developed economies but is also home to a number of economies in transition; e-government has a key role to play in all of these countries. Some governments in the ECE (Economic Commission for Europe) region are at a relatively advanced stage, using technologies such as ICT, big data, AI and machine learning to improve public services, empower people, and ultimately provide a better quality of life. Others are in the nascent stages of e-government (and broader digital) development.

Challenges

- **Trade facilitation**: The EU is the largest economic bloc in the region and benefits from a customs union. Trade regulatory systems are designed for seamless electronic communication between trading stakeholders and government entities within the EU. Heightened challenges on this front are faced by countries that are not part of the bloc (except Switzerland and Norway)

- A number of countries in Europe and Central Asia are not advanced in the digital provision of services in both the public and private sectors. The discrepancies extend to all sectorial areas of e-government at the national and subnational levels

- **Digital connectivity and the interoperability** of regulatory systems have far-reaching implications for the regional integration of landlocked developing countries (LLDCs). A review of the situation in the LLDCs confirms that a gap remains between the implementation of digital services and the availability of provisions for the facilitation of cross-border paperless trade

- Despite the recent progress, laws and regulations governing **electronic transactions in the region's LLDCs remain weak**, and the same can be said of their institutional capacity for certifying electronic documents and their ability to exchange electronic customs declarations

Opportunities

- Greater implementation of digital cross-border measures can help improve the competitiveness of these countries in global markets. The LLDCs in the ECE region have made some progress in this area, but there is still work to be done to ensure that the necessary mechanisms are in place for optimised integration

- Digital customs systems have been fully or partially implemented in all of the region's LLDCs and include mechanisms for the electronic submission of customs declarations and supporting documentation. In Kazakhstan, for example, all customs declarations have been processed electronically since 2018, and internet connectivity for customs offices and other border agencies is strong and well supported

Opportunities for development: Regional initiatives and partnerships

- **United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT):** It was created to improve worldwide coordination and cooperation in the exchange of trade products, services and information among business, trade and administrative organisations. Specifically, the centre is tasked with facilitating national and international transactions through the simplification and harmonisation of cross-border trade procedures and information flows. For several decades, UN/CEFACT has been developing facilitation methods and mechanisms – often through the use of digital technologies

Western Asia

- The power of digital technology to drive innovative and agile sustainable development is recognised by most countries in Western Asia. Priorities for improving service delivery in the region include enhancing citizen participation, fostering innovation within government structures and institutions, opening government data, and digitalising institutions. These priorities are being addressed throughout the region; however, the adoption and application of new technologies and related standards varies considerably among countries, with effective deployment in some areas hampered by challenges relating to the digitalisation process itself and/or to broader environmental factors such as low levels of socioeconomic development, political instability, or ongoing war and violence.

Challenges

- **Diverse national needs and capacities**: Countries in conflict or post-conflict situations, such as Iraq, Libya and Yemen, are focusing on enhancing access to ICT infrastructure and basic government services. Countries with moderate levels of development, such as Egypt, Jordan and Lebanon, are improving and expanding their digital offerings to ensure the effective delivery of high-quality inclusive government services. Higher-income countries, such as Bahrain, Qatar and the United Arab Emirates (UAE), are mobilising the potential of emerging technologies to provide advanced government services and ensure a high level of user satisfaction

- Although digitalisation is a priority across the region, some countries are facing challenges that have undermined progress on this front. **Conflict and civil strife** have caused major disruptions in many parts of the Arab region, and the millions of people who have been displaced find it extremely difficult or even impossible to access services, including e-government services, in their home or host countries

- In the LLDCs and some middle-income countries in the region, **poverty** prevents large numbers of people from enjoying the benefits of e-government, as many do not have the means to pay for the electronic devices or ICT services needed to access online public services. In some countries, public facilities are available where anyone can access internet, but the scale of deployment remains limited

- Little has been done with regard to **adoption of cutting-edge technology applications** for conflict-affected countries such as Yemen, the Syrian Arab Republic, and Lebanon

Opportunities

- Deployment of e-government services in the early phases of recovery and reconstruction during times of conflicts has the potential to provide internally displaced persons and refugees with **access to essential information and services**

- **The adoption of emerging and frontier technologies** has generated new opportunities for a number of countries in the region. Since 2016, some of the member countries of the Cooperation Council for the Arab States of the Gulf have explored the use of new technologies such as blockchain and AI for the delivery of government, financial and commercial services. Recently, the UAE developed the UAE Strategy for Artificial Intelligence and Emirates Blockchain Strategy 2021

- The **Bahrain Economic Vision 2030** integrates provisions for digital development. The **Saudi Vision 2030,**

Oman 2040 and **Kuwait 2035** strategies also include several initiatives related to digital government transformation. The **Smart Qatar** initiative was launched in 2017, with plans for implementation by 2020. In the UAE, several strategies related to digital government transformation have been developed, including **Smart Dubai 2021**. In Egypt, **the ICT 2030 Strategy** includes provisions for the digital transformation of government services. Morocco has adopted a national plan known as **Digital Morocco 2020**, which is expected to be updated in the next year

Opportunities for development: Initiatives and cross-border partnerships

- Economic and Social Commission for Western Asia (ESCWA), through its technical cooperation programme, is helping some countries in the region with the formulation of digital development plans. In **Jordan**, a plan for the digital transformation of government services was developed in 2019. The **State of Palestine** and the **Syrian Arab Republic** are also preparing their national digital transformation plans with assistance from ESCWA

- Framework of the **Government Electronic and Mobile Services (GEMS)** Maturity Index: The GEMS Maturity Index is measured across three sub-indices: i) service availability and sophistication, ii) service usage and satisfaction, and iii) public outreach

America

- Countries in Latin America and the Caribbean have been actively engaged in e-government development since the beginning of the 21st century. Various initiatives carried out in the region have focused on priorities such as encouraging e-participation, promoting evidence-based knowledge generation, and improving technology access for vulnerable groups.

Challenges

- Although internet connectivity has improved somewhat in recent years, about 50% of households in Latin America and the Caribbean still **lack internet access.** The potential of e-government and e-participation initiatives cannot be fully realised if only half of the population can be reached. In parts of the region, particularly in the Caribbean, internet affordability is an issue and **levels of human capital development remain low**

- **Economic and social barriers** create immense challenges for governments endeavouring to leave no one behind in the provision of public sector e-services. Governments in the region also face challenges in terms of spurring technology-driven growth in the private sector. **Small and medium-sized enterprises (SMEs) lack the resources** to invest in digital technologies and may be unable to assess the attendant risks

- The **region lacks laws and regulations** that can help create a solid institutional framework for the introduction and broad dissemination of ICT and its intensive use among commercial businesses, particularly SMEs.

- **Human capital deficits** constitute a major challenge to ICT development in the region. There are not enough skilled workers to adequately support digital transformation

- The **exchange of knowledge**, data and digital information within and **between the public and private sectors is weak** in Latin America and the Caribbean. Consequently, not enough is known about public sector needs and private sector requirements to foster economic and social development through digitalisation

- **Governments alone do not have sufficient financial resources or human capital** to build the foundations and develop the tools needed to support e-government initiatives. They require the expertise and resources of private technology companies to be able to create effective platforms for the provision of e-services to individuals and businesses

Opportunities

- Although there are a number of challenges to be addressed, there are also many promising opportunities that,

if leveraged appropriately, can move the digital transformation process forward in Latin America and the Caribbean.

- The region has what might be considered a demographic advantage in that **young people under the age of 25** constitute a significantly high proportion (80%) of the population. Various reports and studies have confirmed that young people are the driving force behind digitalisation and innovation. This "youth advantage" and **rapid urbanisation** in the region are likely to contribute to greater openness to and engagement in a data-driven and information-oriented future

- Although a number of countries in the region still lack widespread broadband connectivity, others have made important strides in ICT infrastructure development in recent years. In 2010, **Brazil implemented Plano Nacional de Banda Larga (PNBL),** which has created an affordable 25,000-kilometre broadband network that extends to various less developed municipalities. The implementation of the **Plan Vive Digital strategy in Colombia** has increased ICT availability and demand, particularly among some of the more vulnerable groups in the society

- There are a number of regional cooperation and knowledge-sharing mechanisms for Latin American and Caribbean countries – including the Economic Commission for Latin America and the Caribbean (ECLAC), the Caribbean Centre for Development Administration, the Latin American Centre for Development Administration, and the Network of e-Government Leaders of Latin America and the Caribbean (Red GEALC). Entities such as these collectively offer countries a platform for working together to achieve regional digital transformation
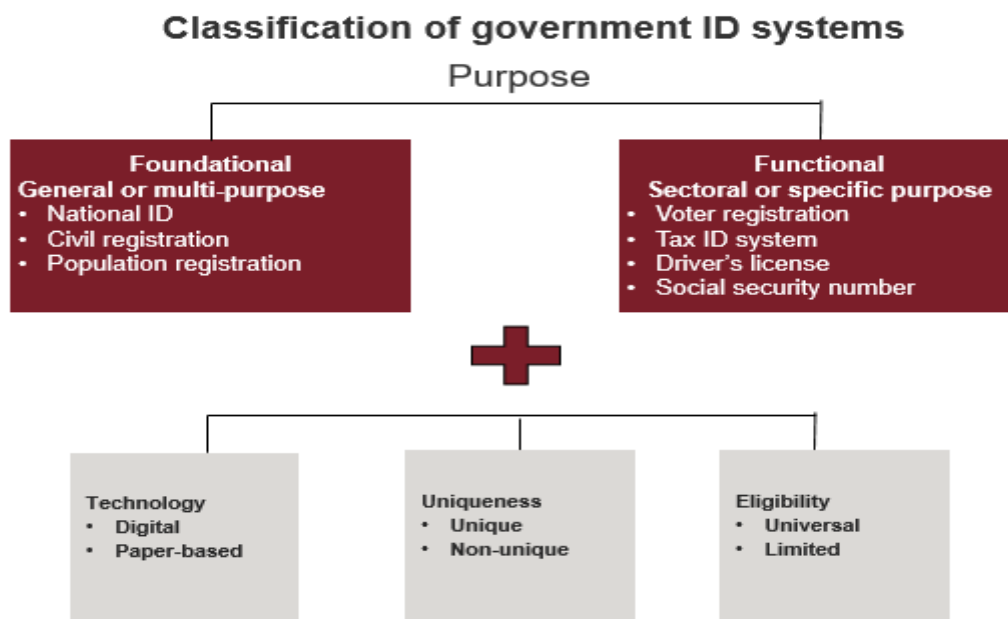
Opportunities for development: Regional initiatives and partnerships

- **Red GEALC** was established in 2003 to promote horizontal cooperation and the exchange of expertise between the region's countries. Horizontal cooperation between governments allows the generation and dissemination of knowledge relating to the digitalisation of public services. This cooperation is facilitated through a variety of mechanisms, including an e-government expert database, e-government awards ceremonies, training courses for e-government officials, and virtual working groups

- In recent years, a number of Latin American countries and ECLAC have worked on fostering collaboration with the private sector – including companies such as **Telefónica, IBM, Microsoft** and regional multinational banks – on data-related activities

  - The national and regional digitalisation efforts that have been undertaken and the digital strategies that are being developed for future growth reflect a strong commitment to unleashing the potential of new technologies to drive sustainable development. Although there remains a long road ahead, the integrated national/intraregional/interregional approach to digital transformation is beginning to bear fruit in many regions. In this era of increased interdependence and accelerated change (largely driven by advances in digital technology), strengthening digital cooperation and cross-border partnerships is the best way to address relevant challenges and opportunities.

Overview of national ID issuance and authentication solutions

Historically, governments have operated a variety of ID systems to serve the purpose of ID. Primarily, this includes **foundational ID systems**, such as civil registers, national IDs and population registers, which are created to provide identification to the general population for a wide variety of transactions. **In addition, governments have often created a variety of functional ID** *systems* **to manage identification, authentication, and authorization for specific sectors or use-cases**, such as voting, taxation, social protection, travel, and more. In some countries—and particularly those that do not have a foundational ID system beyond civil registration—functional identity credentials are used as proof of identity for purposes beyond their original scope. In the **United States**, for example, social security numbers and driver's licenses in the United States are issues as proof of authorization for specific purposes but are used as general-purpose credentials.

Classification of government ID systems

Purpose

Foundational	Functional
General or multi-purpose	**Sectoral or specific purpose**
• National ID	• Voter registration
• Civil registration	• Tax ID system
• Population registration	• Driver's license
	• Social security number

Technology	Uniqueness	Eligibility
• Digital	• Unique	• Universal
• Paper-based	• Non-unique	• Limited

Legal identity is a fundamental human right

According to World Bank, there are ~7.5 billion people on Earth, of which ~1.1 billion cannot securely prove their identity. And every year, ~140 million babies are born, of which ~40 million go unregistered. As such, these citizens are deprived of social benefits, such as education and health, and their civil rights to vote and travel. They are excluded from the economy because they cannot sign up for bank accounts, loans, or mobile phone subscriptions.

Also among the 1.1 billion unregistered people, many live primarily in Africa and Asia, more than one third are children susceptible to violence whose births have not been registered, as per the World Bank's Identification for Development (ID4D). In many countries, births of children born out of wedlock or as a result of rape are sometimes deliberately concealed for fear of discrimination. In China, avoiding birth registration was also deliberate for years for fear of repercussions due to the one-child policy.

The problem is particularly acute in geographical areas whose residents face poverty, discrimination, epidemics or armed conflicts.

Share of population (age 15+) without a national ID (year 2018)

Economy	Continent	Share of population (age 15+) without a national ID
Hungary	Europe	0.3%
Uruguay	Latin America	0.3%
Paraguay	Latin America	0.4%
Thailand	Asia	0.5%
Chile	Latin America	1.2%
Estonia	Europe	1.4%
China	Asia	1.5%
Brazil	Latin America	1.6%
Peru	Latin America	1.6%
Russian Federation	Europe	2.1%
India	Asia	3.2%
Serbia	Europe	3.3%
Turkey	Europe	3.3%
Singapore	Asia	5.3%
Malaysia	Asia	5.8%
Malaysia	Asia	5.8%
Vietnam	Asia	5.9%
Greece	Europe	7.2%
Sri Lanka	Asia	7.9%
South Africa	Africa	8.1%
Colombia	Latin America	8.4%
Kenya	Africa	9.1%
Rwanda	Africa	9.4%
Indonesia	Asia	9.6%
Mexico	Latin America	10.8%
Cambodia	Asia	11.4%
Zambia	Africa	13.5%
Zimbabwe	Africa	15.9%
Uganda	Africa	18.6%
Pakistan	Asia	20.5%
Afghanistan	Asia	28.6%
Lesotho	Africa	30.3%
Mozambique	Africa	41.9%

Economy	Continent	Share of population (age 15+) without a national ID
Lao PDR	Asia	59.3%
Chad	Africa	62.7%
South Sudan	Africa	78.6%
Malawi	Africa	84.3%

Source: ID4D-Findex Survey Data 2018, CRISIL Research

Many governments around the world have introduced ID systems. However, only a few countries have managed to roll them out at the full national level. As depicted in the table, the countries having the lowest share of population (age 15+) without a national ID are Hungary, Uruguay and Paraguay, while the countries having the highest share are Malawi, South Sudan and Chad.

Based on the World Bank's Identification for Development (ID4D) program's database, more than 40% of those lacking IDs in the world live in Africa. The sub-Saharan Africa has the lion's share of the identity gap. This overrepresentation is partly due to the fact that it is the region with the lowest birth registration rates; while these have risen impressively in some African countries, they remain low or have fallen in others. And while almost every country on the continent has opted to have a national ID system—most of them digital and making use of biometrics— some countries have not yet been able to implement their plans. Among those that have, only a handful have managed to enroll more than two-thirds of the eligible population.

There are promising signs that Africa may be entering a new phase in the development of its ID systems. The political commitment of African governments to improve birth registration rates as well as civil registration and vital statistics (CRVS) broadly is evidenced by the series of biennial ministerial-level meetings. More than a dozen countries have conducted a comprehensive CRVS assessment; many more will be completed in the near future. The list of countries digitizing their registries continues to grow. Thereby, showing that the National ID initiatives are under way in much of Africa.

National ID schemes increased in number, visibility and reach

- The UN and World Bank's ID4D initiatives aim to provide everyone on the planet with a **legal identity** by 2030

- At the ID2020 summit in May 2016 in New York, the UN initiated discussions around digital identity, blockchain, cryptographic technologies, and their benefits for the underprivileged. As many as 400 experts shared best practices and ideas on how to provide **universal identity** to all

- Soon after, **the ID2020 Alliance** was created. Based in New York, the NGO's main participants include Accenture; Microsoft; Gavi, The Vaccine Alliance; The Rockefeller Foundation; and IDEO-ORG

- Numerous new **national eID programmes** (including card and mobile-based schemes unrelated to ID2020) were launched or initiated. Examples include new projects in Algeria, Belgium (mobile ID), Cameroon, Ecuador, Jordan, Kyrgyzstan, Italy, Iran, Japan, Senegal, Thailand and Turkey; major announcements in Afghanistan, Denmark, the Netherlands, Bulgaria, the Maldives, Norway, Liberia, the Philippines (PhilSys ID), Poland, Jamaica, Sri Lanka and Zambia; and a pilot scheme in Myanmar. Some of these programmes now include **biometrics**, the majority in the form of fingerprints

- Schemes such as the **Gov.UK Verify** initiative started in 2016, and **Australia** launched the first phase of its digital identity programme in August 2017

- **France** also announced in early 2018 its national eID scheme for fall 2019

- **Germany** announced in 2020 that its citizens would be able to store a digital version of their national ID card

on their phone and use it as a digital ID (with a PIN for authentication) by fall 2021

- **Canada** is also progressing with its federal digital identity scheme named Pan-Canadian Trust Framework, piloted by the Digital ID Authentication Council of Canada, a non-profit organisation. A national proof-of-concept project for a unified login authentication service called Sign In Canada started in fall 2018

- **Aadhaar, India's national eID scheme,** crossed the 1 billion users mark in 2016. At the end of 2020, 1.26 billion Indian residents (99% of adults) got their Aadhaar ID, a digital identity that can be obtained based on biometric and demographic data

- Founded in 2014**, ID4Africa** is an NGO that accompanies African nations on their journeys to develop robust and responsible identity ecosystems in the service of development and humanitarian action. The movement is driven by the need to establish *identity for all,* not just as a legal right (consistent with SDG 16.9) but also as a practical necessity to enable inclusive access to services in Africa

Challenges for IT infrastructure

- **Lack of a definite legal framework** (defining tools used, data collected, uses authorised, etc.) deprives the project of any legitimacy. However, in recent years, while many African countries have adopted new digital identity technologies, they still lack the appropriate legal frameworks to support and regulate modern identity management systems, warned in 2019 a concept note of the Fifth Conference of African Ministers Responsible for Civil Registration

- **Lack of a single entity, specifically tasked for the project,** can generate tensions between different state bodies claiming the project's responsibility and supervision as their own. In Burkina Faso, civil status is the joint responsibility of both the Ministry of Justice and the Ministry of Territorial Administration and Decentralisation. The Department of Civil Status Centres, Courts and Statistics collects statistical data, and transmits it to the General Department for the Modernisation of Civil Status. Health centres issue birth notifications. This context makes the deployment of a single identity solution more complex

- **Physical access to identity registration offices is difficult**. There are not enough offices, and some people live very far from registration points. Therefore, using digital channels to source information would be useful

- **Access to technology essential to the solution is not guaranteed for all**. For instance, the internet network does not cover parts of the country, while the registration process requires internet access. In Africa, a campaign to register inhabitants was hampered by difficulties in access to energy: numerous power cuts made it impossible to collect and send data

- **Isolated communities are excluded**, for example, in rural areas, due to lack of communication or excessive distance from a registration office

- The nation's ID project may be poorly understood due to inadequate communication. Some situations (illiteracy, minorities with poor command of the official language, refugee or displaced populations, etc.) have not received the specific attention they deserve

- **Registering is not cost-effective.** The project communication must highlight the advantages of registration, and these must be specific and real (access to financial bonuses, medical services, education, banking services, easier travel, etc.). In a report on the state of identification systems in Africa, the World Bank expressed that costs to the user are the most consistently observed barrier to civil registration and identification. This is true whether considering direct costs (late birth registration, duplicate identity document, etc.) or indirect costs (absence from work, travel, etc.)

- The document people receive at the end of the single legal identity registration (whether digital or material) is of no immediate use: the services it entitles the bearer to access have not been deployed yet, or they can be accessed without the document

Comparison of national IDs in developed and emerging economies

China

China has a comprehensive civil ID programme. Last year, it began trials on a civil ID function that would track owners' online history. But the country remains a largely closed, state-funded ecosystem, making it difficult to win a significant market share. With a top-down economy, China's national leaders choose winners and losers.

Russia

Russian politicians, meanwhile, view with awe the progress its neighbour has achieved with standardised civil IDs (and surveillance). Like China, Russia has historically suffered from governmental dysfunction and xenophobia, leading regime after regime to seek the greatest control over its people's actions, including their travel. But dominated by oligarchs, any strategic new technology or procedures will result in artificially low outsider industry participation.

India

India's **Aadhaar national ID programme** is the most advanced such biometric identifier among democracies and developing economies. It continues to be more deeply integrated into the nation's government, business and cultural spheres.

Aadhaar authentication is one of the methods used by Indian citizens for registration with the country's vaccine management system. Financial transactions and onboarding are already available. Biometric features including de-duplication of bank accounts, authenticated voting and annual certification for pension benefits show how Aadhaar is being woven into individual lives.

With India being a democracy, complaints about and protests against the national ID programme – including loss of privacy, data security concerns and government abuse – are more visible in the country than in China and Russia. Balancing the speed and comprehensive scope of feature rollouts has created hurdles for the national government.

EU

The EU has a unique position in this arena. It is a coalition of European countries with common economic interests – the European single market. Physical borders between the members years ago were softened in order to promote greater economic integration. Leaders of the EU and those of many of its constituent nations are pushing for a unified eID, preferably one that would involve driver and health certificates. As many as 14 of the 27 members operate digital civil IDs. In mid-2020, the EU signed off on new biometric standards for physical IDs, which today are too easy to forge. Those cards are being phased out in favour of a card with a contactless chip that holds the owner's biometric data. The EU is a democratic club, and its economies are as open as any developed nation's economy. It suffers cultural ills that run counter to the ideas of a unified eID program.

Digital identity in African countries

In **Mauritius** national e-ID card is chip based smart card. This card is linked to the population database to serve as an ID document, and prove identity and allow secure and reliable e-service transactions. In 2015, the Registrar-General Department (RGD) announced that Mauritius is planning to implement the second phase of its e-registry project (MeRP) to provide e-services and facilitate e-submission of documents, e-payment of fees, e-registration, e-search, and e-delivery of registered documents. According to the World Bank, presently, 99% of the population in Mauritius has either has a national ID or a voter ID.

Rwanda's national ID system is one the most advanced and well-functioning in Africa. Each person in Rwanda is issued a 16-digit unique national identification number (NIN); biometrics (thumbprints) are collected during registration for the national ID card to ensure uniqueness. According to the World Bank, Rwanda's electronic national population register (NPR) captures the information of approximately 98% of the population. It is considered to be one of the strongest foundational national identification (ID) systems in Africa due to the robust back end and information management systems that underpin it.

Nigeria is in the process of scaling registration in its National Identity Number system, and **Kenya** is working on its Huduma Namba. These are two prominent examples of a common approach in Africa of establishing overarching foundational civil IDs.

Since its launch in 2013**, Lesotho's** national ID system has steadily expanded coverage and strengthened links to service delivery. Lesotho has made great strides providing its population with a trusted, unique, and verifiable identity from birth to death. As per World Bank, national ID covers an estimated 85% of the eligible population (that is, a little over 1.2 million people of a total population of 1.4 million), compared to the sub-Saharan Africa average of 71%.

Current trends:

Throughout the world – primarily in the world's largest economies – the digitisation of driver's licences and passports as mobile device-based IDs is an emerging trend.

The International Organization for Standardization has standards under development for mobile driver's licences; digital travel credential schemes established by world bodies have reached the trial stage.

Emerging economies, meanwhile, continue to work towards registering their populations for civil IDs to bring them into the formal economy and increase the reach of their programmes and services.

Major players in providing national ID:

Acuant, Aratek, CardLogix, CMI Tech, Fujitsu, Giesecke & Devrient, HID Global, HSB Identification, Idemia, Integrated Biometrics, NEC, Regula, SecuGen, Thales group, VaultID, and Zetes.

Need for IT infrastructure solution for authentication in emerging economies

The rapid adoption of digital identity and biometric technology by consumers has created a seismic shift in the attitudes of large institutions. Whilst developed countries are prolific in the use of these technologies to improve security and ease of use, it is the developing countries that are looking at how the use of digital identity can empower communities and the people within.

The most significant transformation can be observed in emerging economies that are adopting the technology on a large scale. The technology is enabling developing countries to provide greater access to government benefits, secure cross-border authentication and digital transactions, and is contributing to continued economic growth. Governments across these developing economies are spending more on digital identity and biometrics than ever before.

Digital identity authentication

India and South Africa are excellent examples of how access to mobile devices has enabled the successful implementation of single, low-cost verification infrastructures. Citizens can be easily authenticated; at the same

time, they can protect their personal data. **Ipsidy Inc.** (a division of Safe Trade Africa) has successfully integrated an identity transaction platform that supports low-cost mobile transactions that are embedded with the participant's authenticated identity. This significantly reduces the opportunity for data theft and fraud. In February 2019, Ipsidy Inc. and Ayonix announced the release of 'Biometric IP Selfies', which use facial recognition technology to authenticate identity and then approve business transactions in just 20 to 30 seconds

One-time password

One-time password (OTP) is a strong form of authentication, providing better protection to e-banking, corporate networks, and other systems containing sensitive data. OTP is often preferred to stronger forms of authentication such as public-key infrastructure and biometrics because an air-gap device does not require the installation of any client desktop software. In **India, the mAadhaar** app for the mobile phone allows a person to generate a dynamic OTP or time-based OTP (TOTP). The eight-digit code is valid for 30 seconds.

Centralised authentication

IDP System is a centralised authentication solution that creates, maintains and manages identity information and authentication for a service provider. It is also responsible for providing identifiers for users looking to interact with the system.

Certificate authority

Enterprise CA is a fully functional certificate authority built in Java. Based on JEE5 technology, it constitutes a robust, high-performance and component-based certificate authority. Both flexible and platform independent, Enterprise CA can be used as standalone or integrated into any JEE5 application, and is suitable for large enterprises. Enterprise CA has support for the e-Passports projects – it integrates the common features of e-Passports. Thus, Enterprise CA is strongly recommended for e-Passports projects.

Biometric technology in election voting

The first major transformation in emerging economies has been access to government benefits and opportunity to vote in government elections. **India's government has certified online voting start-up** Right2Vote for use in future elections by Indian citizens abroad or residing in a state other than the one they are eligible to cast votes in. The identity of the voter is verified through a selfie, Aadhaar fingerprint, iris biometrics, or Aadhaar OTP. Identity is key to critical services and participation in financial, social and political systems, leading to greater empowerment. **Ghana is preparing for its first digital election** and a digital census, utilising tablet devices with the aid of satellite imagery. A recent study in **Nigeria** earlier this year demonstrated how enhanced digital onboarding has been implemented to instil trust for banks and fintechs, while increasing their customer base and decreasing the prevalence of fraud.

Cross-border authentication

Developing economies are securing borders through cross-border authentication. HID Global is currently collaborating with the government of **Tanzania to implement an e-immigration platform** for web-based visa applications and residence permits. This programme helps the Tanzanian government to better adapt to changing standards, adopt new capabilities and issue many different types of identity documents. It encompasses all critical system elements, spanning the entire identity journey from data capture and enrolment (including biometric identification) to application process, adjudication, data preparation, personalisation and issuance.

Biometric smart cards

Another major transformation is enabling emerging economies to process **payments digitally through the use of mobile** and, more recently, **biometric smart cards**. In 2017, **South Africa** trialled a biometric card developed by MasterCard that allowed customers to make a payment at any EMV terminal and to authenticate the transaction by placing their finger on the embedded sensor. Cardholders enrol their card by simply registering with their financial institution. Upon registration, their fingerprint is converted into an encrypted digital template that is stored on the card. The card is now ready to be used at any EMV card terminal globally. When shopping and paying in-store, the biometric card works like any other chip card.' In February 2019, **NEXT Biometrics and M-Tech joined forces to deploy biometric smart cards in India**. The partnership targets contact-based and dual interface biometric smart card solutions to address current and evolving banking card standards.

The digital identity and biometric industry continues to expand on a global scale. There is considerable investment in emerging economies that are adopting and scaling these solutions at an extraordinary rate. Whilst developed countries are prolific in the use of these technologies to improve security, privacy and ease of use on existing platforms, it is the developing countries that are looking at how the use of digital identity can empower communities and the people within. The significant transformation achieved through the use of digital identity and biometric technologies will continue to support the growth and advancement of these emerging economies for years to come.

Overview of IT infrastructure for vaccine administration

The countries also provide data in relation to the vaccinations administered to its population. Once a vaccine has received approval or authorisation from the authority, the four key tasks to achieve the primary objective of ensuring vaccine access for every human who wants it are to:

● Continue engaging with state, tribal, territorial and local partners, other stakeholders, and the public to communicate public health information, before and after distribution begins, around the vaccine and promote vaccine confidence and uptake

● Distribute vaccines immediately upon granting of emergency use authorisation/biologics license application, using a transparently developed, phased allocation methodology

● Ensure safe administration of the vaccine and availability of administration supplies

● Monitor necessary data from the vaccination programme through an IT system capable of supporting and tracking distribution, administration and other necessary data.

Multiple critical components to vaccine implementation
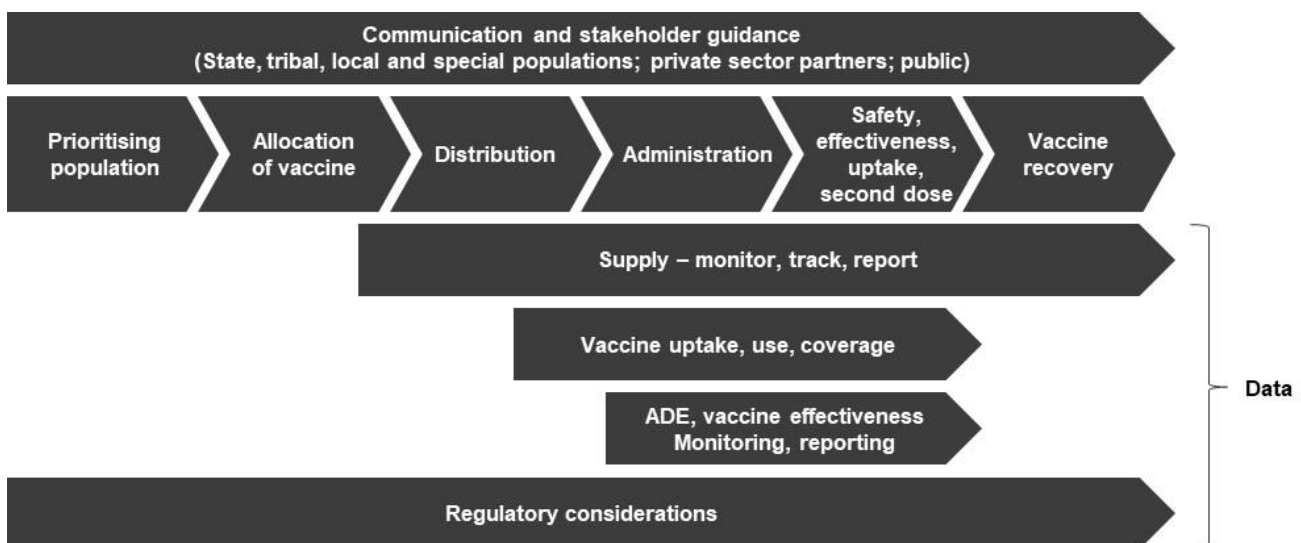
Public health impact relies on rapid, efficient and high uptake of complete vaccine series, with focus on high-risk groups.

Immunisation infrastructure is of the utmost importance at the federal, state and local levels to strengthen vaccination practices in both the public and private sectors. Advancements in health information technology create multiple opportunities for greater access to and utilisation of immunisations among adults. Immunisation information systems, also known as registries, are confidential, population-based, computerised databases that record all immunisation doses administered by participating providers to persons residing within a given area.

Immunisation information systems (IIS)

With the growing use and importance of health information technology, IIS are an essential part of the immunisation infrastructure. IIS are confidential systems that exchange data with electronic health records and allow providers real-time access to comprehensive, consolidated immunisation records for individuals. Improving IIS and integrating them into the healthcare system is critical to expanding access to and utilisation of immunisations, which, in turn, will lead to a healthier future. It helps patients keep track of their vaccination history (preventing both over- and under-vaccination). Immunisation programmes use federal funds to support their IIS. As many as 49 states have IIS, 42 of which maintain immunisation records across the lifespan.

There are many countries providing date for the data for vacancies online, below is a table depicting the same

Number of countries publishing government vacancies online for key regions (2018-2020)
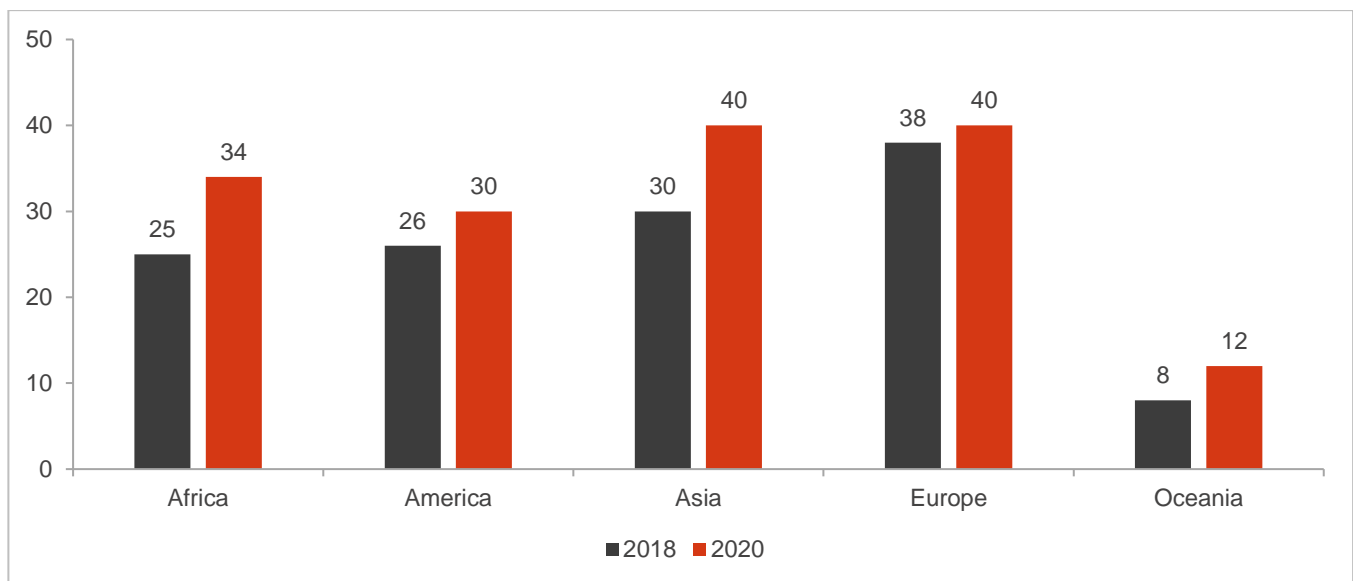
Source: 2018 and 2020 UN e-government surveys

The number of countries publishing government vacancies online rose to 156 in 2020 from 127 in 2018. At the regional level, Europe has the highest proportion of countries recruiting for public positions online (40 of 43 countries), while Africa has the lowest (34 of 54 countries).

Global coverage of Covid-19 vaccination campaigns

The first published reports of Covid-19 vaccinations outside clinical trials occurred on December 13, 2020, in the UK. The rapid development, testing and manufacturing of multiple effective vaccines against SARS-CoV-2 was a

ground-breaking achievement in 2020. Never before has a vaccination campaign started this soon after a new pathogen was identified. In many cases, it took years or decades until a vaccine was developed. In the case of Covid-19, scientists have developed several highly efficacious vaccines within a year. The question now is whether the global rollout of the vaccines can match the speed with which they were developed: whether they can be administered quickly and equitably across the world. To do this, governments and public health officials need to understand the most effective approaches to mass vaccination rollouts and prioritise the administration in a way that minimises morbidity and mortality from the disease.

To help manage the US Covid-19 vaccination programme, the Centers for Disease Control (CDC) and Prevention is using cloud infrastructure and health management applications from Oracle. **Oracle National Electronic Health Records** Cloud will serve as the CDC's central data repository for all vaccination data in the nation.

Microsoft Consulting Services announced the company has developed a vaccine tracking solution of its own. The Vaccination Registration and Administration Solution enables the tracking and reporting of immunisation progress through a secure data exchange that uses industry standards, such as Health Level Seven, Fast Healthcare Interoperability Resources and open application programming interfaces. Health providers and pharmacies can track specific vaccine batches, and health administrators can analyse the results of vaccine deployment in large population groups.

In September 2020, **Salesforce announced Work.com for Vaccines**, a cloud-based platform to manage vaccine inventory and administration, appointment scheduling, notifications and outcome monitoring for health providers and individuals.

Simplus, an Infosys company, built a vaccine management solution on the Salesforce platform that covers campaign management, citizen registration, prioritisation, provider enrolment, supply chain visibility, forecasting, vaccine administration, wellness surveys and adverse event monitoring. Integrated with Salesforce Health Cloud and tapping other Salesforce products and solutions, the Simplus platform serves both individuals and providers. Individuals can find information, register with state and local governments, and schedule vaccine appointments. Providers can apply to become a Covid-19 vaccine provider, manage appointments, maintain inventory, log vaccine administration details, and document adverse effects.

Azure Health Bot released new capabilities and templates for vaccinations to check eligibility for Covid-19 vaccines and provide answers to related questions.

A digital immunisation system of the future

Connecting public, healthcare providers, and public health: simultaneous access to immunisation records

IIS development has focused on meeting the needs of public health officials to calculate coverage rates. Often, this data remains only accessible to public health authorities. A modern IIS should facilitate simultaneous access by the public, healthcare providers and public health, maximising the collection and utilisation of these data. This would be achieved through a set of interoperable systems, rather than a single monolithic system. Each stakeholder (healthcare providers, public health, and individuals) would be using a system specifically designed to meet their workflow.

Needs analysis, hot-spotting, and vaccine messaging to combat vaccine hesitancy

The next generation of IISs will also be an important tool to raise responsiveness for vaccination. More accurate, real-time immunisation coverage data, and the opportunity to conduct enhanced surveillance of IIS data, create a path to address declining immunisation coverage rates and tackle emerging vaccine hesitancy.

Consent directives

With the storage of personal health information and consent for immunisation in an IIS comes the importance of developing processes and procedures to manage consent directives across the various systems. Building suites of interoperable systems has traditionally been challenging. However, the migration to cloud-based platforms will accelerate interoperability and real-time data transmission.

As the immunisation data would exist in several systems simultaneously, clinical terminology standards must be employed. This would preserve data integrity (i.e. this dose of MMR is still the same dose of MMR in each system) while allowing for "viewer customised" terms in each system.

Digital verifiable immunisation receipts

The IISs of the future will have an important role to play in providing patients with the ability to prove that they have received immunisation. Through the course of an individual's life, there may be several instances where one must prove that they have been immunised, like when registering for primary and post-secondary school, starting a new job in certain fields (especially healthcare), and when crossing international borders.

Future IIS will have the capacity to meet the needs of public health officials, healthcare providers and citizens. Such a system will provide real-time, geographical data on immunisation coverage, a more comprehensive assessment of vaccine safety, and higher quality data for vaccine effectiveness assessments. Importantly, it will connect citizens digitally to their healthcare providers and public health officials and permit the creation of lifelong digital immunisation records.

Overview of IT infrastructure for other e-health initiatives

The concept of ICT adoption in healthcare delivery has attracted international initiatives with huge budgets, to bridge the global digital divide with equitable care delivery. e-Health is viewed as a major mechanism of ICT adoption, for proliferating equitable care delivery from palliative, curative to preventive care in the top cities to remote rural areas, especially for developing countries. e-Health delivery to remote locations relies on three major links between patient and care provider.

● Telecommunication infrastructure,

● Back-end computing/storage infrastructure and

● End-User platforms.

National level e-governance healthcare initiatives: India

Initiative	Description
Office automation	
e-office	MoHFW, GoI, has started e-office implementation, comprising the creation of e-files, e-sign, etc., to improve government processes (MoHFW, 2018)

Initiative	Description
Video conference facility	MoHFW, GoI, has started a video conferencing facility in the offices (MoHFW, 2018)
Digital payments	Under Digital India Programme, MoHFW has initiated the digitisation of payments in the health sector (MoHFW, 2018)
Online Services	
National Health Portal	A web portal that acts as a single point of access to authenticate health-related information for citizens of India (MoHFW, GoI, 2016)
e-hospital	A hospital management system for delivery of services, such as patient care, diagnostics, etc., in government hospitals (MoHFW, GoI, 2019)
Online registration system	An Aadhaar-based online registration system for booking an OPD appointment, availing services, such as online diagnostic reports, enquiring blood availability in any government hospital in India (Ministry of Electronics & Information Technology, GoI, 2015)
Food Safety and Standards Authority of India	A website for providing services, such as the issuance of license, product approval, etc., to food business operators (MoHFW, GoI, 2020)
National Organ & Tissue Transplant Organisation	A web portal for registration and retrieval for organ/ tissue transplantation (MoHFW, GoI, 2019)
Central Drugs Standards Control Organisation, "SUGAM"	Single window access to various stakeholders, such as pharmaceuticals, citizens and regulators, for applications and approvals of drugs, vaccines, cosmetic products, medical devices, clinical trials and ethics committee (MoHFW, GoI, 2019)
Mera Aspataal	An initiative to capture patient feedback for the services received at the hospital (MoHFW, GoI, 2020)
PMSMA portal	A web and android-based system with help desk to facilitate Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) programme, covering free of cost ANC care for pregnant women on 9th of each month (MoHFW, GoI, 2018)
Ayushman Bharat-Pradhan Mantri Jan Arogya Yojna Portal	A GoI portal providing information and services related to Pradhan Mantri Jan Arogya Yojna (National Health Authority, GoI, 2018)
Mobile applications and services	
Swasth Bharat (Disease, Lifestyle, First Aid)	An android-based mobile application that provides reliable information related to disease conditions, symptoms, available treatment options, public health alerts, healthy lifestyle, first aid, etc. (MoHFW, GoI, 2016)
NHP Indradhanush : Vaccine Tracker	An android-based mobile application to help parents register and track immunisations of their children under 16 years of age (MoHFW, GoI, 2016)
National health portal directory services	A mobile application providing information related to hospitals and blood banks across Indi a(MoHFW, GoI, 2016)
TB missed call initiative	A Mobile health service by the GoI for providing counselling and treatment to Tuberculosis (TB) patients (MoHFW, GoI, 2016)
Kilkari	GoI mobile initiative that delivers free weekly 72 messages related to pregnancy care, delivery and child care to pregnant women from 2nd trimester until when child is 1 year of age (MoHFW, GoI, 2016)

Initiative	Description
Mera Aspataal	A mobile app to capture patient feedback for the services received at the hospital (MoHFW, GoI, 2020)
National Health Helpline (Doctor on Call)	An initiative to provide free on call healthcare consultation to patients across India by qualified doctors (MoHFW, 2018)
Health information dissemination	
NHP health information kiosks	Health information kiosks are being established in hospitals (so far done in 17 hospitals) for the purpose of disseminating authentic and reliable health related information to the citizens (MoHFW, 2018)
NHP voice web	National Health Portal developed a 24x7 toll free voice web service for sharing authentic health information with citizens (MoHFW, GoI, 2016)
Process automation	
Hospital information system (HIS)	It helps in the automation of hospital processes like patient registration, diagnostics, drugs, treatment, discharge, follow-up etc. It is functional in public health facilities up to CHC level (MoHFW, GoI, 2019)
Drugs and vaccines distribution management system (DVDMS) ('eAushidhi')	It helps in automation of purchase, inventory management and supply of drugs, surgical items and sutures to warehouses of DH,CHC, PHC (MoHFW, GoI, 2019)
eRakt Kosh	An online system for connecting and streamlining the workflow of all the licensed blood banks across the nation (MoHFW, GoI, 2019)
Personal health record management system (PHRMS)	A platform for patients to upload their health data for the purpose of storage, easy access and sharing with doctors for seeking medical advice (Centre for Development of Advanced Computing (C-DAC) 2019)
ANM on Line (ANMOL)	ANMOL is a tablet based application used by ANMs to enter data related to the RCH programme (MoHFW, GoI, 2019)
Service delivery and tracking	
electronic-health management information system (e-HMIS)	A web-based portal functioning across the nation to monitor programmes under National Health Mission (MoHFW, GoI, 2019)
Nikshay	A web-based portal for tracking TB patients and monitoring National TB programme (MoHFW, GoI, 2019)
Mother and child tracking system (MCTS)	A web-based portal for tracking pregnant women and children under 5 years of age (MoHFW, GoI, 2019)
Ayushman Bharat - Health and Wellness Centre (HWC) portal	MoHFW launched a web portal to monitor the delivery of comprehensive primary healthcare (CPHC) services through the health and wellness centres across the nation (MoHFW, GoI, 2019)
CPHC non-communicable disease (NCD) programme	MoHFW, GoI, under the Ayushman Bharat CPHC, is undertaking a population-based NCD programme to screen all individuals above 30 at population level for five non-communicable diseases: hypertension, diabetes, oral, breast and cervical cancers. This solution helps digitise all paper records related to the screening conducted for women and men above 30 years of age (MoHFW, GoI, 2018)
Surveillance and monitoring	
Integrated disease surveillance programme (IDSP) Portal	Web based portal by GoI for disease surveillance in the country under National Health Mission (MoHFW, GoI, 2009)

Initiative	Description
Central dashboard	It is being developed to help monitor key indicators related to various existing and upcoming National health programmes (MoHFW, GoI, 2019)
Regulations and standards	
National Identification Number (NIN) to Health Facilities	Web portal for registration of health facilities in India and assigning them a unique permanent NIN (MoHFW, GoI, 2016)
Metadata and data standards (MDDS)	Health domain MDDS have been developed for bringing interoperability between various health IT applications (MoHFW, GoI, 2019)
Electronic health record (EHR) standards	EHR Standards, notified in 2016 by the GoI, include 35 set of standards for clinical terminology, E-prescription, data encryption, coding, etc.
Online registry of clinical establishments	Web portal for registration of all types of clinical establishments except for armed forces (MoHFW, GoI, 2015)
Capacity building	
Mobile Academy	An initiative to provide free audio courses to train ASHAs on healthcare service delivery intended to improve their knowledge base and communication skills (MoHFW, GoI, 2019)
Training management information system (TMIS)	This system helps in the building capacities of healthcare professionals (MoHFW, GoI, 2019)
National digital literacy mission (NDLM) – DISHA	Under this initiative, IT training will be provided to 52.5 lakh persons, which includes ASHA, Anganwadi workers and authorized ration dealers across the nation(National Institute of Electronics & Information Technology 2015)
Online consultation - Telemedicine	
National Medical College Network (NMCN)	NMCN is being established to link all the medical colleges of the nation for the purpose of establishing e-classrooms, providing tele education, Continuous Medical Education (CME) and building capacities (MoHFW, GoI, 2019)
National Telemedicine Network (NTN)	NTN is being established across the nation connecting health facilities in rural areas (SC, PHC, CHC) with the district hospitals and medical college for providing telemedicine services (MoHFW, GoI, 2019)
SATCOM based telemedicine nodes	Telemedicine nodes are being established at the pilgrimage places for the purpose of providing speciality consultation, screening of diseases and providing preventive care to the devotees (MoHFW, GoI, 2019)

The Ministry of Health in Bangladesh has undertaken an initiative to develop e-health data standards and an interoperability framework for the database systems that have been or will be developed, benefiting not just the Ministry and other government agencies but also development partners, the private sector and civil society organisations.

The role of digital government in Covid-19

ICT plays a vital role in promoting the health and safety of people and keeping economies and societies working during the pandemic situation. Digital government technologies, either through information sharing or online services, have kept governments and people connected. Digital technologies have also enabled governments to make rapid policy decisions based on real-time data and analytics, to enhance the capacities of local authorities for better coordination and deploy evidence-based services to the neediest. The efforts in developing digital

government strategies post-Covid-19 should focus on improving data protection and digital inclusion policies and strengthening the policy and technical capabilities of public institutions. Even though public-private partnerships are essential for implementing innovative technologies, government leadership, strong institutions and effective public policies are crucial to tailor digital solutions to countries' needs and prioritise security, equity and the protection of people's rights. Covid-19 has not only emphasised the importance of technology, but also the pivotal role of an effective, inclusive and accountable government. This policy brief addresses how digital government has played a central role as a key tool of communication and collaboration between policymakers and society during the pandemic. Policymakers need to embrace the future of digital government, even post-Covid-19.

Sharing information

The most basic form of information found on some national portals is some media coverage informing people about the outbreak, travel restrictions, practical guidance on protection, and governmental response. A slightly more advanced way seems to be having a dedicated portal or section about the outbreak—usually with a custom domain name. As the first custodian of related data of Covid-19, governments have also started publishing statistics about the outbreak. These include the total number of cases in a country, total fatalities, as well reporting of cases by jurisdictions. Reliable information from governments helps people make informed decisions about their daily routines, build public trust, enabling public authorities to act decisively to flatten the curve.

Percentage of government portals (UN member states) with Covid-19 information
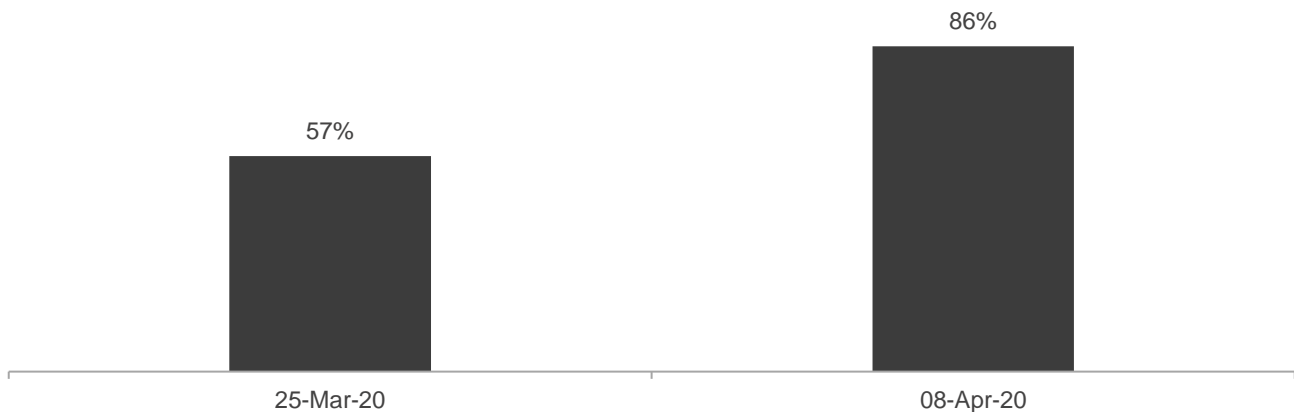
Source: UN DESA

The pandemic has also brought new needs for digital government services and more demand for existing services. Some of which are as under:

● Designing new apps and services to fight against Covid-19

● Digital ID and digital signature

● Taking care of fake news and viral hoaxes

Governments need to provide accurate, useful and up-to-date information to people, particularly during times of crisis. During the pandemic, governments started providing information on their national portals, mobile apps or social media platforms. A review of the national portals of the 193 UN member states showed that by 25 March 2020, 110 countries (57%) have put in place some kind of information on Covid-19, while around 83 countries (43%) did not provide any information. However, further analysis by UN DESA showed that by 8 April 2020, around 86% (167 countries) had uploaded information and guidance about Covid-19 on their portals.

Engaging people

Online engagement initiatives by governments can help people cope with the crisis and improve government operations. In a crisis situation, it becomes crucial reach out to vulnerable groups in society, respond to their needs and ensure social stability. Engaging with civil society allows governments to tackle socio-economic challenges in a more productive way. Involving civil society organisations, businesses, social entrepreneurs, and the general public in managing Covid-19 and its aftermath can prove to be highly effective for policy- and decision-makers.

Government-organised hackathons is one such way of engaging people in finding innovative solutions to economic, social and technological challenges of Covid-19. Public officials, together with software developers, civil society and social entrepreneurs can collectively search for issues and resolutions. For example, lack of medicines and protective medical equipment, shortage of health personnel (i.e., in hospitals or food banks), issue of food hoarding, or deteriorating mental health of people due to social isolation.

Establishing multi-stakeholder partnerships

Governments often lack financial and human resource capabilities to quickly and efficiently develop digital tools during a crisis. Therefore, building partnerships with private technology companies, social entrepreneurs or other national and international organisations, can help governments to use the existing technologies to meet the needs of people and soften the impact of the crisis. Public authorities have started cooperating with a variety of stakeholders during Covid-19. For example, the US government issued a call for action to key industry stakeholders and AI experts to develop new text and data mining techniques that can help the scientific community answer high-priority questions related to Covid-19.

Partnerships between governments, private sector and international organisations can play a crucial role in maintaining services for mission-critical communications and ensuring greater connectivity. The International Telecommunication Union (ITU) has launched a platform to assist national policymakers, regulators and industry stakeholders to ensure that networks are kept resilient and telecommunication services are available to all to prevent further aggravation of digital divides during Covid-19.

Accelerating implementation of innovative digital technologies

Since the crisis has put public services under stress, governments are urged to deploy effective digital technologies. AI-powered technology supported healthcare services, when emergency lines outpaced capacity. Many people have turned to self-checks for symptoms and accessed virtual doctors' through telemedicine to get medical advice. Multilingual chatbots offered solutions in overcoming language barriers, accessing information and communicating with health practitioners. 3D printing technologies are used to produce replacement valves for reanimation devices, and protective medical face shields to address the shortage. Robots and drones have been effective in providing security and sanitation, thus reducing staff exposure to risk. Patrol robots using facial recognition and thermal cameras are deployed at airports and public places to scan crowds and identify potentially infected people. Sterilisation robots equipped with ultraviolet lights have been helpful to disinfect hospitals and contaminated areas. Other robots monitor vital parameters from medical devices or allow patients to communicate remotely with the nurses. Governments are also using drones with similar technologies to monitor streets, deliver medical supplies or disinfect public spaces.

Future

The Covid-19 pandemic is forcing governments and societies to turn toward digital technologies to respond to the crisis in the short term, resolve socio-economic repercussions in the mid-term and reinvent existing policies and

tools in the long term. Governments need to adopt an open approach and use digital communication channels to provide reliable information on global and national Covid-19 developments. E-participation platforms can represent useful tools to engage with vulnerable groups online and establish digital initiatives to collectively brainstorm for policy ideas to critical social and economic challenges. Effective public-private partnerships, through sharing technologies, expertise and tools, can support governments in restarting the economy and rebuilding societies. Developing countries, in particular, will need international cooperation and support in mitigating the crisis. Therefore, regional, national and local project-based collaborations with private sector companies, international organisations and other stakeholders are necessary. In the long term, governments need to accelerate the implementation of innovative digital technologies, such as AI-powered technology, blockchain, and drones. Investments in these technologies can tremendously support the future resilience of the health economy and public services delivery.

Digital government policies in response to Covid-19

Time	Policy action	Digital government response
Short-term	React	● Use digital platforms (such as online portal, social media) for accurate and timely information sharing
		● Lead two-way communication with people and foster e-participation (such as hackathons, brainstorming event)
		● Protect people's privacy and sensitive data and take into consideration unintended consequences of technologies
Mid-term	Resolve	● Form effective multi-stakeholder partnerships (ie, private sector, international organisations, academia) on regional, national and local levels
		● Leverage lessons learned and policy ideas from the ongoing crisis
Long-term	Reinvent	● Invest in innovative technologies (ie, AI, blockchain, robots, drones) to increase resilience of healthcare, the national economy and public services delivery
		● Revisit data protection and privacy legislations along with lessons learned to invest in innovative technologies (ie, AI, blockchain, robots, drones) to increase resilience of healthcare, the national economy and public services delivery

In the long term, governments need to accelerate the implementation of new digital technologies, such as AI, blockchain, and drones. Investments in these technologies can tremendously support the future resilience of the economy by improving the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks (SDG 3: Good Health and Well-Being). However, at the same time, governments need to consider and mitigate the privacy risks and the risks of over-surveillance associated with using new technologies. As the survey has emphasised, achieving sustainable e-government transformation also means following a holistic approach of - analysing the current situation, articulating a shared vision, formulating a common strategy, and monitoring and evaluating its impact.

The pandemic has been an inflexion point in the digital maturity of governments. While the initial efforts to accelerate digital transformation have reaped dividends, governments will need to continue the momentum. This means agencies should adopt a cohesive approach to enhance their digital capabilities. Some of the essential components include the following:

● **Embracing operational adaptability:** Expand the business models that can help the agency adapt and thrive in changing conditions. Rethink the end-to-end organisation structuring and break the silos that affect optimisation

- **Building a flexible and scalable infrastructure:** Leverage cloud computing for scalability and agility in administrative processes

- **Creating intelligent workflows:** Continue to leverage AI and automation to increase efficiency and migrate human resources to higher-value tasks

- **Enhancing infrastructure resilience:** Provide cyber response and resilience to secure infrastructure (network and IT), apps, devices, and data at the centre and the edge. Adopt federated security to manage situational awareness and access points as contexts change

- **Developing digitally savvy, open talent networks:** Support human-machine collaboration to augment the workforce and provide better service delivery. Additionally, inculcate a digital mind set by training and upskilling the workforce

- **Accelerating with control:** Identify key areas of digital transformation. Alternate between improving citizen experience and operational excellence

- **Continuing the momentum:** Use the experience of agility for continued digital transformation

The crisis has illustrated that it is impossible for societies to ignore technological advancements, as they are continuing to change business models and people's everyday lives. Policymakers should seize the Covid-19 crisis as an opportunity to establish tailor-made digital government tools, strategies and collaborations for the future. Embracing e-government and harvesting the digital opportunities amplified by the pandemic holds the potential to support the long-term sustainable development of all UN member states.

Major solution providers in e-governance and government IT infra space

Companies	Details	Service/offerings
Akal Infosys	Aims at improving processes and public administration services under the e-governance plan and digital India mission. Its e-governance services aim at uniting information, processes, people and technology for achieving good governance. AKAL has a track record of delivering time-bound 'mission critical' projects, with robust expertise in providing software application development, back-end support and system integration	- Direct benefit transfer - Financial assistance - Public distribution systems - Dashboards - Payment gateways - Accreditation programs - Grievance redressal - Recruitment solutions - Licensing solutions - Real-estate management - Trade fair management - Loan management
Protean	Protean eGov Technologies Ltd. has played a pioneering role in laying down the basic infrastructure for e-Governance in the country by enabling the government to unleash the untapped.	- System integration 360-degree technology solutions - Solution architecture - Software-as-a-Service - Managed services
Vee Technologies	Offers e-governance services that simplify processes for governments, their citizens and various business/interest groups by implementing IT solutions for simple, transparent, moral and accountable governance. Delivers services that offer easy access and	- Aadhaar enrolment - Scanning and digitisation - Document management systems - Financial inclusion - System integration - Online and offline examinations

Companies	Details	Service/offerings
	provides necessary information quickly and efficiently	• Manpower service provider • Digital India platform • Android-based mobile applications • Survey implementation • Smart card implementation • National Public Registration (NPR) – UPPCL & MPPKVVCL • Electric meter reading, bill generation and serving through SBM/mobile apps
e-Zest	Offers a wide spectrum of services and solutions in e-governance. It has expertise in delivering solutions enriched with the highest standards of usability, flexibility, and scalability. The major areas of expertise include police, social and rural services, agriculture, EWS services, etc.	• Web- and mobile-based e-governance solutions • Employee appraisal system across multiple states/departments • Portfolio management solution • Government health and family services solutions • Workflow management systems Performance tracking and management solutions • Education university model for e-governance
Silver Touch Technologies	Being an IT solution provider and software development company in India, it immensely contributes in the implementation and rollout of e-governance initiatives. It assists government interactions with citizens (G2C), businesses (G2B), employees (G2E), and helps the government to co-ordinate internally (G2G)	• e -Aadhaar • e-KYC • MyGov • Open Data • Digi Locker • e-Office • e-Hospital • e-District • Passport Seva
SGS South Africa (Pty) Ltd.	It has portfolio of innovative services for governments, international institutions and partner organizations across the public and private sectors covers a variety of verification and technology based solutions.	• Customs management system o Customs processing o Transit and presentation o Classification o Electronic communication and document printing • Inland revenue and sales tax systems to foreign exchange control (CEPECS) • facilitate international trade, valuation services such as ValiTrade and ValuNet, monitoring tools such as TransitNet and NGO benchmarking

Although e-governance is gaining momentum in India, public awareness and digital divide remain crucial issues. The success of e-governance measures largely depends on the availability of high-speed internet, and the nation-wide roll-out of 5G technology.

15   Overview of competitive landscape

For the peer comparison section, CRISIL Research has considered companies with similar offering and are operating in same line of business and having certain similar products as Protean eGov Technologies Ltd.

Details of key players considered and respective business geographies

Company Name	Registered Office	Incorporated year	Business geographies
CDSL ventures Ltd.	Mumbai, India	2006	India
CMS computer Ltd.	Mumbai, India	1980	India
Computer Age Management Services (CAMS) Ltd.	Chennai, India	1988	India
CSC e-governance services Ltd.	Delhi, India	2009	India
Karvy data management services Ltd.	Hyderabad, India	2008	India
Kfin technologies Pvt Ltd.	Hyderabad, India	2017	India, Canada, USA, Oman, India, Malaysia, United Kingdom, UAE, Maldives, Singapore, Australia, Hong Kong, Philippines, and Bahrain
Protean eGov Technologies Ltd.	Mumbai, India	1995	India
Sify technologies Ltd.	Chennai, India	1995	India, North America, the United Kingdom and Singapore.
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	Mumbai, India	1993	India

Source: Company websites, CRISIL Research

Product offering by key players considered

Offerings	NPS CRA	PAN Card issuance/ verification	Aadhaar Authentication / E-KYC	Certifying authority for E-sign	GST suvidha provider	Aadhaar Enrolment	Others	Total revenue in million (FY20)
CDSL ventures Ltd.	✖	✖	✖	✔	✔	✖	RTA activity, National academic repository, CKYC processing etc.	668
CMS computer Ltd.	✖	✖	✖	✖	✖	✔	Energy management solutions, Media & broadcasting solutions, surveillance and work force solutions, transportation and traffic solutions	2,553
Computer Age Management Services (CAMS) Ltd.	✖	✖	✔	✖	✖	✖	Mutual fund services, transfer agency services, customer care services, distributor services, Electronic payment collection services, Insurance services etc.	7,206
CSC e-governance services Ltd.	✖	✖	✔	✖	✖	✔	G2C services, Election Commission Services, Digital literacy and other educational	11,362

Offerings	NPS CRA	PAN Card issuance/ verification	Aadhaar Authentication / E-KYC	Certifying authority for E-sign	GST suvidha provider	Aadhaar Enrolment	Others	Total revenue in million (FY20)
							services, services under Financial Inclusion, Healthcare services, Skill Development, and other B2C services	
Karvy data management services Ltd.	✖	✖	✔	✖	✖	✖	Liability product services, Asset product services, Credit card services, Business support services, System Integration, Digitisation services, Surveys etc.	3,977
Kfin technologies Pvt Ltd.	✔	✖	✖	✖	✖	✖	Corporate registry, Mutual fund services, global business services, Private wealth management, Alternate investment fund services etc.	4,553
Protean eGov Technologies Ltd.	✔	✔	✔	✔	✔	✖	System integration, Business process re-engineering, Solution architecture, Data centre coalition, IT consulting, Vidya Laxmi (loan application platform), Vidyasaarathi (scholarship application platform) Account aggregator	7,546
Sify technologies Ltd.	✖	✖	✖	✔	✖	✖	Network services, Data centre coalition, Migration services, cloud services, Web portal solutions etc.	23,253
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	✖	✔	✖	✖	✖	✔	Medical bill processing, Mutual fund distributor, Agency services, project management services, IT infrastructure services etc.	3,581

Source: Company filings, company website, CRISIL Research

Operational Overview of key competitors

Company	Business details	
CDSL ventures Ltd. (CVL)	CVL is a wholly owned subsidiary of Central Depository Services Limited (CDSL) India. CVL is the first KYC registration agency (KRA) appointed by SEBI to provide common KYC services to investors in capital markets.	As of Mar' 20, the company generates 80% of its revenues from KRA services for capital market investors
CMS computer Ltd. (CCL)	CCL is engaged in providing IT support for government utility services, e governance solutions, energy management solutions, surveillance and workforce solutions, smart city projects, maintenance and facility management services for biometric attendance systems, supply of traffic controllers, EMS, kiosk and technology support for broadcasting and media business.	As of Mar'20, the company has generated 90% of its revenues from of sale of services.
Computer Age Management Services (CAMS) Ltd.	CAMS is one of the registrar and transfer agency in Indian mutual fund segment. Other services of CAMS include data processing, customer care, insurance repository services, KYC, software license and development & support services.KYC process is done through CAMS Investor Services Private Limited (subsidiary) which is licensed for storing, safeguarding and retrieval of KYC documents	As of Mar'20, company generates 79% of revenues from data processing services and 9% of revenues from customer care services
CSC e-governance services Ltd.	CSC E-governance services Ltd. is special purpose vehicle established by the Ministry of Electronics & IT, India for the implementation of CSC (Common Service Centers) scheme in India. The company majorly engages with government bodies, public entities, Banks, Insurance companies to provide wide range of services through its CSCs	As of Mar'20, CSC generates 22% of revenues from its Digi seva portal, 17% from internet service provider segment and 15% of financial inclusion and digipay segment
Karvy data management services Ltd.	Incorporated in, Karvy Data Management Services Ltd. (KDMSL) is a subsidiary of Karvy stock broking limited. The company provides integrated business and knowledge process services. The company renders its services across various industries such as banking & finance, E-governance, contact center and record management.	Karvy KRA KYC services is provided by Karvy Data Management System.
Kfin technologies Pvt Ltd.	Kfin Technologies Private limited (formerly known as Karvy fintech private limited) was formed through amalgamation of Karvy Computershare Private Limited (KCPL) with demergered entity of Karvy consultants Limited.	The company acts as Central Record Keeping agency (CRA) for National Pension System (NPS) where it performs services like maintaining records, administration and customer service
Protean eGov Technologies Ltd.	The company closely works with Central/ State Government, Financial and non-financial entities, regulating bodies in the country to provide e-governance solutions. The company acts as Central Record keeping Agency (CRA) for NPS and is issuer of PAN cards. Other than mentioned, company also	As of Mar'20, the company generates 80% of its revenues from transaction fees and rest 20%

Company	Business details	
	derives revenue from other areas of business such as Tax Information Network (TIN), Aadhaar authentication and E-kYC, certifying authority (CA) for e-sign etc. The major focus of international projects lie in following sectors – Identity, Authentication, Education, Taxation, Pension and social security.	constitutes revenue from account maintenance fees and others
Sify technologies Ltd.	Sify Technologies is an ICT company providing end to end ICT solutions including telecom services, data center services, cloud & managed services, transformation integration services and application integration services. Through its Safescrypt data security solution, company act as certifying authority (CA) in e-sign ecosystem.	As of Mar'20, company generates 92% of its revenues from sale of services
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	UTIITSL was formally known as UTI technology services limited (UTI TSL) UTIITSL is one of the largest financial service provider in India providing Register and Transfer services to investors in mutual fund AMC. In addition to that primary activities of company include printing PAN cards on behalf of Income Tax department under Government of India and acting as a Medical Bill processing agency for CGHS, ESIC, etc.	As of Mar'20, the company generates 69% of the revenue from PAN processing for central board of direct taxes (CBDT)

Source: Company websites, Annual Reports, Company filings, CRISIL Research

Total Aadhaar Enrolments

Registrar	Total Enrolments by registrar (In million)	% share
CSC e-Governance Services India Limited	193	15%
Registrar General India ECIL	113	9%
Dena Bank	106	8%
Registrar General India BEL2	92	7%
Protean eGov Technologies Ltd.	91	7%

Note:
- Above mentioned data is as per 26th August 2021
- % share is a represents share of specific registrar among total enrolments

Source: Aadhaar Dashboard, CRISIL Research

Transactions by AUA

AUA	Total transactions (In million)	% share
Protean eGov Technologies Ltd.	634	1.1%

Note:

- Above mentioned data is as per 26th August 2021
- Total transactions include transactions made by Protean eGov Technologies Ltd. and Protean eGov Technologies Ltd. CeG Karnataka
- % share is representation among all the AUAs present in the segment

Source: Aadhaar Dashboard, CRISIL Research

Transactions by KUA

KUA	Total transactions (In Million)	% share
Protean eGov Technologies Ltd.	135	1.4%

Note:

- Above mentioned data is as per 26th August 2021
- Total transactions include transactions made by Protean eGov Technologies Ltd. and Protean eGov Technologies Ltd. CeG Karnataka
- % share is representation among all the KUAs present in the segment

Source: Aadhaar Dashboard, CRISIL Research

Key observations:

- Protean eGov Technologies Ltd. ranked fifth amongst 239 registrars of UIDAI in terms of cumulative number of Aadhaar Enrolments as of 26th August 2021

- Protean eGov Technologies Ltd. occupies 1.1% share among cumulative number of transactions done by AUAs as of 26th August 2021

- Protean eGov Technologies Ltd. has been involved at multiple nodes of the Aadhar value chain starting from enrolments to digital transactions creating digital public infrastructure and providing enabling solution to the Aadhar ecosystem

Protean eGov Technologies Ltd. occupies 1.4% share among cumulative number of transactions done by KUAs as of 26th August 2021

Overview of key e-governance projects by key Indian IT consulting players

Company	Salient projects
Tata Consultancy Services (TCS)	• Under private public partnership (PPP) model, TCS has executed passport services where in it sets up and manages Passport Seva Kendras (facilitation centres), IT and non-IT infrastructure, end-to-end core passport application, networking, portal, data centre, and disaster recovery operations for government of India. This project was executed under build-operate-own-transfer (BOOT) framework • For Government of Telangana, India, TCS has provided an end-to-end IT application suite to manage the state run health insurance scheme called Aarogyasri • TCS has developed a fully integrated taxation system for Uganda Revenue authority (URA) through its DigiGov tax solution. This is generalised solution which includes registration, payments, audits, accounting for tax payer, debt collection etc.
Infosys Limited	• Infosys public services (IPS) a foreign arm of Infosys has been granted a contract to modernise and automate public services and procurement Canada (PSPC) for the purchase of various goods and services through a single portal • IPS has created a new sourcing model for flexible healthcare staffing provider based out of UK to meet the rising demand for flexible worker requirement at NHS England in the wake of pandemic. • Infosys public services has developed a new customer-centric carrier registration, licensing and performance monitoring system for Ministry of transportation Ontario (MTO) which helps in automating the processes and easier access to information
Wipro Limited	• Wipro has developed has end-to-end case management to manage parole applications which provides offenders details, comprehensive view of records, report, review and assessment through its "offender 360" solution • Wipro through its Desktop as a Service VirtuaDesk solution helped the large government entity in UK to virtualise its desktops and half of its laptops to improve performance, scalability leading to uninterrupted operations
Protean eGov Technologies Ltd.	• Tax Information Network (TIN) was setup by Protean eGov Technologies Ltd. acting as consolidated tax ledger for tax payers. As a part of this, company has created Online Tax Accounting System (OLTAS) where banks can upload tax collection details on a daily basis • The company also deals in accepting and processing of PAN card applications over online as well as through its TIN facilitation centres or PAN centres across India.

Source: Company websites, CRISIL Research

Volume of NPS subscribers for key competitors in the segment (May 2021)

Entity Name	Number of subscribers (In million)	Share (%)	Asset under Management (In Rs. Billion)	Share (%)
Protean eGov Technologies Ltd.	42	99%	6,040	99%
Kfin technologies Pvt. Ltd.	0.4	1%	34	1%

Note:
- *Protean eGov Technologies Ltd. and Kfin technologies Pvt. Ltd. are the only two players operating the NPS CRA segment*
- *Values mentioned are consolidated as of 31st May 2021*

Source: Industry sources, CRISIL Research

Cumulative volume of authentications for key competitors (ASA/KSA) in the segment (3rd July 2021)

Entity Name	Authentications (In million)	% share
National Payments Corporation of India (NPCI)	18,060	32.6%
National Informatics Centre (NIC)	14,210	25.6%
Bharat sanchar nigam limited (BSNL)	4,613	8.3%
CSC e-governance services Ltd.	3,151	5.7%
Bharati Airtel	2,342	4.2%
Protean eGov Technologies Ltd.	2,335	4.2%
Computer Age Management services Ltd.	152	0.3%
Karvy data management serives Ltd.	59	0.1%

Note:
- *Aadhaar authentications are consolidated as of 3rd July 2021*
- *% share is representation among all the ASA/KSAs present in the segment*

Source: Aadhaar Dashboard, CRISIL Research

Market share of annual allotment of PAN cards
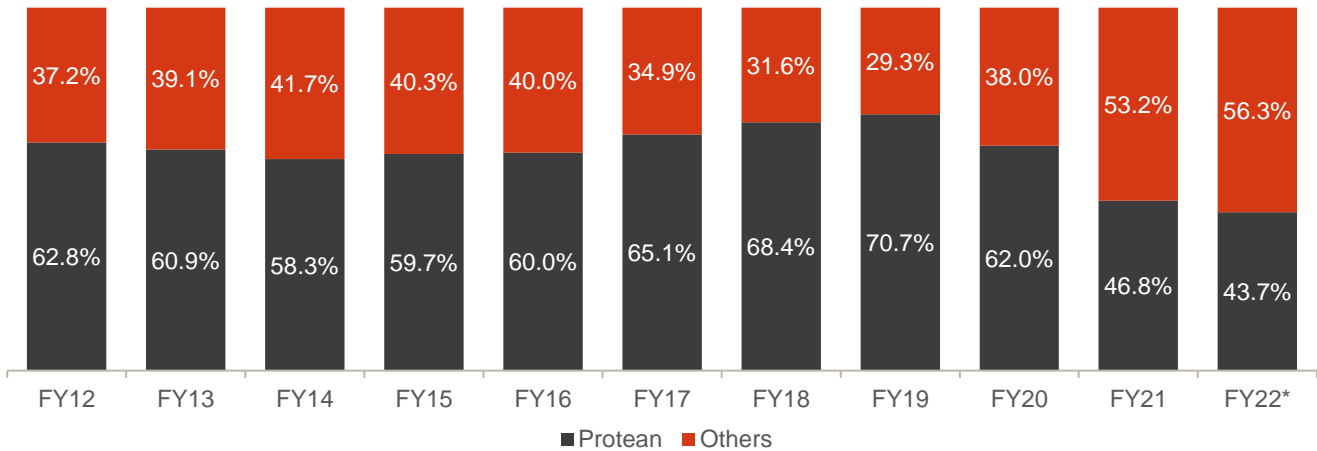
Chart data:

	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22*
Others	37.2%	39.1%	41.7%	40.3%	40.0%	34.9%	31.6%	29.3%	38.0%	53.2%	56.3%
Protean	62.8%	60.9%	58.3%	59.7%	60.0%	65.1%	68.4%	70.7%	62.0%	46.8%	43.7%

■Protean ■Others

*Only till May 2021
Source: Company documents, CRISIL Research

Key observations

- Protean eGov Technologies Ltd. is market leader in NPS CRA segment occupying a market share of 97% in terms of NPS subscribers and 99% in terms of NPS AUM in fiscal 2021

- Protean eGov Technologies Ltd. has a leading market share in provision of e-governance services such as management of the Tax Information Network, PAN processing and NPS where the company had a market share of 60%, 46.8% and 97%, respectively, in fiscal 2021

- Protean eGov Technologies Ltd. have been identified by the GoI to manage the Atal Pension Yojana under NPS

- Between the period December 2020 and May 2021 (both inclusive), Protean eGov Technologies Ltd. has handled average of 26.7 million NPS CRA transactions per month (consisting of NPS regular, NPS lite and APY transactions)

- Of the 29 ASAs present in the authentication segment, Protean eGov Technologies Ltd. occupied sixth place in terms of authentications performed as of 3rd July 2021

- Among the 56 billion cumulative Aadhaar authentications performed as of 3rd July 2021, Protean eGov Technologies Ltd. occupies a share of 4.2%

- From FY12 to FY21, Protean eGov Technologies Ltd. has processed higher number of PAN applications than its sole competitor in the PAN segment, UTIITSL. As of 31st May 2021, of the new PAN applications processed, Protean eGov Technologies Ltd. has occupied a share of 43.7% with others (UTIITSL and instant PAN) occupying rest of share. Protean eGov Technologies Ltd. is a market leader in PAN applications industry

- During the fiscal year 2021, Protean eGov Technologies Ltd. has processed average of 74,126 new PAN applications per month

- Protean eGov Technologies Ltd. is among the few private players in India in e-governance space working toward Digital India initiative and has undertaken multiple large scale projects ranging such as Tax Information Network, Online Tax Accounting System (OLTAS), PAN card issuance, NPS CRA, Protean GST ASP and GSP services,

Aadhaar issuance, Aadhaar authentication and e-KYC services, National Judicial Reference System, Revenue Management System. Most of the projects listed above are unique and critical in terms of impact they create while serving the population of the country highlighting Protean eGov Technologies Ltd.'s potential in conceptualising, and building large-scale IT infrastructure. The company also has presence in other sector offerings such as Vidya Lakshmi, Vidyasaarathi, Data center co location services.

- The new areas the company to planning to explore include Education and skilling, Cyber security, Public Finance Management, Financial Services & Customer on-boarding, Agritech, Healthcare, Mobility, Payments, and Digital marketplace.

- Presence in multiple sectors and working for large scale e-governance projects as highlighted above makes Protean eGov Technologies Ltd. one of the key IT-enabled solution companies in the country.

Financial Overview of key competitors

Operating income of key players considered

| Operating income (Rs. Million)	Type	FY17	FY18	FY19	FY20	CAGR
CDSL ventures Ltd.	Standalone	243	367	429	557	32%
CMS computer Ltd.	Consolidated	2,336	2,320	2,344	2,493	2%
Computer Age Management Services (CAMS) Ltd.	Consolidated	4,783	6,415	6,936	6,996	14%
CSC e-governance services Ltd.	Consolidated	NA	5,537	9,202	10,989	NA
Karvy data management services Ltd.	Standalone	4,031	7,053	7,533	3,825	-2%
Kfin technologies Pvt Ltd.	Consolidated	NA	NA	1,587	4,406	NA
Protean eGov Technologies Ltd.	Standalone	6,166	8,982	7,598	7,168	5%
Sify technologies Ltd.	Consolidated	18,432	20,686	21,547	23,049	8%
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	Standalone	2,303	3,379	2,920	3,233	12%

Note:

Apart from providing e-sign services, SIfy technologies is also involved in business of data centers and cloud management services, managed security services, network centric services, digital services other than e-sign (as of Mar'20, 92% of revenues are from services)

NA: Not Applicable

Highlighted in red are top 3 companies wrt to operating income in FY20 among the players listed above

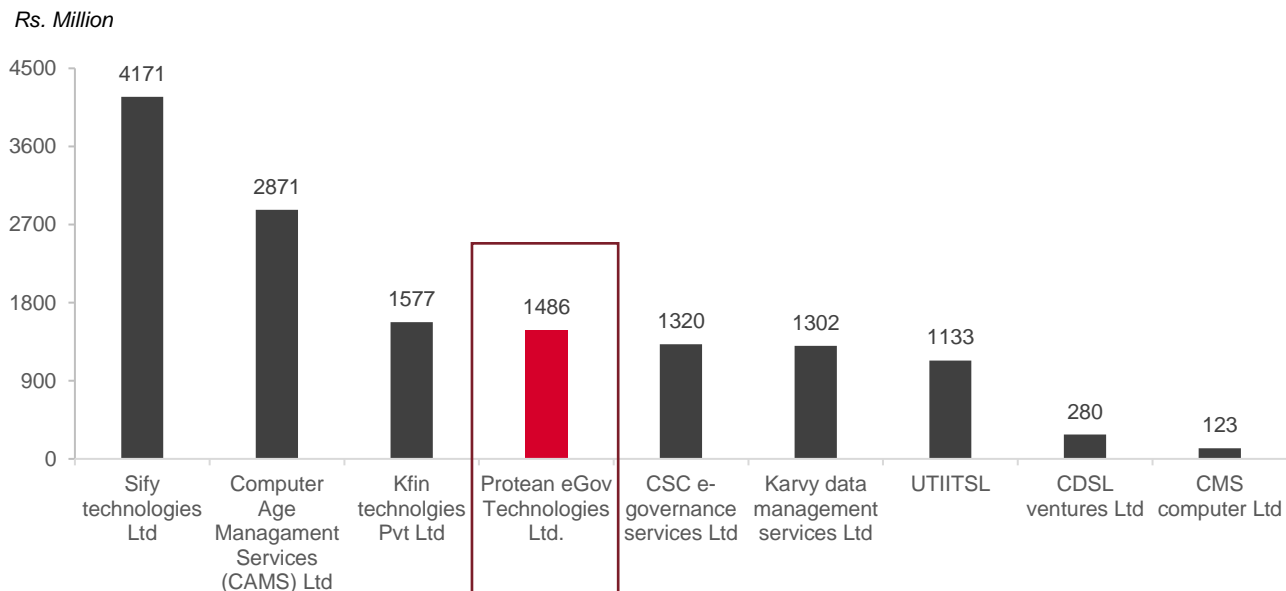*Source: Company filings, CRISIL Research*

Operating income for key players considered (FY20)
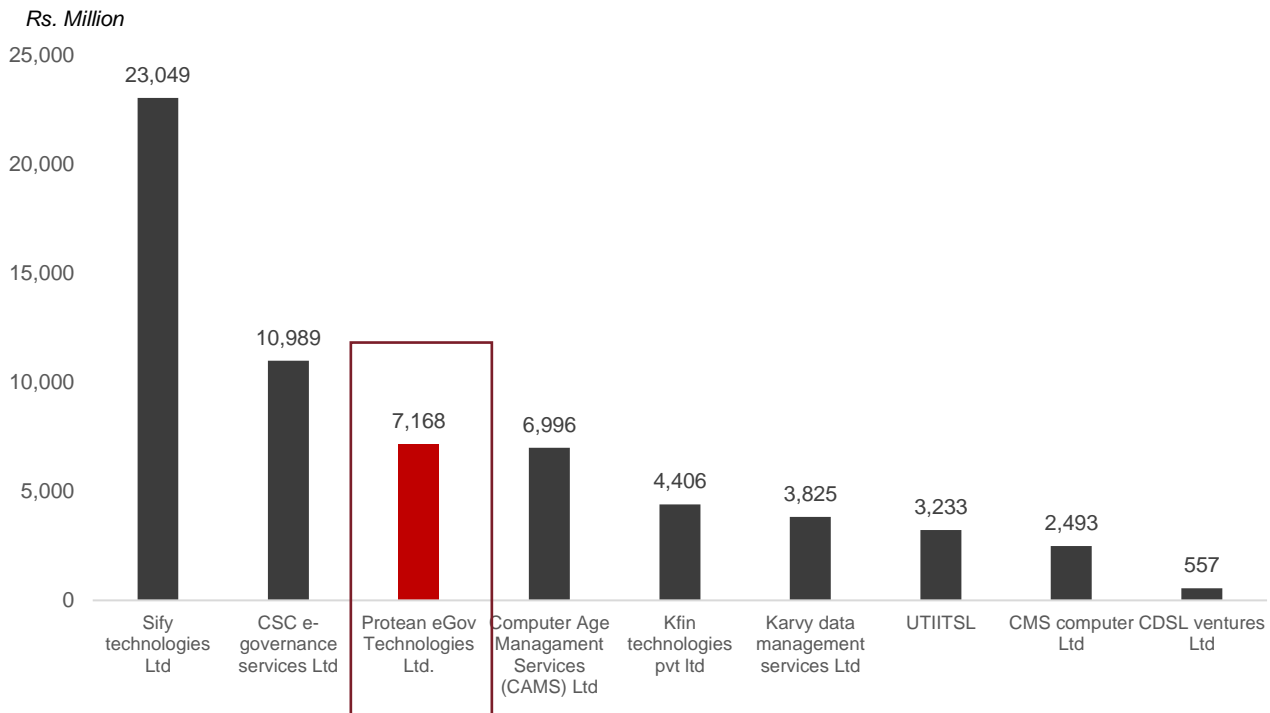
Rs. Million

Note: Apart from providing e-sign services, SIfy technologies is also involved in business of data centers and cloud management services, managed security services, network centric services, digital services other than e-sign (as of Mar'20, 92% of revenues are from services)

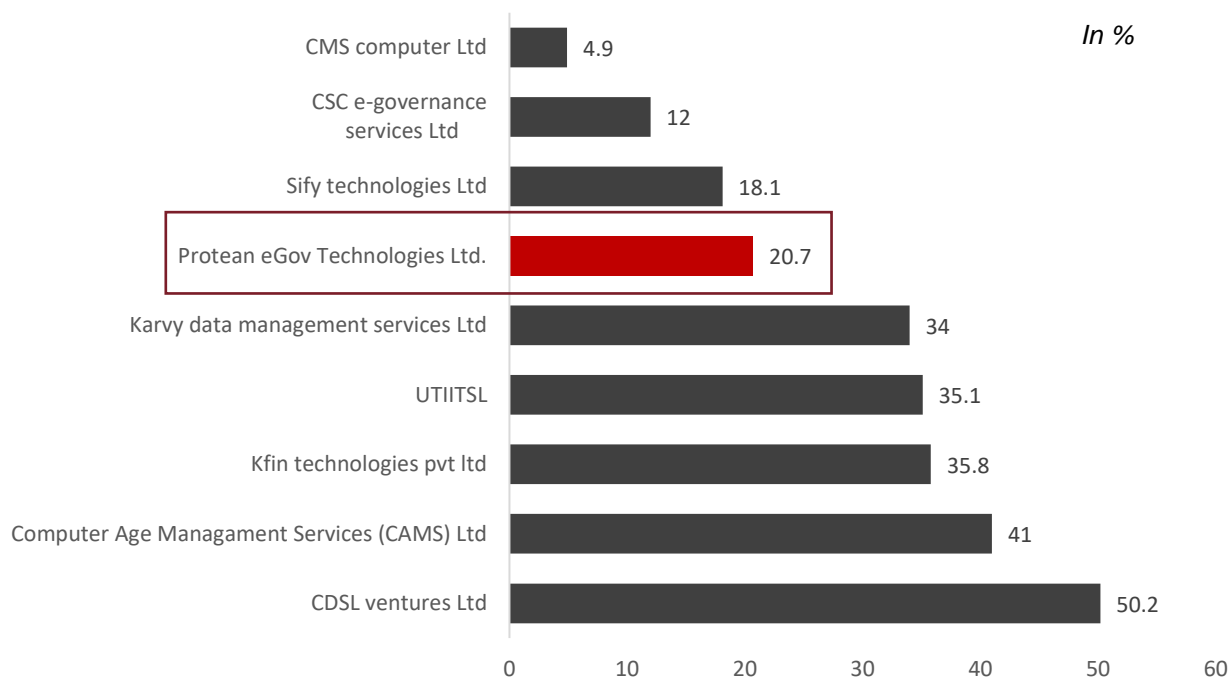Source: Company filings, CRISIL Research

Operating profit for key players considered (FY20)

Rs. Million

Note: Apart from providing e-sign services, SIfy technologies is also involved in business of data centers and cloud management services, managed security services, network centric services, digital services other than e-sign (as of Mar'20, 92% of revenues are from services)

Source: Company filings, CRISIL Research

Operating profit margin for key players considered (FY20)

293

In %

EBITDA (Rs Million) for key players

EBITDA (Rs Million)	Type	FY17	FY18	FY19	FY20	CAGR
CDSL ventures Ltd.	Standalone	236	329	367	390	18%
CMS computer Ltd.	Consolidated	84	187	452	202	34%
Computer Age Management Services (CAMS) Ltd.	Consolidated	2105	2547	2357	3045	13%
CSC e-governance services Ltd.	Consolidated	NA	1350	2266	2825	N.A
Karvy data management services Ltd.	Standalone	1035	1591	1760	1450	12%
Kfin technologies Pvt Ltd.	Consolidated	NA	NA	630	1647	N.A
Protean eGov Technologies Ltd.	Standalone	1899	2072	2009	1864	-1%
Sify technologies Ltd.	Consolidated	2839	3171	3334	4365	15%
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	Standalone	824	1408	1243	1399	19%

Note: N.A: Not Applicable. Highlighted in red are top 3 companies reporting highest EBITDA in FY20 among the players listed above

EBITDA (Rs Million) for key players (FY20)

Rs. Million
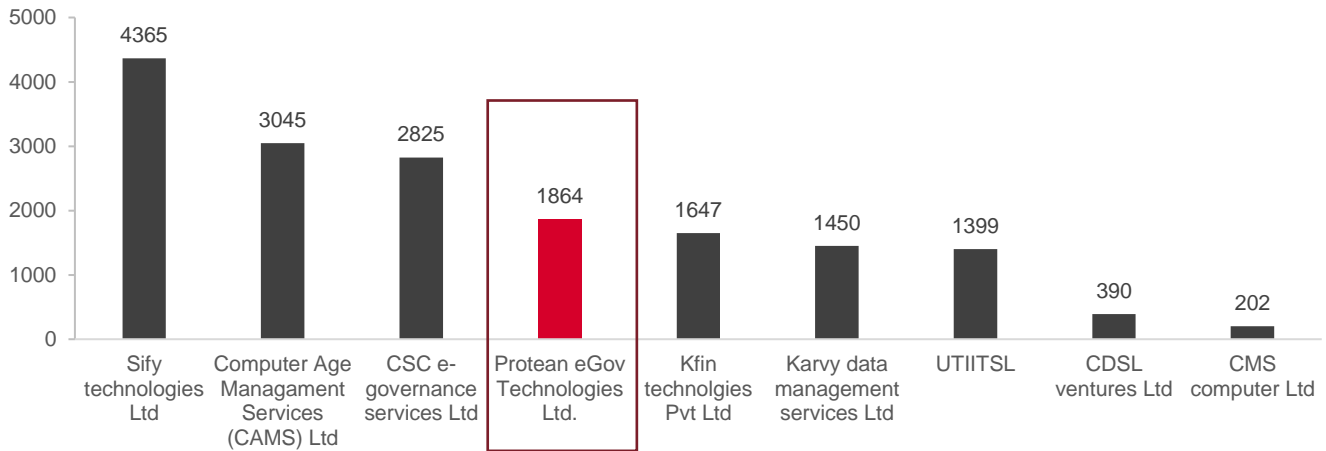
Source: Company filings, CRISIL Research

EBITDA margin (%) for key players

EBITDA Margin (%)	Type	FY17	FY18	FY19	FY20
CDSL ventures Ltd.	Standalone	79%	77%	71%	58%
CMS computer Ltd.	Consolidated	4%	8%	17%	8%
Computer Age Management Services (CAMS) Ltd.	Consolidated	42%	39%	33%	42%
CSC e-governance services Ltd.	Consolidated	NA	22%	22%	23%
Karvy data management services Ltd.	Standalone	26%	22%	23%	36%
Kfin technologies Pvt Ltd.	Consolidated	NA	NA	39%	37%
Protean eGov Technologies Ltd.	Standalone	30%	22%	25%	25%
Sify technologies Ltd.	Consolidated	15%	15%	15%	19%
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	Standalone	33%	39%	39%	40%

Note:

Higher EBITDA margins for CDSL ventures are due to lower costs resulting in higher OPBDIT

N.A: Not Applicable

Highlighted in red are top 3 companies reporting highest EBITDA margin in FY20 among the players listed above

Source: Company filings, CRISIL Research

EBITDA margin (%) for key players (FY20)
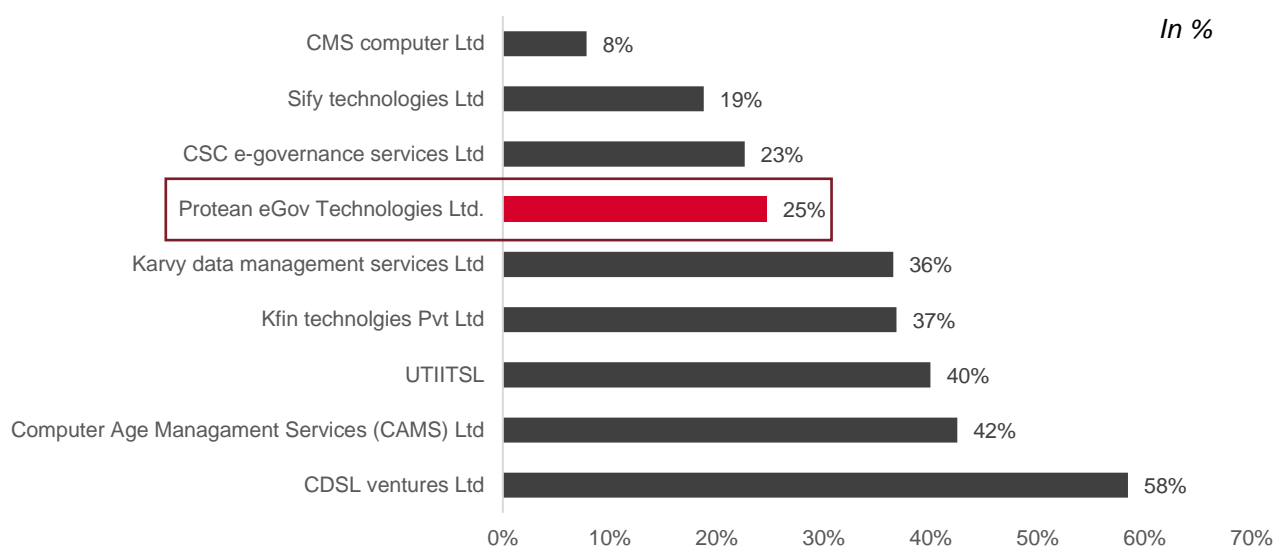
Source: Company filings, CRISIL Research

Profit After Tax (PAT) of key players considered

Profit after Tax (Rs. Million)	Type	FY17	FY18	FY19	FY20	CAGR
CDSL ventures Ltd.	Standalone	175	242	273	282	17%
CMS computer Ltd.	Consolidated	6	63	326	105	167%
Computer Age Management Services (CAMS) Ltd.	Consolidated	1,271	1,497	1,352	1,719	11%
CSC e-governance services Ltd.	Consolidated	NA	464	730	946	NA
Karvy data management services Ltd.	Standalone	232	303	333	164	-11%
Kfin technologies Pvt Ltd.	Consolidated	NA	NA	85	59	NA
Protean eGov Technologies Ltd.	Standalone	1,217	1,355	1,245	1,212	-0.1%
Sify technologies Ltd.	Consolidated	642	923	1069	705	3%
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	Standalone	524	991	469	975	23%

Note:

High CAGR for CMS computer Ltd. is due to lower base effect associated with negative non-operating income for the period FY17
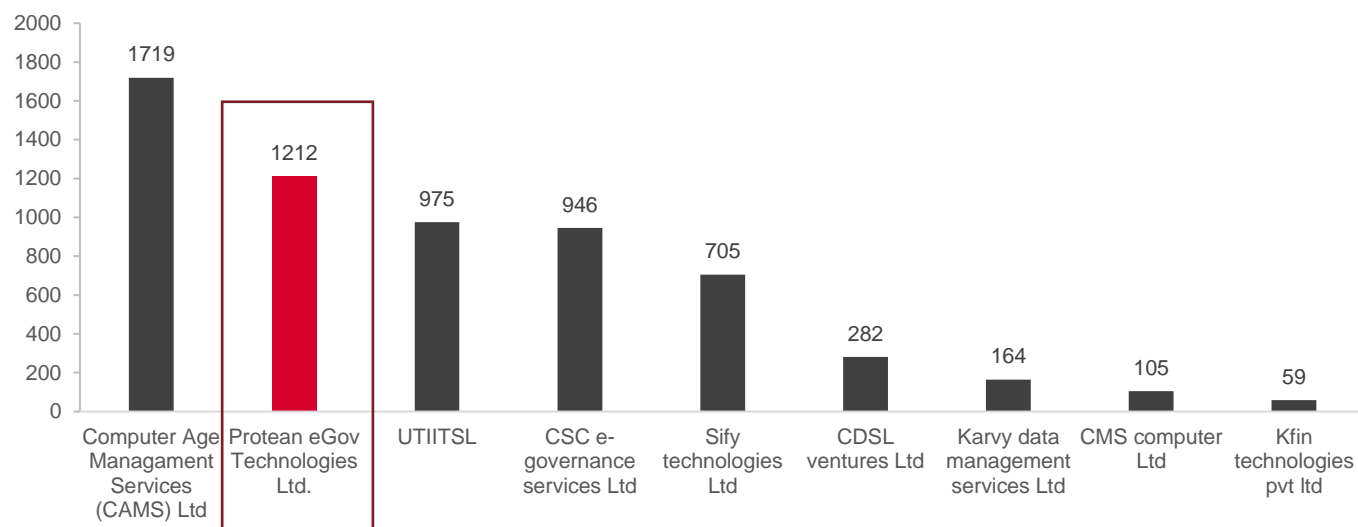
NA: Not Applicable

Highlighted in red are top 3 companies reporting highest PAT in FY20 among the players listed above

Source: Company filings, CRISIL Research

Profit After Tax (PAT) for key players considered (FY20)

Rs. Million

Source: Company filings, CRISIL Research
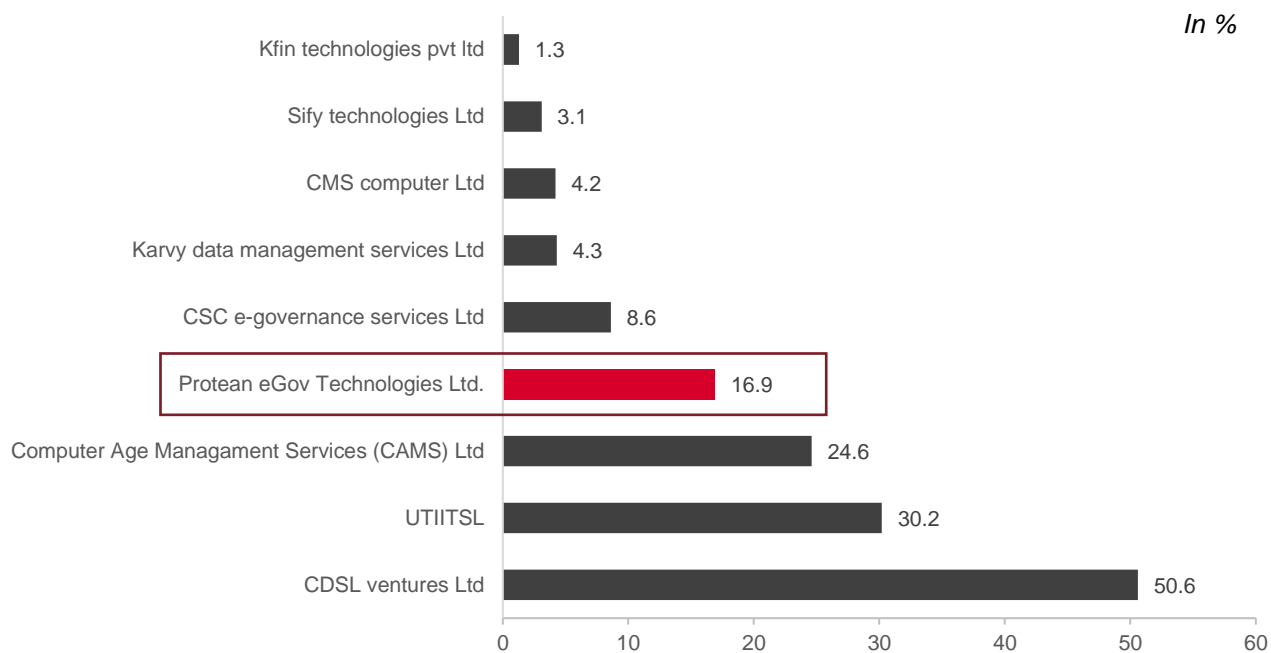
PAT margin (%) of key players considered

PAT margin (%)	Type	FY17	FY18	FY19	FY20
CDSL ventures Ltd.	Standalone	72	66	64	51
CMS computer Ltd.	Consolidated	0.2	3	14	4
Computer Age Management Services (CAMS) Ltd.	Consolidated	27	23	20	25
CSC e-governance services Ltd.	Consolidated	NA	8	8	9
Karvy data management services Ltd.	Standalone	6	4	4	4
Kfin technolgies Pvt Ltd.	Standalone	NA	NA	5	1
Protean eGov Technologies Ltd.	Standalone	20	15	16	17
Sify technologies Ltd.	Consolidated	4	5	5	3
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	*Standalone*	*23*	*29*	*16*	*30*

Note: Lower PAT margin for CMS computer Ltd. in FY17 is due to negative non-operating income leading to decline in PAT

Highlighted in red are top 3 companies reporting highest PAT margin in FY20 among the players listed above

Source: Company filings, CRISIL Research

PAT margin for key players considered (FY20)

In %

Company	PAT margin
Kfin technologies pvt ltd	1.3
Sify technologies Ltd	3.1
CMS computer Ltd	4.2
Karvy data management services Ltd	4.3
CSC e-governance services Ltd	8.6
Protean eGov Technologies Ltd.	16.9
Computer Age Managament Services (CAMS) Ltd	24.6
UTIITSL	30.2
CDSL ventures Ltd	50.6

Note: CDSL ventures Ltd. has higher PAT margin than operating margin for FY20 due to increase in provisio *In %* *red tax causing increase in PAT*

Source: Company filings, CRISIL Research

Return on Capital Employed (ROCE) of key players considered

ROCE (%)	Type	FY17	FY18	FY19	FY20
CDSL ventures Ltd.	Standalone	29	32	28	23
CMS computer Ltd.	Consolidated	2	5	15	6
Computer Age Management Services (CAMS) Ltd.	Consolidated	55	51	70	74
CSC e-governance services Ltd.	Consolidated	NA	76	50	46
Karvy data management services Ltd.	Standalone	17	19	16	11
Kfin technologies Pvt Ltd.	Consolidated	NA	NA	28	37
Protean eGov Technologies Ltd.	Standalone	44	38	30	23
Sify technologies Ltd.	Consolidated	9	11	11	11
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	Standalone	31	45	20	32

Note: NA: Not Applicable

Highlighted in red are top 3 companies reporting highest ROCE in FY20 among the players listed above

Source: Company filings, CRISIL Research

ROCE for key players considered (FY20)

In %
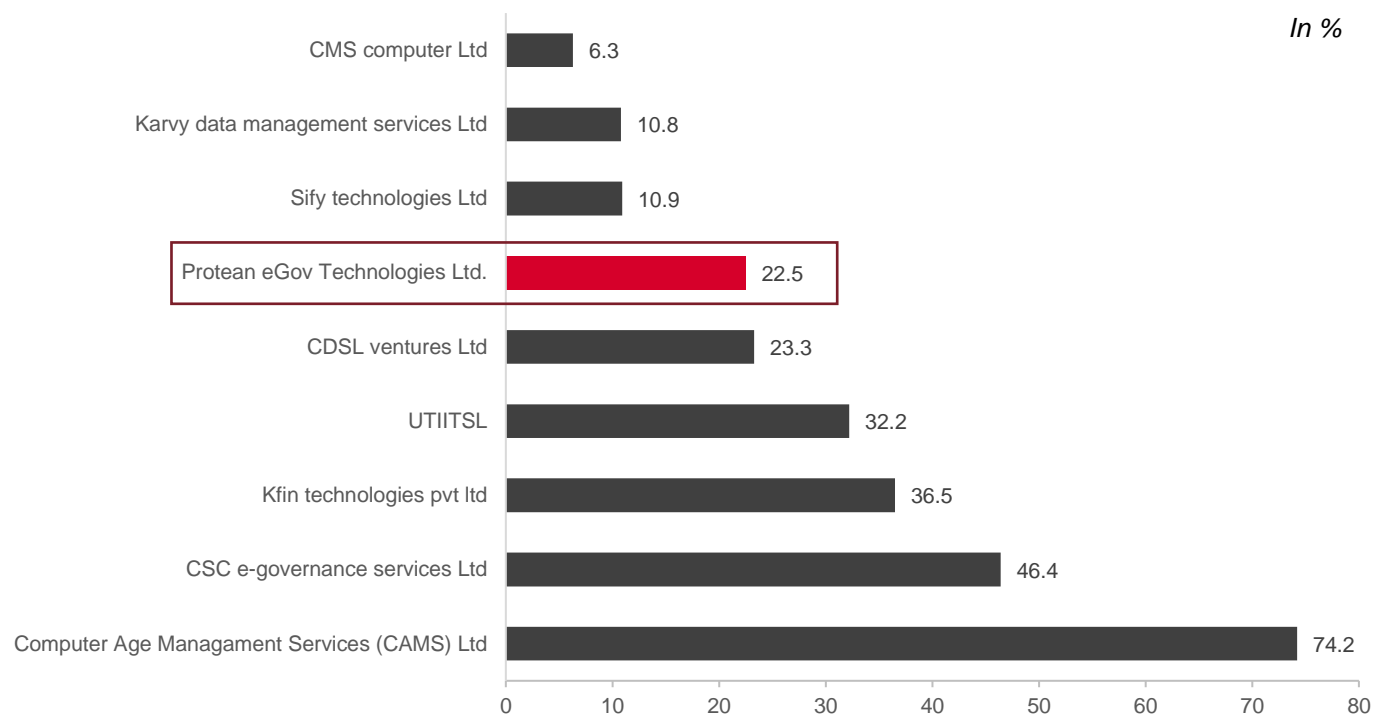
Source: Company filings, CRISIL Research
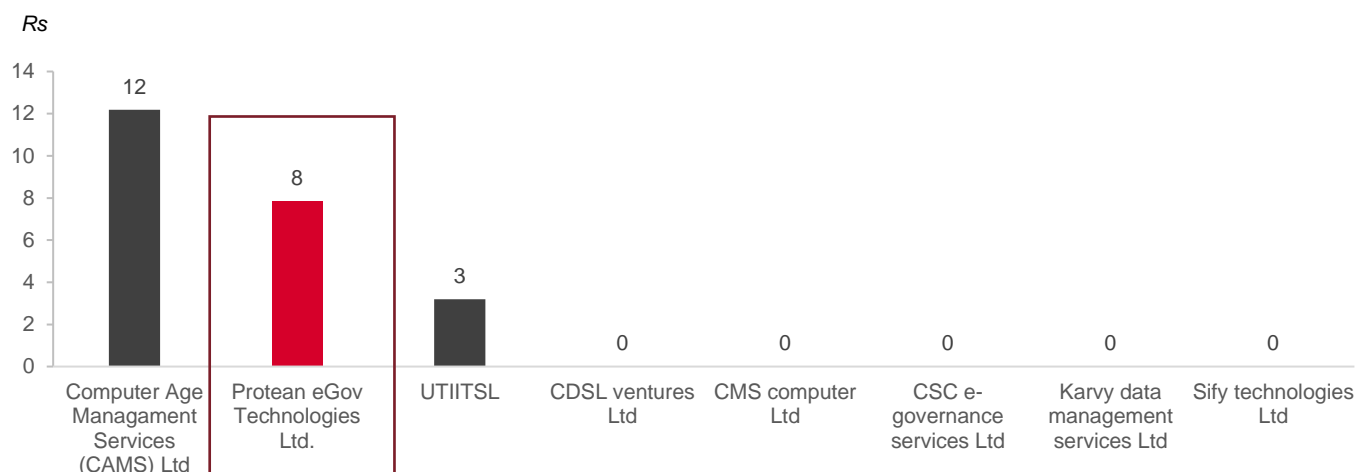
In %

Dividend per Share of key players considered

Dividend / Share		FY17	FY18	FY19	FY20
CDSL ventures Ltd.	Standalone	0	0	0	0
CMS computer Ltd.	Consolidated	0	0	0	0
Computer Age Managament Services (CAMS) Ltd.	Consolidated	13.2	15.0	22.5	12.2
CSC e-governance services Ltd.	Consolidated	0.0	60.0	60.0	0.0
Karvy data management services Ltd.	Standalone	0	0	0	0
Kfin technolgies Pvt Ltd.	Consolidated	N.Ap	N.Ap	N.Ap	N.Ap
Protean eGov Technologies Ltd.	Standalone	7.8	7.8	7.8	7.8
Sify technologies Ltd.	Consolidated	1.0	1.0	1.2	0.0
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	Standalone	2.5	2.5	2.6	3.2

Note: NA: Not Applicable

Highlighted in red are top 3 companies reporting highest dividend per share in FY20 among the players listed above

Source: Company filings, CRISIL Research

Dividend per share for key players considered (FY20)

Source: Company filings, CRISIL Research

Payout ratio of key players considered

Payout ratio		FY17	FY18	FY19	FY20
CDSL ventures Ltd.	Standalone	0%	0%	0%	0%
CMS computer Ltd.	Consolidated	0%	0%	0%	0%
Computer Age Managament Services (CAMS) Ltd.	Consolidated	51%	49%	81%	35%
CSC e-governance services Ltd.	Consolidated	NA	4%	3%	0%
Karvy data management services Ltd.	Standalone	0%	0%	0%	0%
Kfin technolgies Pvt Ltd.	Consolidated	NA	NA	NA	NA
Protean eGov Technologies Ltd.	Standalone	26%	23%	25%	26%
Sify technologies Ltd.	Consolidated	28%	19%	20%	0%
UTI Infrastructure Technology and Services Ltd. (UTIITSL)	Standalone	15%	8%	17%	10%

Note: NA: Not Applicable

Highlighted in red are top 3 companies reporting highest dividend per share in FY20 among the players listed above

Source: Company filings, CRISIL Research

Payout ratio for key players considered (FY20)

In %

Chart: Payout ratio for key players considered (FY20):
- Sify technologies Ltd — 0%
- Karvy data management services Ltd — 0%
- CSC e-governance services Ltd — 0%
- CMS computer Ltd — 0%
- CDSL ventures Ltd — 0%
- UTIITSL — 10%
- Protean eGov Technologies Ltd. — 26%
- Computer Age Managament Services (CAMS) Ltd — 35%
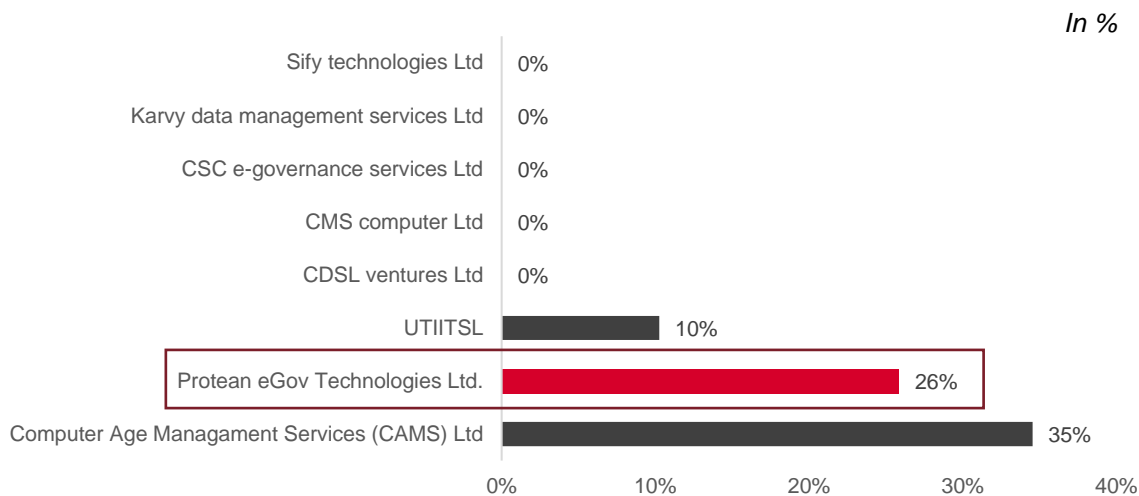
Source: Company filings, CRISIL Research

Key Observations:

- As of fiscal 2020, Protean eGov Technologies Ltd. has recorded an operating income of Rs 7,168 million. Among the peers compared above, Protean eGov Technologies Ltd. stands third in terms of operating income (only next to Sify technologies Ltd. and CSC e-governance services Ltd.) during the same period.

- In terms of Profit After Tax (PAT), Protean eGov Technologies Ltd. has recorded PAT of Rs 1,212 million for fiscal 2020. Among the peers compared above, for fiscal 2020, Protean eGov Technologies Ltd. stands second in terms of PAT only next CAMS Ltd., during the same period.

- As of fiscal 2020, Protean eGov Technologies Ltd. has recorded an operating profit of Rs 1,486 million. Among the key players considered above, Protean eGov Technologies Ltd. stands fourth only next to sify technologies, CAMS Ltd. and Kfin technologies Ltd.

- During the fiscal 2020. Protean eGov Technologies Ltd. has an operating profit margin of 20.7% and PAT margin of 16.9%. Among the peers compared above, Protean eGov Technologies Ltd. stands 6th in terms of operating profit margin and 4th in terms PAT margin for fiscal 2020.

- Protean eGov Technologies Ltd. reported Return of Capital Employed (ROCE) of 22.5% for the fiscal 2020.

- As of fiscal 2020, Protean eGov Technologies Ltd. has recorded an EBITDA profit of Rs. 1,864 Million. Among the key players considered Protean eGov Technologies Ltd. stands fourth only next to sify technologies, CAMS Ltd. and CSC e-governance services Ltd.

- During the fiscal 2020, Protean eGov Technologies Ltd. has an EBITDA margin of 25%. Among the peers compared above, Protean eGov Technologies Ltd. stands 6th in terms of EBITDA margin.

- In terms of dividend per share, in fiscal 2020, Protean eGov Technologies Ltd. (Rs. 7.8 dividend/ share) stood second after CAMS Ltd. (Rs. 12.2 dividend/ share)

- As of fiscal 2020, Protean eGov Technologies Ltd. has recorded payout ratio of 26%. Among the key players considered above Protean eGov Technologies Ltd. stood second with 26% payout ratio after CAMS Ltd. which recorded a payout ratio of 35% in fiscal 2020

# 16 Introduction to the agritech industry in India

16.1 An overview of the sector's contribution to the economy

Agriculture plays a vital role in the Indian economy. The sector plays a significant role in rural livelihoods, employment and national food security. Agriculture contributes around one-sixth of the gross domestic product (GDP) and provides employment to over 40% of the total workforce. It is also an important part of internal and external trade, positioning India as a significant agricultural exporter, with the sector contributing over 10% to India's exports. The sector also impacts non-agricultural segments, such as consumer products, retail, chemicals and e-commerce, which are dependent on agricultural cash crops for raw material (tea, coffee, cotton, jute, sugarcane, oilseeds).

The agriculture and allied sector's gross value added (GVA) at current prices grew at CAGR of 10.7% during fiscals 2012 to 2020 and at constant 2011-12 prices it grew at a CAGR of 3.4% during fiscals 2012 to 2020. The contribution of agriculture to the GVA at constant prices saw a steady decline, decreasing from 18.5% in fiscal 2012 to 14.8% in fiscal 2020, due to relatively higher growth performance of non-agricultural sectors such as real estate, hospitality and other services. Indian agriculture broadly comprises farming (crops and horticulture) and forestry, livestock (milk, eggs, meat) and fisheries.

The agribusiness ecosystem comprises the business activities performed from farm to fork, covering the entire value chain, from the supply of agricultural inputs, the production and transformation of agricultural products, and their distribution to final consumers. Indian agribusiness remains largely unorganised and unstructured, with the presence of multiple levels of intermediaries and middlemen across the agriculture value chain. The production part of the value chain remains highly fragmented and unorganised, with small and marginal farmers as the primary providers of food and nutrition to the country

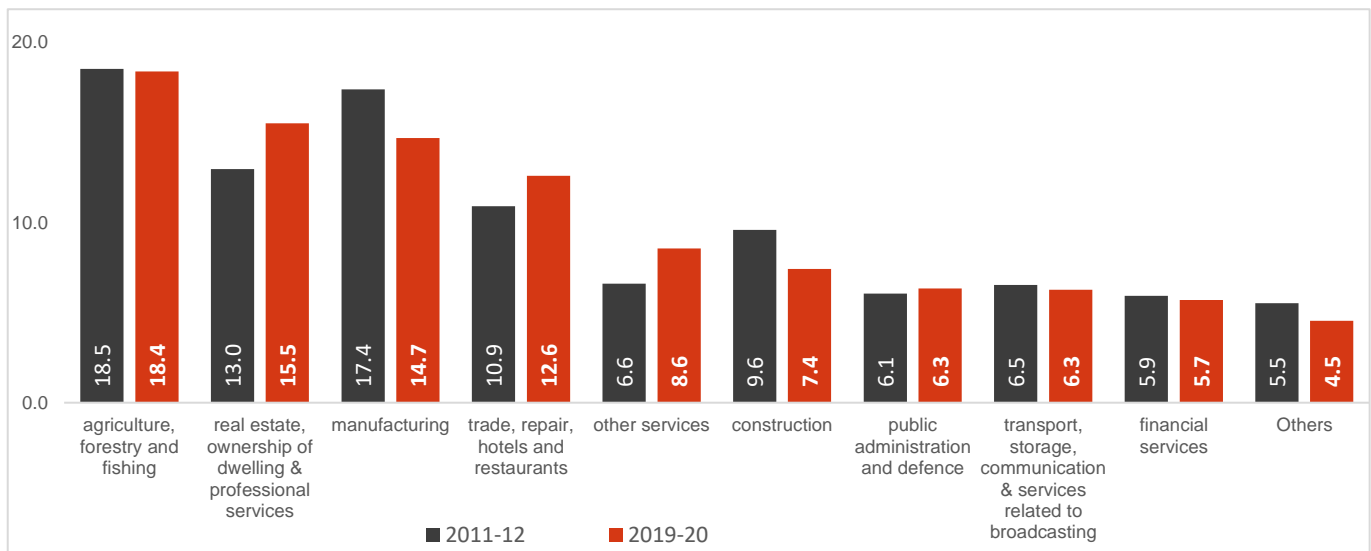**GVA (at constant 2011-12 prices) and GVA contribution**
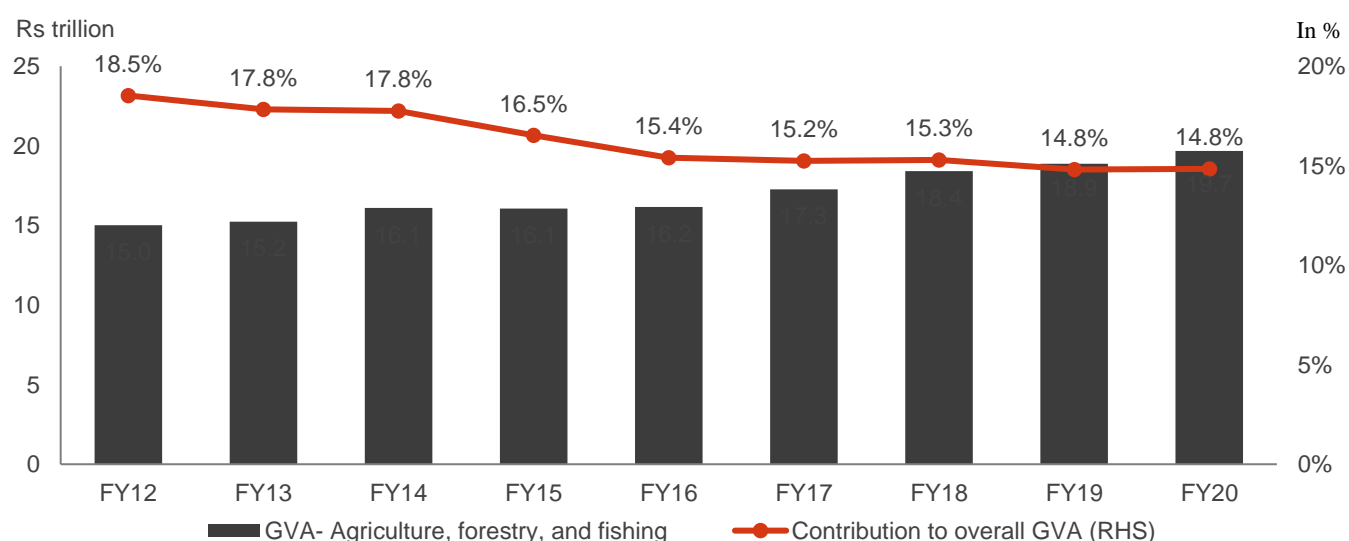
Source: MOSPI

Agriculture sector is highest contributor to GVA at current prices
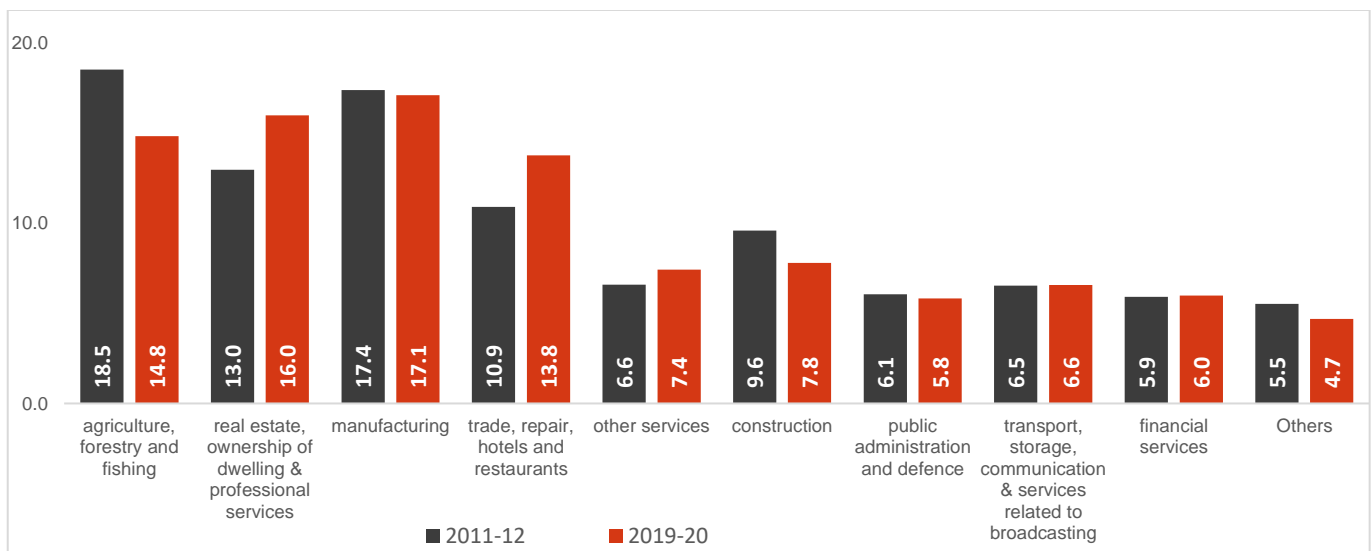
The contribution of agriculture to the GVA at current prices was stable from 18.5% in fiscal 2012 to 18.4% in fiscal 2020. Agriculture sector was consistently the largest contributor to GVA at current prices from fiscal 2012 to 2020. Food articles have seen a wholesale price inflation of 5.4% during fiscal 2012 and fiscal 2021, pushing up the current price contribution of overall agriculture sector in GVA.

Contribution of various sector to GVA at current prices

Source: MOSPI, CRISIL Research

Contribution of various sector to GVA at constant 2011-12 prices

Source: MOSPI, CRISIL Research

GVA growth comparison (at constant 2011-12 prices)

In %

Legend:
- Agriculture,forestry, and fishing GVA growth
- Overall GVA growth

Data points (Agriculture, forestry, and fishing GVA growth): FY13: 1.5%, FY14: 5.6%, FY15: -0.2%, FY16: 0.6%, FY17: 6.8%, FY18: 6.6%, FY19: 2.6%, FY20: 4.3%

Data points (Overall GVA growth): FY13: 5.4%, FY14: 6.1%, FY15: 7.2%, FY16: 8.0%, FY17: 8.0%, FY18: 6.2%, FY19: 5.9%, FY20: 4.1%
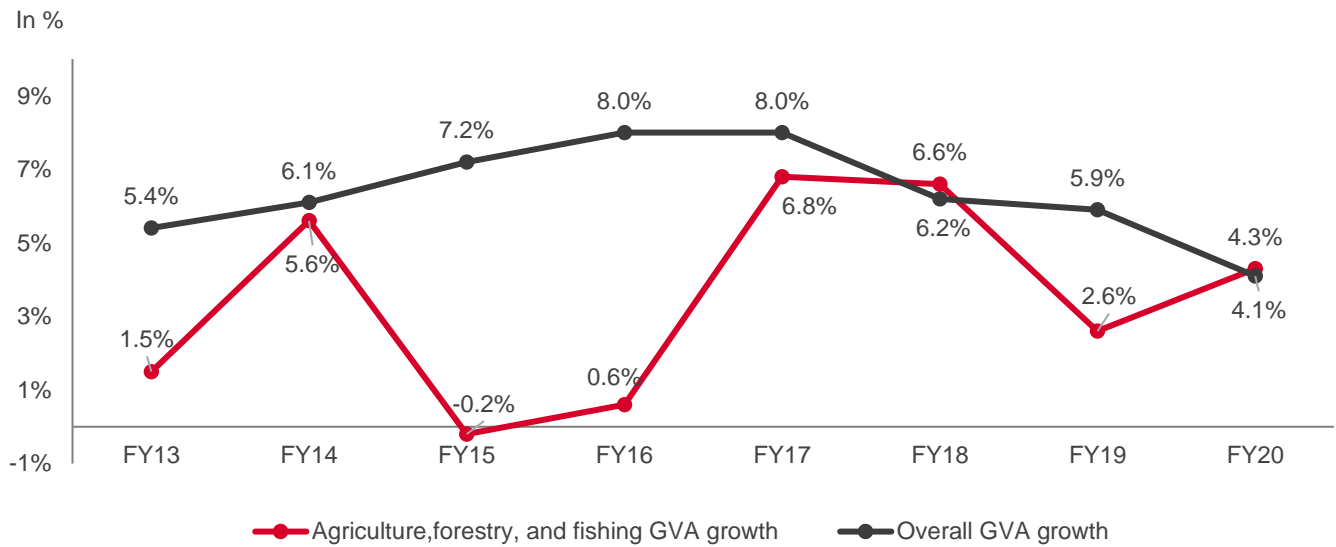
Source: MOSPI, CRISIL Research

India has major contribution of agriculture sector to GDP as compared to global average (constant prices)

In %

India: 2010: 17.0%, 2011: 17.2%, 2012: 16.8%, 2013: 17.1%, 2014: 16.8%, 2015: 16.2%, 2016: 16.4%, 2017: 16.6%, 2018: 16.0%, 2019: 16.7%, 2020: 18.3%

World: 2010: 3.7%, 2011: 3.7%, 2012: 3.6%, 2013: 3.7%, 2014: 3.6%, 2015: 3.5%, 2016: 3.5%, 2017: 3.4%, 2018: 3.3%, 2019: 3.5%, 2020: NA

Legend: India, World
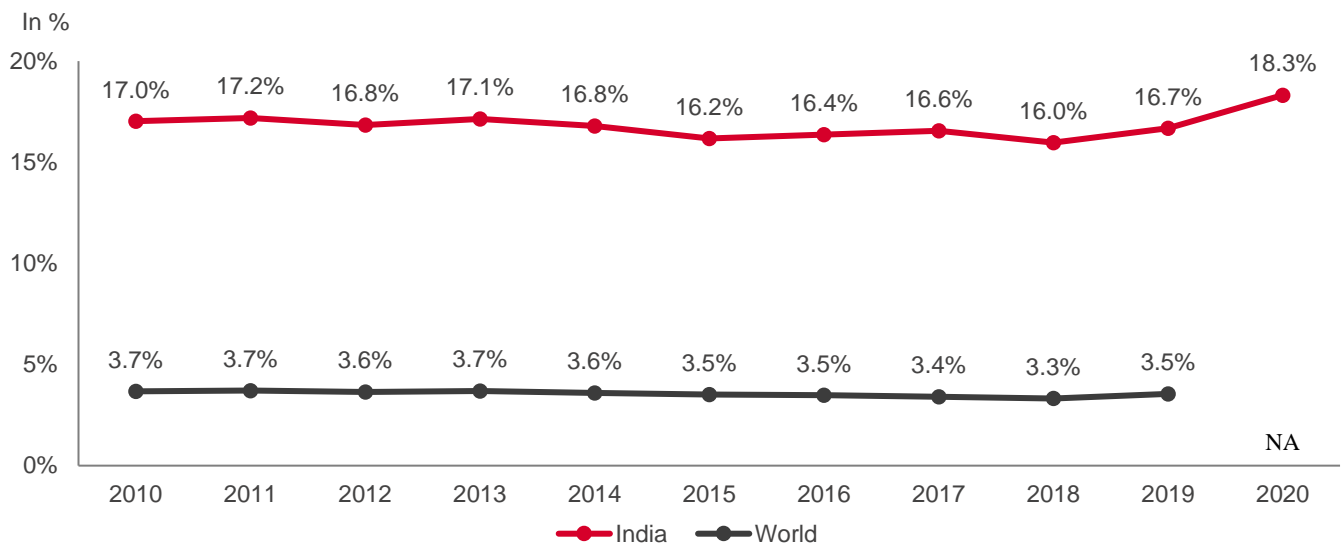
Source: World Bank

India's agrarian culture and varied regional climate have significantly contributed to the global demand of agricultural produce. Agriculture export saw a CAGR of 11.6% in the last decade. The share of agricultural export in the overall export also improved from 10.0% in FY10 to 11.4% in FY20.

Agricultural export and contribution to overall exports has increased
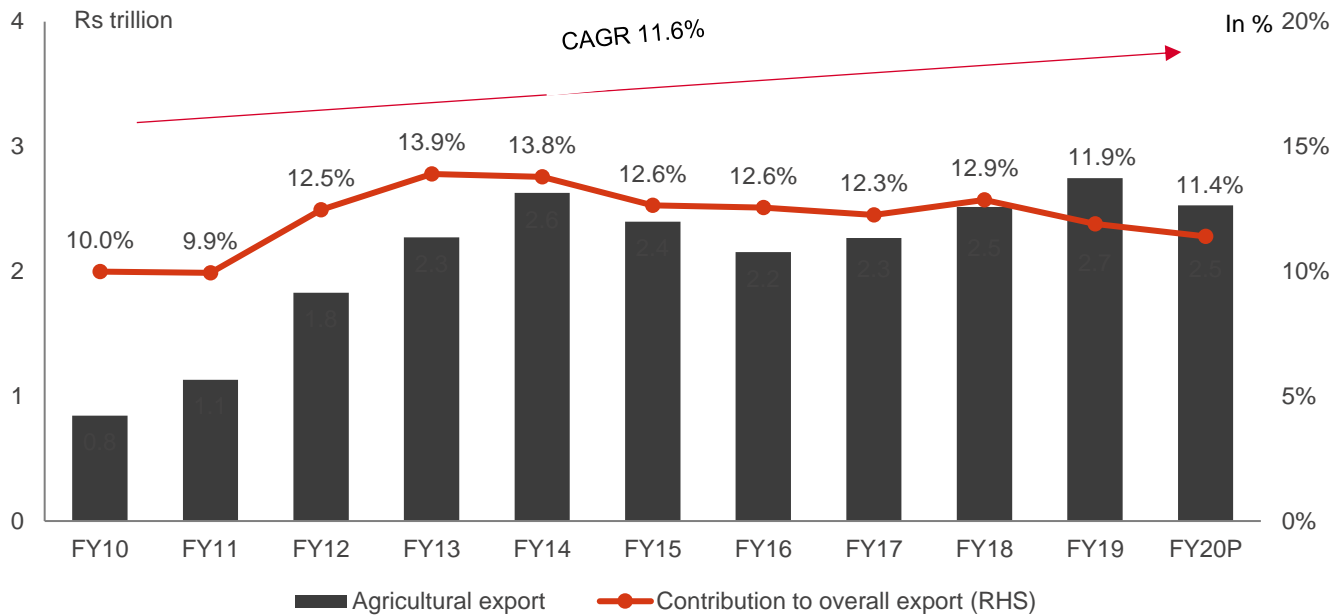
P: Provisional
Source: Agricultural Statistics, 2020

Employment generation (% of total employment)
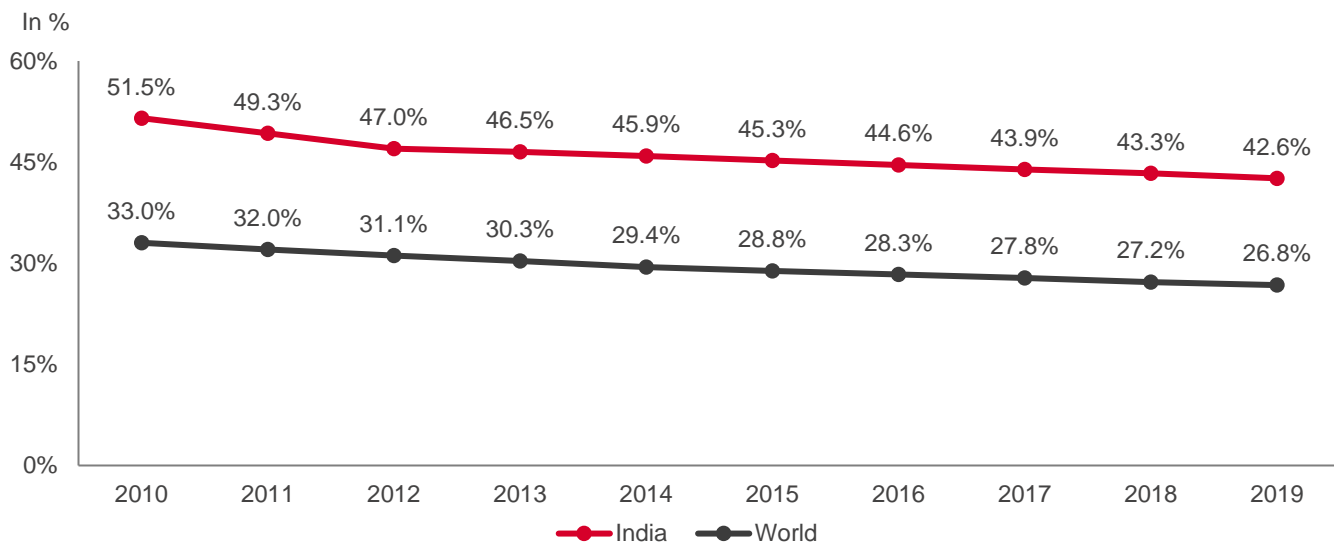
Source: World Bank

Horticulture production has shown a CAGR of 3.9% and food grain production a CAGR of 3.1% in the last decade. Combined food grain and horticulture production grew by 3.4% CAGR during the same period.

Food grain and horticulture production

In MT
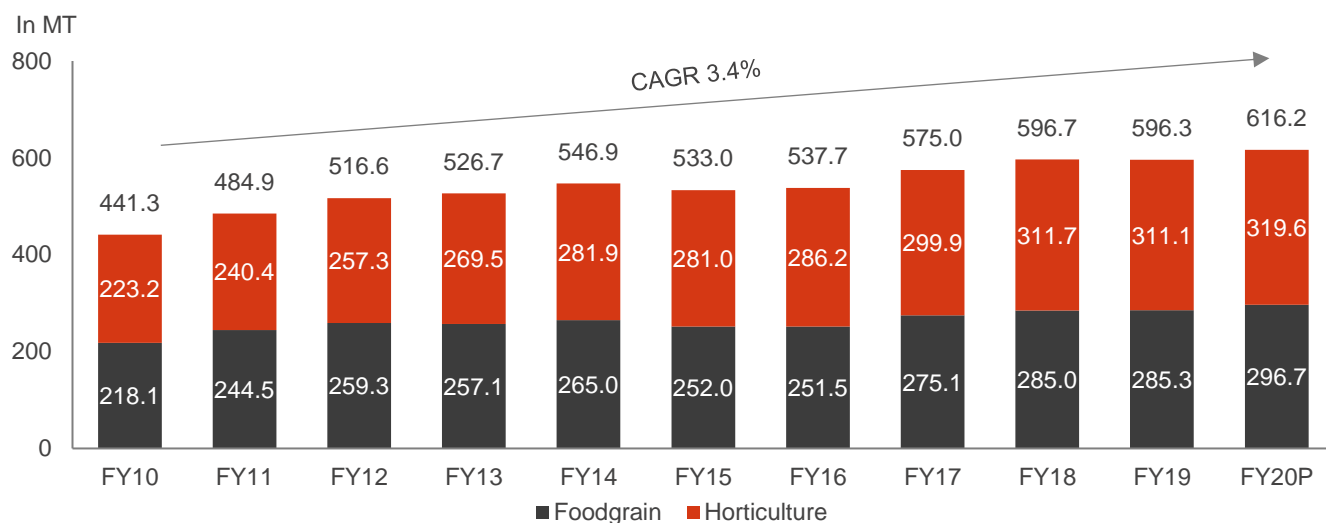
P: Provisional
Source: Agricultural Statistics, 2020

The area under cultivation for horticulture and food grain from FY10 to FY20 grew by a CAGR of 0.5% and 2.4% respectively, which is lesser than the growth in production of horticulture and food grain during the same period. The combined area under cultivation showed a CAGR of 0.8% during the same period.

Area under cultivation

In MHa
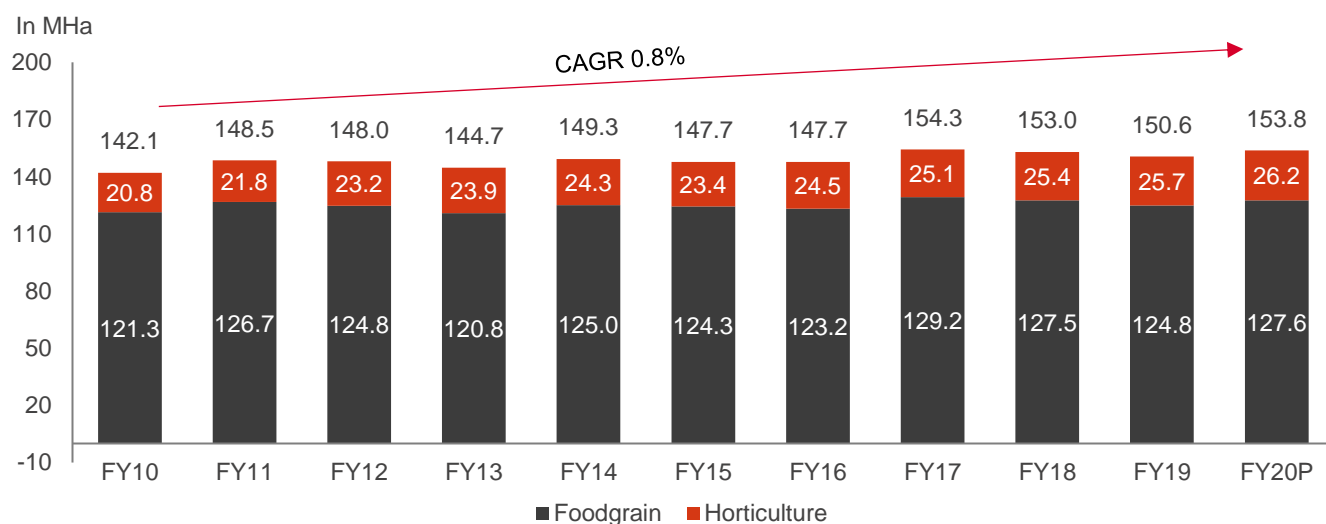
P: Provisional
Source: Agricultural Statistics, 2020

16.2 An overview of challenges with agriculture in India

Challenges in the agriculture sector in India
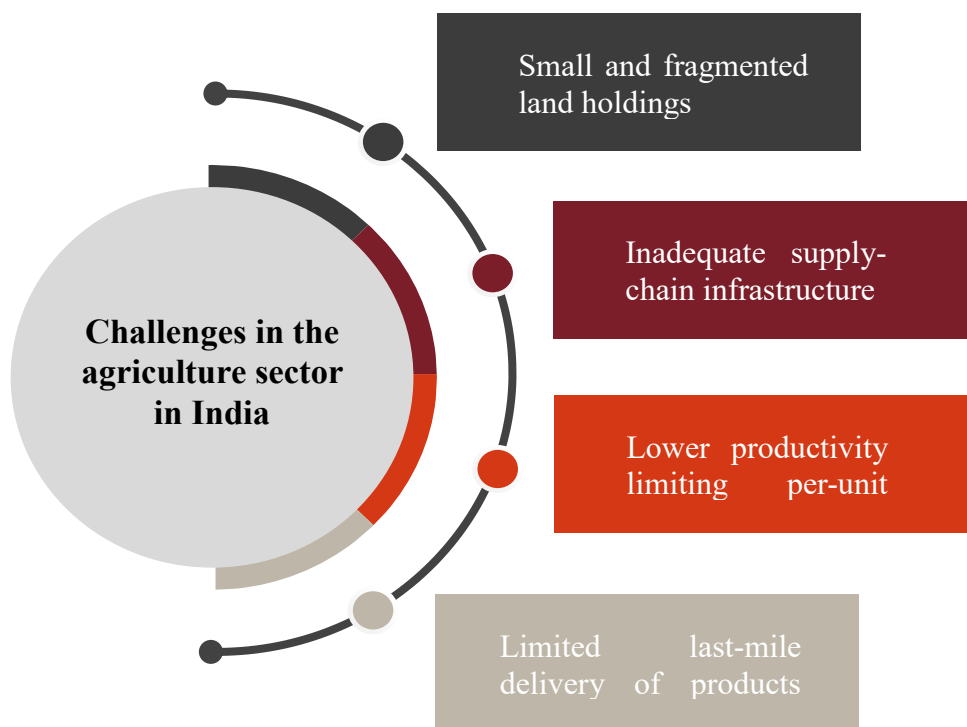
Source: CRISIL Research

Small and fragmented land holdings

Indian farms are fragmented and small; nationally, more than 70% are less than 1 hectare, while the national average land holding is less than 2 hectares. In Europe and the US, average sizes are 30 times and 150 times those in India. Due to the growth of population and break-down of the joint family system, continuous subdivision of agricultural land into smaller and smaller plots has occurred. Large land holdings enable the farmer to implement modern agricultural techniques and boost productivity, small land holdings restrict the farmer to use traditional methods of farming and limit productivity. The problem of small and fragmented holdings is more serious in densely populated and intensively cultivated states, such as Kerala, West Bengal, Bihar and eastern part of Uttar Pradesh, where the average size of land holdings is less than one hectare and in certain parts it is less than even 0.5 hectare. The size of the holdings will further decrease with the infinite sub-division of the land holdings.

Most land holdings are small and uneconomic. So, the advantages of large-scale farming cannot be derived, and cost per unit with divided land holding is high and output per hectare is low. More people invariably work on the farms in the rural areas and coupled with the obsolete technology. This results into farmers not being able to generate sufficient marketable surplus. Thus, they are not only poor but, in many cases, are in debt. Therefore, the increasing demand for agricultural output requires support for aggregation of farm operations for increased and sustained productivity. Government, private players, start-ups are entering into the agriculture and agri-tech segment to solve some of these issues

Inadequate supply chain infrastructure

On the supply side, India presents abundant sources of raw material to meet the demands of the food processing industry. The production advantages are huge; however, the level of processing for perishables remains very minuscule. The level of wastage of agricultural produce is very high and is estimated at over 15 billion annually due to the dilapidated supply chain network.

Warehousing and supply-chain capacity in India has not kept pace with the production and procurement increase. Storage facilities in the rural areas are either totally absent or grossly inadequate. Under such conditions, the farmers are compelled to sell their produce immediately after the harvest at the prevailing market prices, which are bound to be low. Such distress sale deprives the farmers of their legitimate income.

One of the main handicaps with Indian agriculture is the lack of cheap and efficient means of transportation. Even at present there are lakhs of villages that are not well connected with the main roads or with market centres. Most roads in the rural areas are *kutcha* roads and become non-operational in the rainy season. Under these circumstances the farmers cannot carry their produce to the main market and are forced to sell it in the local market at low prices. The upcoming agri-tech sector is also exploring this segment to provide affordable supply chain infrastructure by aggregating demand.

The preponderance of middlemen and agents in Indian agriculture renders the farmers and farming situations still worse. Farmer needs on the demand side are controlled by middlemen and agents who own the fragmented supply chains. They even control the produce's pricing. Such a convoluted supply chain with poor infrastructure needs digital and disruptive solutions for improvement.

Lower productivity limiting per-unit yield

The contribution percentage of India in key food grains in acreage terms is ~15%, but the production contribution is only ~8.7%, which indicates productivity woes. The productivity issue in agriculture is a culmination of multiple issues in agriculture and may be observed as an applied issue rather than a basic one. Indian soil has been used for growing crops over thousands of years without caring much for replenishing. This has led to depletion and exhaustion of soil resulting in their low productivity. The average yield of almost all crops are among the lowest in the world.

Little or no use of machines is made in ploughing, sowing, irrigating, thinning and pruning, weeding, harvesting threshing and transporting the crops. This is specially the case with small and marginal farmers. It results in huge wastage of human labour and in low yield per-capita labour force. Irrigation is the most important agricultural input in a tropical monsoon country such as India where rainfall is uncertain, unreliable and erratic. Only one-third of the cropped area is under irrigation in India. It is difficult to achieve sustained progress in agriculture unless and until more than half of the cropped area is brought under assured irrigation. This is testified by the success story of agricultural progress in Punjab, Haryana and western parts of Uttar Pradesh, where irrigation facilities are better. Lack of institutional-credit facility is also one of the prime reasons behind low yields. The exhibit below explains the existing situation of Indian productivity in comparison with the global scenario.
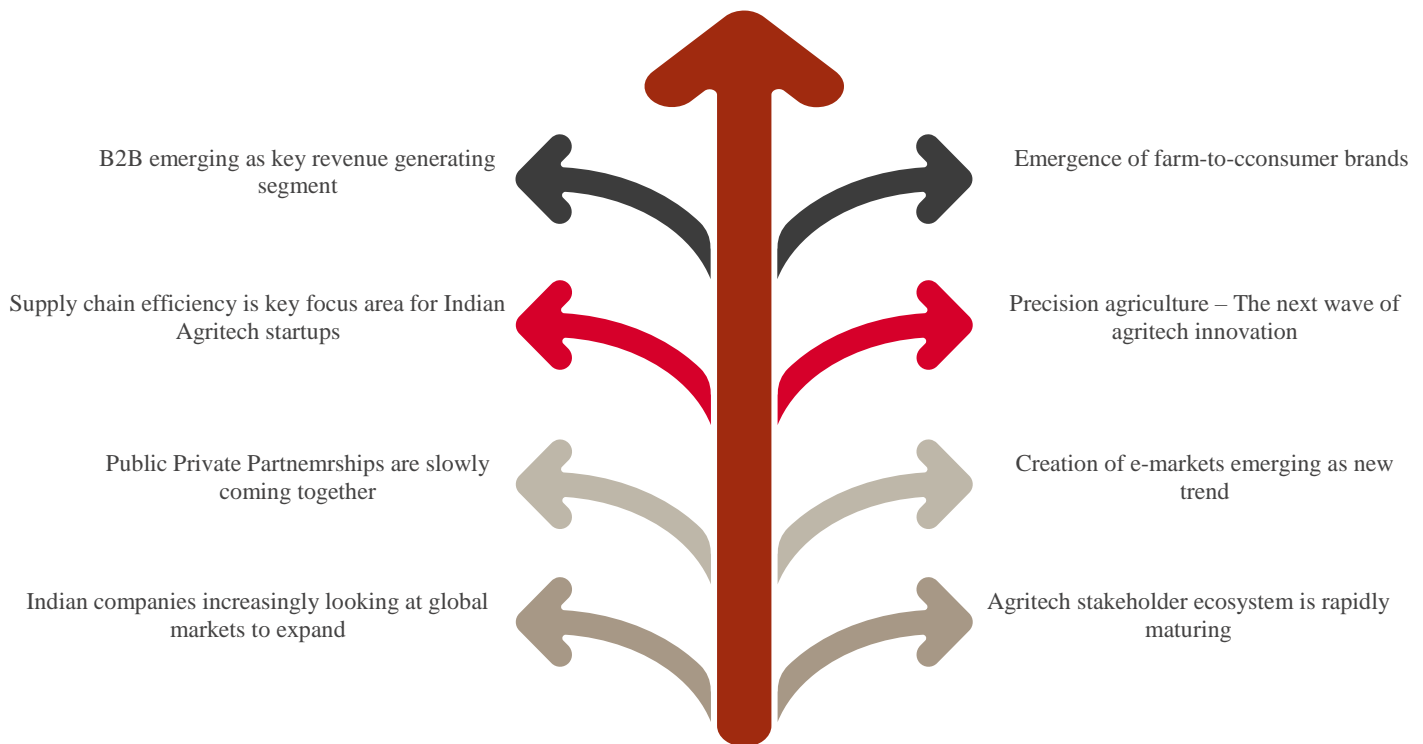
Yield comparison (2018)

In tonnes/ha

Source: Agricultural Statistics 2020, CRISIL Research

Limited last-mile delivery of products and services

Agriculture is a risky prospect, wherever it is subject to the vagaries of nature, such as flood, drought and cyclone. Any disturbance in agricultural production has a multiplier effect on the economy, along with the direct effect on the income of farmers. To insulate farmers against risks in agriculture, the government launches several schemes but due to the lack of access to such information the farmers may not be aware of all the schemes implemented by the Central and state governments for their welfare. The existing platform at the panchayat/Common Service Centre/Krishi Vigyan Kendras (KVK) – that is, the Farm Science Centre/Department of Agriculture level – seems limited in making available requisite products and services to the real beneficiary. This knowledge, digital and physical divide not only leads to market distortions but also product distortions and slippage, leading to multiple losses to agriculture.

16.3 Recent trends observed in the sector

Recent trends in the agriculture sector

B2B emerging as key revenue generating segment

Emergence of farm-to-cconsumer brands

Supply chain efficiency is key focus area for Indian Agritech startups

Precision agriculture – The next wave of agritech innovation

Public Private Partnemrships are slowly coming together

Creation of e-markets emerging as new trend

Indian companies increasingly looking at global markets to expand

Agritech stakeholder ecosystem is rapidly maturing

Source: CRISIL Research

Rise of B2B platforms and farmer marketplaces

The rise of e-commerce has ensured that digital marketplaces are now a mainstay for consumers in urban areas. Less visible but equally vibrant are the B2B marketplaces that are thriving in multiple industries. As a natural extension to the next billion consumers who are coming online, the agritech sector had also begun to see the creation of such platforms much before Covid-19, with established players such as Ninjacart, Agrostar, and DeHaat rapidly achieving significant scale.

The pandemic has imposed a difficult situation in front of farmers with challenges, such as shortage of farm labour, farming equipment and agri-inputs (seeds and crop protection products). This situation aided the agritech companies in the digital space to respond, and advance their penetration with thoughtful interventions, and farmers' acceptance of digital platforms. There has been an increasing trend to leverage various ecommerce platforms for last-mile delivery of essential agri-inputs to farmers. Additionally, farmers received crop-specific advisory, funding, and market linkages to buy their produce back from various agritech players. Such support in a crisis acted as a tool in winning the farmers' trust.

Inferior traditional supply chain giving rise to innovative solutions

Indian consumers today are better educated with improved access to information, leading to the evolution of conscious consumers. They foster greater awareness and interest in the supply chain that lies behind the products they consume. Moreover, the pandemic has led to increasing health consciousness, with consumers becoming more vigilant about eating healthy and unadulterated food. This trend has led to increasing acceptance of farm-to-

consumer business models. Technology plays a key role, through which farm-to-consumer brands are able to maintain safe and reliable delivery of the agricultural produce. There has been a shift in distribution channels from retail to consumer doorstep delivery. This saw the emergence of various players entering last-mile distribution of fruits and vegetables.

Increasing acceptance of technological innovations

Historically, India has had low levels of farm mechanisation compared with mature agricultural economies. While mechanisation levels have been rising quickly in recent years, India still remains a country that is heavily reliant on manual labour for a large portion of farming activities. The pandemic caused mass movement of migrant labour back to their homes, eroding the workforce to carry out basic operations. Lockdowns restricted movement of agents to farms, as a result of which agribusinesses and BFSI institutions were left with no reliable ways of collecting on-ground data. This provided a strong fillip to several innovative agritech start-ups that were looking to automate agri-related operations. Remote monitoring using artificial intelligence (AI) / machine learning (ML) models and layering them with satellite imagery, stage-specific actionable digital data collection, utilisation of complex algorithms, Internet of Things (IoT) and ML tools to innovate other automatic solutions are on the rise.

Creating market linkages through digital channels has gathered pace

The past few months have created a perfect storm of events to accelerate the digitisation of agri-markets. There are multiple key enablers for e-markets to gain traction in India – Covid-19 forcing comfort with digital selling due to lack of access to physical markets, macro policy encouraging digitised trade and transparent pricing, standardisation of quality as a key driver for multiple stakeholders, and warehouse / logistics infrastructure that allows custodianship and specialised offerings to serve a digitised supply chain. Supporting infrastructure for creation of e-markets, such as innovative financing and warehousing models, is also gaining momentum. Technology initiatives for supply chain management, quality assessment, traceability, precision agriculture, farm management and other services such as farmer advisory and provision of financial services are inter-linked and considered essential for the overall development and profitability of the agriculture sector.

Agri National Open Digital Ecosystem (NODE) can act as a strong value add in agri sector

Many of the initiatives and developments in agriculture sector struggle to reach the necessary scale and desired service levels. Their limited success can primarily be attributed to two factors- lack of access to data that is spread across multiple institutions, and fragmented, disconnected solutions that fail to provide a seamless user-centric journey. In such an environment, an Agri National Open Digital Ecosystem (NODE) can prove to be a viable solution for the multiple challenges faced by the agriculture sector in India. NODE can be defined as "Open and secure delivery platforms, anchored by transparent governance mechanisms, which enable a community of partners to unlock innovative solutions, to transform societal outcomes.

There are three key components of the NODE are:

- **Delivery platforms**: Delivery platforms comprise the "tech" component of the NODE that facilitate the delivery of services and solutions to the end-users. Builders (entrepreneurs, business, public agencies, etc.) build new solutions on top of Delivery Platforms, to create a wider range of services.

- **Governance**: Strong governance framework to ensure fair value sharing while keeping stakeholder behaviours in check, with both preventive and corrective measures laid out.

- **Community**: The vibrant community of NODW will comprise of Government, foundations, think tanks, businesses and entrepreneurs that will transact and collaborate via the platform to create new user-centric solutions and enable value unlock.
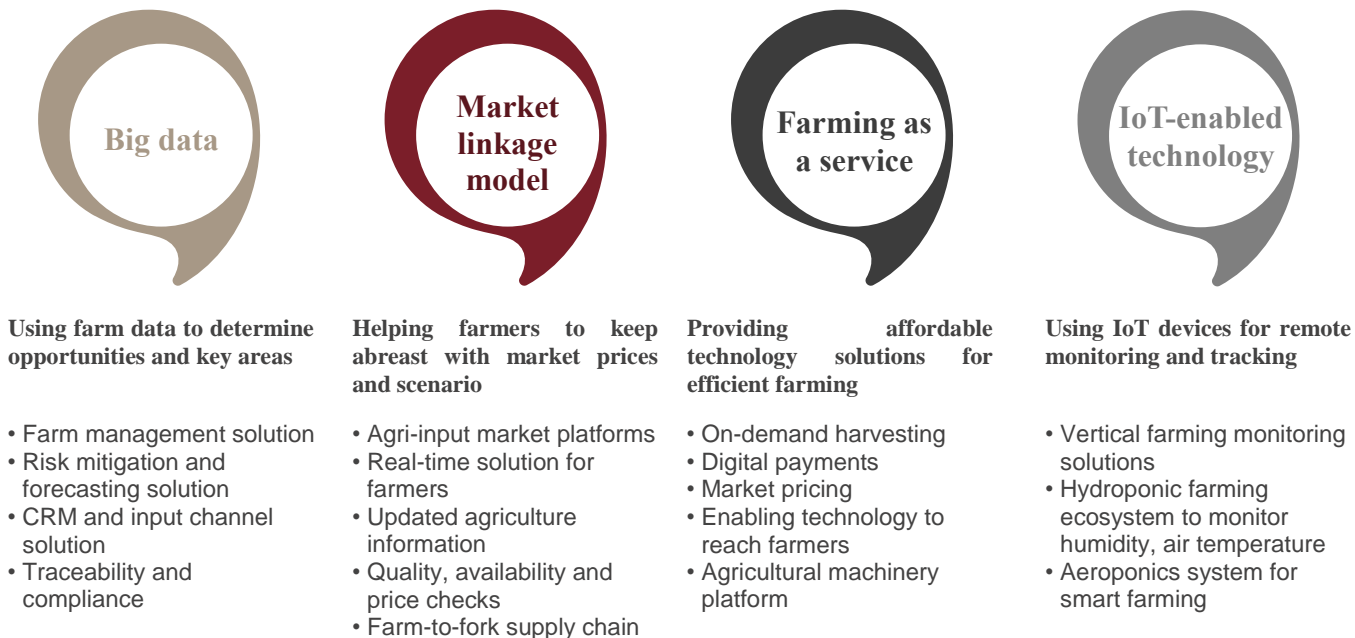
All the stakeholders involved in NODE, citizens, government bodies, entrepreneurs and businesses can derive benefits from adopting NODE.

16.4 Agritech landscape and offerings by players

Broad categorisation of agri start-ups in India

Broad categorisation of agri start-ups based on solutions offered in the value chain

Big data

Market linkage model

Farming as a service

IoT-enabled technology

Using farm data to determine opportunities and key areas

- Farm management solution
- Risk mitigation and forecasting solution
- CRM and input channel solution
- Traceability and compliance

Helping farmers to keep abreast with market prices and scenario

- Agri-input market platforms
- Real-time solution for farmers
- Updated agriculture information
- Quality, availability and price checks
- Farm-to-fork supply chain

Providing affordable technology solutions for efficient farming

- On-demand harvesting
- Digital payments
- Market pricing
- Enabling technology to reach farmers
- Agricultural machinery platform

Using IoT devices for remote monitoring and tracking

- Vertical farming monitoring solutions
- Hydroponic farming ecosystem to monitor humidity, air temperature
- Aeroponics system for smart farming

Big data based agri start-ups

Development of farm-specific, data-driven diagnostics to determine soil and crop health has come up as a big opportunity area. Start-ups are leveraging drones or tractor-based solutions to get data – both on weather and agricultural produce – on field to determine risk. Growing smartphone penetration is enabling precise decision-making in farming activity, helping farmers to drive increased productivity and revenue while reducing unit costs.

Start-ups developed around the market-linkage model

Innovations must be included to help farmers with timely and accurate estimation of sowing and harvesting in sync with consumer demand patterns. Such linkages operate at the two critical ends of the supply chain: input and output models. These models aim to link producers to remunerative sourcing agencies for procurement and to profitable buyers for output sales.

Start-ups developed around Farming as a Service (FaaS)

FaaS seeks to provide affordable technology solutions for efficient farming. It converts fixed costs into variable costs for farmers, thus making the techniques more affordable for the majority of small farmers. Specific farm practices are being identified for provision of technological breakthrough services. Activities such as equipment renting and crop-care practices are areas seeing market traction. FaaS is available on a subscription or pay-per-use basis.

IoT-enabled technology based agri start-ups

Smart farming, including high-precision crop control, data collection, and automated farming techniques, helps in removing inefficiencies and bolstering productivity. Information on crop yields, rainfall patterns, pest infestation and soil nutrition can be used to improve farming techniques over time. Low capex for predominantly software-based solutions is the key feature for such solutions.

Sectoral presence of agri start-ups in India

Agritech focus areas in India

Infrastructure
- Growing system and components
- Aquaponics
- Hydroponics

Farm data & analytics
- Integrated platform
- Remote sensing software platforms
- Farm mapping
- Field operations

Supply chain
- E-distributor
- Listing platform

Finance
- Payments
- Revenue sharing
- Lending

Information platform
- Information dissemination
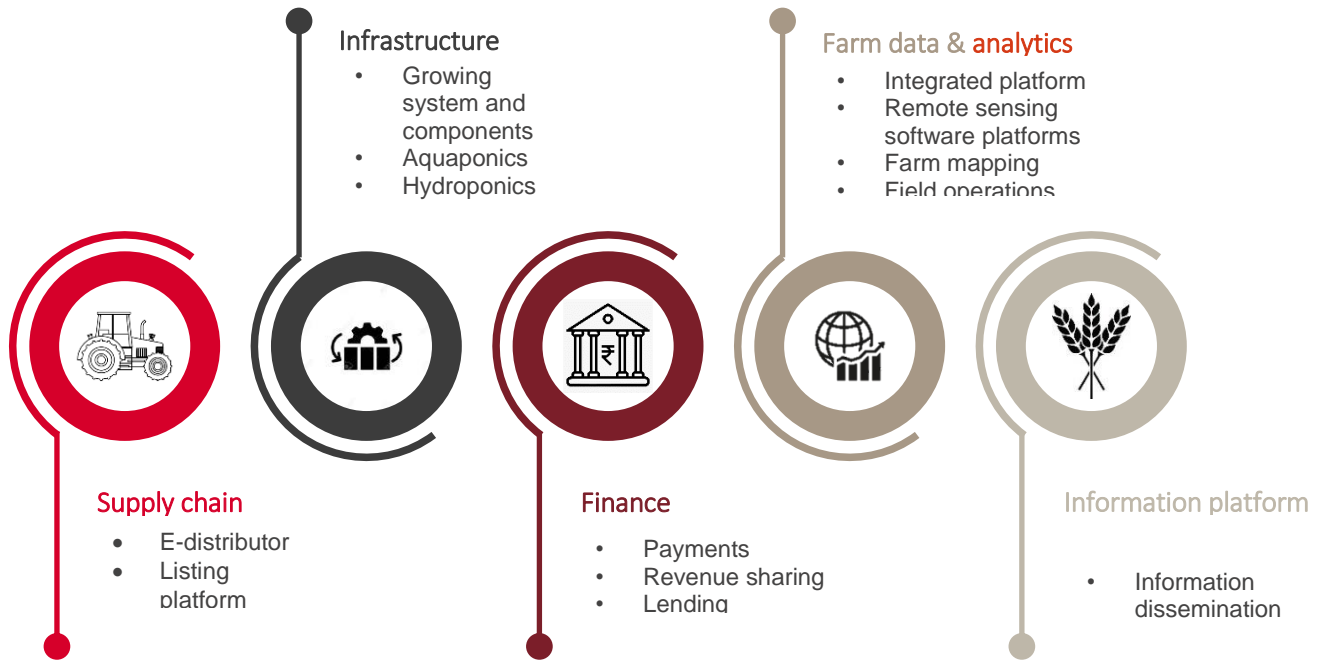
Offerings by agritech players

Market linkage:

The market linkage business models provides farmers with a digital platform to offer their products directly to the end-customer.

Key players operating under this model are:

ninjacart	**NinjaCart** is India's largest fresh produce supply chain platform, connecting food producers directly to retailers, restaurants, and service providers with in-house applications that drive end-to-end operations.
DeHaat® Seeds to Market	**DeHaat** connects farmers to suppliers and buyers on a single platform; it is an online marketplace offering farmers agricultural products and services.
crofarm	**Crofarm** aims to create a supply chain that supports farmers and provides businesses with the freshest produce in the most efficient manner.
GOBASCO	**Gobasco** employs real-time data analytics on data streams from multiple sources across the country, aided by AI-optimised automated pipelines to increase the efficiency of the current agri supply-chain.
KrishiHub	**KrishiHub** runs a fully-managed supply chain operating under the farm-to-fork model; it uses AI to predict demand in advance, which gives better visibility to farmers and reduces crop wastage.
TECHNIFY BIZ	**TechnifyBiz** is a B2B marketplace that organises the non-perishable food commodity market by improving farmers' linkages with food processors and wholesale buyers.
AgriGator	**AgriGator** is a B2B digital supply chain solution that directly connects grain traders, food processors, wholesalers and logistic providers, in order to facilitate a streamlined and transparent value chain.

Other notable players operating under the same vertical include Procol, Kamatan, Waycool, Leaf, INI, Freshokartz, Gram Unnati, Agri10x, FarmTaaza, EcoZen Solutions, Agrowave, Farmlink, Agricx, Our Food, etc.

Digital agriculture:

Digital agriculture-based businesses offers innovative technology solutions to increase crop productivity and farming process efficiency. The business models of such players help drive transparency, traceability and real-time access to information.

Players operating under the digital agriculture business model are:

Aibono uses comprehensive data instruments and predictive analytics to identify real-time production and consumption trends of perishable produce; helps farmers in precision farming, and just-in-time harvests.

Agnext offers cost-effective and unique technology that can help farmers save money during the crop pre and post-harvest stages.

Cropin uses big data analytics, artificial intelligence and remote sensing to analyse data for crops for agriculture processors, distributors, inputs providers, lenders and insurers through its APIs.

Credible creates analytics products that help agri-businesses manage their production/supply risk and price risk. Credible offers cutting-edge analytics to its customers.

KisanHub helps suppliers of fresh produce and food production companies to transform their supply chains and improve margins with greater visibility and data-driven insights.

Other notable players operating under the same vertical include Fasa, SatSure, MyCrop, KisanRaja, Yuktix, etc.

Better access to inputs:

Businesses operating as input providers enable precise and timely delivery of agricultural inputs such as seeds, fertilisers, pesticides, machinery, cattle feed, etc. These businesses provide farmers greater access to agricultural inputs at their doorsteps and help them identify the best input products to increase yields and productivity.

Key players providing agri inputs are:

DeHaat connects farmers to suppliers and buyers on a single platform; it is an online marketplace providing farmers with agricultural products and services.

BigHaat is a pan-India agri inputs digital marketplace platform; it provides farmers with holistic solutions and personalised technical guidance and accessibility to a wide range of high-quality inputs.

AgroStar is a platform that uses farm and farmer-specific data to provide real-time solutions to reduce a farmer's cost of production and improve yields.

Gramophone is an agritech platform that helps farmers achieve better yields with timely information, technology and the right kind of inputs.

Other notable players include Unnati, Agronxt, Behtar Zindgi and Tractor Junction.

Farming as a Service:

Farming as a Service (FaaS) offers affordable technology solutions to farmers by converting fixed costs to variable costs. Activities such as equipment renting and crop care practices are areas seeing market traction under this model. FaaS services are available on a subscription or pay-per-use basis.

Key players operating as FaaS platforms are:

Oxen addresses the challenges related to labour scarcity and rising labor wages for mid-size farmers by bringing the right technology, through operators, on a pay-per-use model.

GoldFarm provides a farm equipment booking platform to help agri equipment fleet owners realize better ROIs on their farm equipment and to empower the farming community.

EM3 provides farm services for the entire cultivation,n bringing tech & mechanisation for the farming community on a pay-for-use basis.

KHETHINEXT is a mobile app that enables the procurement of farm inputs at a lower cost; the app also offers services to farmers to connect with financial institutions and with the rest of the agriculture ecosystem.

Financing:

Agritech-based financing start-ups help underserved farmers get hassle-free loans, and also offer services such as farmer on-boarding, credit scoring, recovery and insurance.

Key players operating under this vertical are:

Samunnati is a specialised agriculture value chain enabler providing innovative, customised financial and non-financial solutions.

FarMart operates a micro software-as-a-service (SaaS)-led agritech platform that helps large food businesses source high quality produce at affordable prices.

Jai Kisan is a fintech platform that provides low-cost and timely financing for agricultural equipment, dairy equipment and other rural yield generational assets to empower farmers.

GramCover is a tech-enabled insurance marketplace that focuses on the development and brokerage of rural insurance products to farmers. It aims to reduce costs and increase penetration in rural areas.

16.5 Investments in the Indian agritech space

List of key investments in agritech

Year	Company	Business segment	Investor	Amount ($ million)
2020	Fresh to Home	Online seafood and meat	Investment Corporation of Dubai, Ascent Capital	121
2020	WayCool	E-distributor of farm products	Lightbox, FMO, Aspada Investments	35.1
2020	DeHaat	Provider of end-to-end farming services to farmer communities	Agfunder, Omnivore, Sequoia & Netherlands Development Finance Co.	12
2020	Bijak	Online B2B marketplace to trade agricultural commodities	AL Fund, Tempo Ventures, Omnivore Partners ,Surge Venture and others	12
2020	Jumbotail	Online B2B platform for packed food product	Heron Rock, Kalaari Capital	11
2020	Clover	Commercial cultivation/distribution of high-quality F&V	Omnivore Partners, Alteria Capital, Accel	6.5
2020	Intello Labs	Quality measurement of crops	fromNexus, Omnivore, Saama Capital, SVG Ventures	6
2020	Jai Kisan	Provide sustainable financing for rural emerging markets	ArkamVentures and Nabventures	3.9
2020	VeGrow	Supply chain tech and output market linkage	Matrix and Ankur Capital	2.5
2019	Ninjacart	Supply chain tech and output market linkage	Tiger Global	89
2019	Samunnati	Financial services	Nuveen Investments	55
2019	AgroStar	Market linkage –farm inputs	Bertelsmann India	27
2019	EcoZen	Farm-to-fork value chain development of perishables	Caspian Impact Investments, Hivos-Triodos Fund	NA

Source: CRISIL Research

16.6 Overview of government regulatory and policy framework

The following are the key initiatives by the government to provide support and accelerate the growth of the agriculture sector.

- Flagship initiative of GoI
- Aims to build a strong ecosystem to nurture innovation and start-ups in the country, to drive sustainable economic growth and generate large-scale employment opportunities.
- Access to tax benefits, easier compliance, IPR fast-tracking
- Initiative is based on the following three pillars:
- Simplification and handholding
- Funding support and incentives
- Industry-academia partnership and incubation

Start-Up

Atal Innovation

- AIM, including SETU, is the GoI's endeavour to promote a culture of innovation and entrepreneurship.
- Its objective is to serve as a platform for the promotion of world-class innovation hubs, grand challenges, start-up businesses and other self-employment activities, particularly in technology-driven areas.
- Two core components of scheme:
- Entrepreneurship promotion through SETU
- Innovation promotion: to provide a platform where innovative ideas are generated

- NewGen IEDC is a programme launched by the National Science and Technology Entrepreneurship Development Board, under the Dept. of Science and Technology, GoI.
- Programme is implemented in educational institutions.
- A maximum of 20 new projects are supported in a year
- -Government provides one-time, non-recurring financial assistance, up to a maximum of Rs 25 lakh, to the institution towards establishment cost, furnishing of cubicles for start-ups, purchase of equipment and library

NewGen Innovation and Entrepreneurship Development Centre

Dairy Entrepreneurship Development Scheme

- Promoted by National Bank for Agriculture and Rural Development
- Objective is to promote setting up of modern dairy farms for production of clean milk
- 25% of the project cost as back-end subsidy restricted to a max of 10 animals, subject to a ceiling of Rs 15,000 per animal for establishing a dairy unit (Rs 6 lakh maximum)
- 25% of the project cost as back-end subsidy restricted to max 20 calves, subject to a ceiling of Rs 6,000 per animal for establishing a dairy unit (Rs

- VCA is financial support in the form of an interest-free loan provided by the Small Farmers'
- Agri-Business Consortium (SFAC) Society, promoted by the Dept. of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture and Farmers Welfare, GoI
- Capital assistance depends on the project cost, location and the promoter's status.
- Assistance is in the form of interest-free venture capital up to Rs 50 lakh or 26% of the promoter's equity, whichever is lower.

Venture Capital Finance Assistance (VCA)

Aspire (MSME)

- A scheme for promotion of innovation, rural industry & entrepreneurship, promoted by the Ministry of Micro, Small & Medium Enterprises, GoI
- The scheme intends to set up a network of technology and, incubation centres
- It seeks to promote start-ups for innovation in the agro-industry.
- The assistance provided is used for automation of agricultural practices, addition of value for agriculture and forest produce, and recycling of pre/post-harvest wastages

Other key government initiatives to drive growth in the agritech sector include:

- Transport and Marketing Assistance (TMA) scheme to provide financial assistance for transport and marketing of agriculture products to boost agriculture exports.

- Agri-Udaan, a programme supported by the Department of Science & Technology, GoI, that focuses on catalysing scale-up stage food and agribusiness start-ups through rigorous mentoring industry networking and investor pitching.

- Rs 5,000 crore grant-based scheme by the National Bank for Agriculture and Rural Development (NABARD) for computerisation of 35,000 Primary Agricultural Credit Societies (PACS) by fiscal 2023.

- Multilingual mobile app, Custom Hiring Service Centres (CHC) – Farm machinery to enable farmers to get farm machinery and equipment on rent through CHCs.

- Implementation and introduction of the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), a national mission to improve farm productivity and ensure better utilisation of the resources in the country. PMKSY focuses on conserving water and increasing irrigation coverage in a focused manner with the targeted objectives of source creation, distribution, management, field application, and extension activities.

- Establishment of the National Centre for Management of Agricultural Extension (MANAGE) in Hyderabad.

- Establishment of the National Agriculture Market (eNAM), a pan-India electronic online trading portal that networks the existing APMC mandis to create a unified national market for agricultural commodities, providing better prices through a transparent auction process.

- The Government has commenced the work for creating an agristack in the country. It is in the process of finalising the India Digital Ecosystem of Agriculture (IDEA) which will lay down a framework for the agri-stack. The IDEA would help in laying down the architecture for the agristack in the country and that would serve as a foundation to build innovative agri-focused solutions leveraging emerging technologies to contribute effectively in creating a better ecosystem for agriculture in India. This ecosystem shall help the Government in effective planning towards increasing the income of farmers in particular and improving the efficiency of the agriculture sector as a whole.

16.7 Overview of potential for growth in India's agritech industry

Costly and inaccessible labour give boost to automation in agri operations

India has been pursuing agricultural self-sufficiency since its independence. While achieving food sufficiency in production, India still faces concerns regarding resource-intensive agriculture and low farmer productivity. Agriculture employs around half of the country's workforce and uses three-fourths of the country's fresh water resources; however, it contributes to only one-sixth of GDP. This indicates low worker productivity. Moreover, the employment generated through agriculture has been declining as the new generation has started looking for opportunities that offer better lifestyles and employment security. This has driven labour shortages and and a demand for higher wages in the agricultural sector.

India is in the very nascent stages of farm automation at the turn of the decade- unmanned vehicles have entered operations, but mostly for remote sensing (capturing data) by institutional users (e.g., revenue department, insurance companies). While this is expected to continue to be a major use case, fleet operators and large farmers will begin to demand autonomous robots for activities like weeding, spraying, and harvesting that involve a lot of

labour and have high human error rates. Autonomous and semi-autonomous farm robots have the potential to substitute labour-intensive human tasks and drudgery in major commercial crop and animal value-chains.

Precision technology is becoming cheaper and more powerful

Globally, the cost of industrial IoT sensors is falling steadily, low altitude hyperspectral observations using unmanned aerial vehicles (UAVs) are bringing down the cost and improving the precision of imaging, while Wi-Fi and cloud computing is set to become cheaper and faster. IoT sensors work best when they are connected to each other. In the Indian context, IoT sensors currently have three major use barriers– poor network, complex user interfaces to read results, and poor maintenance and service networks. With improvement in required technical infrastructure, farms are expected to go "live" with the help of IoT.

The accuracy and detail of remote sensors for complex visual inspection surpass tests administered by humans. This has great significance for how soil and crop growth is studied in the Indian context. Near infrared spectroscopy (NIS) and electrical conductivity (EC) sensors will render traditional titration tests for soils obsolete, revealing the microbiome that lies underneath each plant. Advancements in high spectral imagery (HSI), near infrared spectroscopy (NIS), and machine learning will enable farmers to track the health and growth of individual plants on their farms without having to laboriously inspect their fields. Adoption of IoT will allow for cross-exchanges between phones, sensors, and satellites at breakneck speed and will allow for hyper-precise early detection crop monitoring.

Variable-rate technology (VRT) allows fertiliser, chemicals, lime, gypsum, irrigation water and other farm inputs to be applied at different rates across a field, without manually changing rate settings on equipment or having to make multiple passes over an area. Input data from IoT sensors can be combined with VRTs, allowing each plant in each region of the field to be treated on a case-by-case basis.

Data from farm robotics and IoT sensors generate large volumes of data that are being processed via AI to produce ever more accurate models on crop growth, pest attacks, weather and climatic stresses, and market intelligence. The key trends in AI, namely large-scale machine learning, deep learning and computer vision learning help build models (including neural models for machines) of high accuracy and reliability. The convergence of market, climate and weather, soil health, and hydrological models from local to regional, and up to the national level will enable a strategic and coordinated approach to food production, rather than one based largely on path dependency and instinct today. The continued improvement in computing power will lead to optimisation of every stage of agriculture – from production to consumption – bringing down costs, improving access, and increasing quality of outcomes at the same time. In addition, data-driven experiments will supercharge the pace of innovation i.e. enable more experiments and rapid prototyping with data-driven precision.

A growing demand for hygienic food gives rise to integrated supply chain

Supply chains between the farmer and the consumer in India are notoriously opaque due to the presence of numerous intermediaries, poor data collection, and institutionalised practices of adulteration and pilferage. The status quo is unlikely to persist, both due to the entry of advanced data capture technologies like IoT sensors and because of a vocal and demanding middle class.

Data from IoT sensors deployed at various parts of the supply chain is being integrated by machine learning software at big, modern retailers and FMCG companies. At a nascent stage today, data integration is expected to peak in the coming years when nearly all production and post-production processes will be remotely tracked. Such traceable produce can be sold at a premium, and more importantly, be sold in export markets with higher prices,

increasing farmer incomes. Moreover, traceable systems reduce food wastage and time delays for supply chain players, bringing them tangible monetary savings.

Fragmented landholdings and asset ownership give rise to innovative business models

While fragmentation has been a much debated subject for years, technology adoption across geographies and income segments in recent years promises to upend the long held status-quo. With rapid development in technology, it has now become possible to build an agricultural information system containing geotagged data. Such system will stack data on, Producers: farmers and their financial and asset ownership; Assets: farmland, including its soil profile, productivity, and prevailing climate conditions; Stock: movement of goods and prices in markets. Current efforts to collect data across these levels is dispersed between private agritech companies and government departments, and is beginning to yield results in small pockets of interventions like credit and insurance. Going forward, government can make efforts to collect data at a consolidated level. Such an information system can help to build a composite map of the agricultural ecosystem, made up of building blocks from farmer and farm identities to hydrological and climatic models, and all the way to retail data. Such a platform holds the potential to reduce information asymmetries profoundly, making the system predictable, well-planned, and adaptive.

The agriculture sector has not been left behind when it comes to increasing adoption of shared economy. The shared economy is disrupting expensive outright ownership models for farm tech. Rental and pay-as-you-go models for farm machinery are the way forward. They reduce upfront costs for small farmers and allow for assets to be utilised over larger areas of farmland. Affiliation to groups/organisations is another observed trend. These groups enable sharing of assets like tractors and solar pumps, and enable the move into higher-value crops that yield better returns on precision technology.

17 Overview of cyber security market in India

17.1 Introduction to cyber security

Cyber security involves protection of confidential data from malicious attacks

Securing information technology (IT) systems of an entity from cybercrimes, terrorism, and other network service disruptions, which could possibly affect its everyday operations and even lead to theft of its assets is termed cyber security. For this, a comprehensive range of tools, practices, and techniques are used. Active monitoring of IT assets, outages or malicious movements, and prompt response to interruptions are crucial to securing IT systems. Legacy malware protection, web filtering, and advanced threat defence are used to defend users from internet-borne threats, and to help enterprises enforce internet policy compliance. The cyber security market covers various products and services used to provide security to IT systems from such threats to improve the overall functioning of an organisation.

Cyber security threats and vulnerabilities can change not only on a day to day basis but even every hour. In addition, with the proliferation of cloud, mobility, and bring-your-own-device (BYOD), endpoint protection has become crucial for cyber security departments of all organisations. Steps taken to handle cyber risks do not remain effective for long, which renders maintaining of security in a wireless environment challenging for most vendors. Cyber threats not only affect the IT infrastructure of a company but also lead to disruption of the entire network, impacting the principal business functions and processes. Moreover, rise in malware and phishing threats and a surge in adoption of Internet of Things (IoT) and BYOD by organisations are major factors that drive the growth of the cyber security market.

One constraint for the players in the cyber security market is a constant need to conform to industry standards and regulations of device security. However, with the introduction of new security techniques, the impact of this is expected to become nominal. Further, cyber security is now prioritised and aligned with strategic business functions of enterprises to minimise the damage to IT resources, which is expected to provide remunerative opportunity for further expansion of the global cyber security market.

Rapid digitalisation, increasing cyber threats boosting demand for cyber security

Advancements in technology and its usage have connected people, businesses and organisations in India and brought them closer, leading to economic progress. Internet and broadband penetration in the country has sustained a rapid pace providing the necessary infrastructure for data consumption. All aspects of our lives are facilitated by networks, computer and other electronic devices, and software applications. Critical infrastructure, including healthcare, financial institutions, governments, and manufacturing, all have computers or smart devices as core of their operations. Increased adoption of digital technologies has also resulted in multi-fold increase of sensitive information being stored online. However, these advancements come with critical vulnerabilities that anyone who misuses technology can exploit. Threat actors have a greater incentive than ever to find ways to infiltrate computer systems for financial gain, extortion, or to achieve political or social ends.
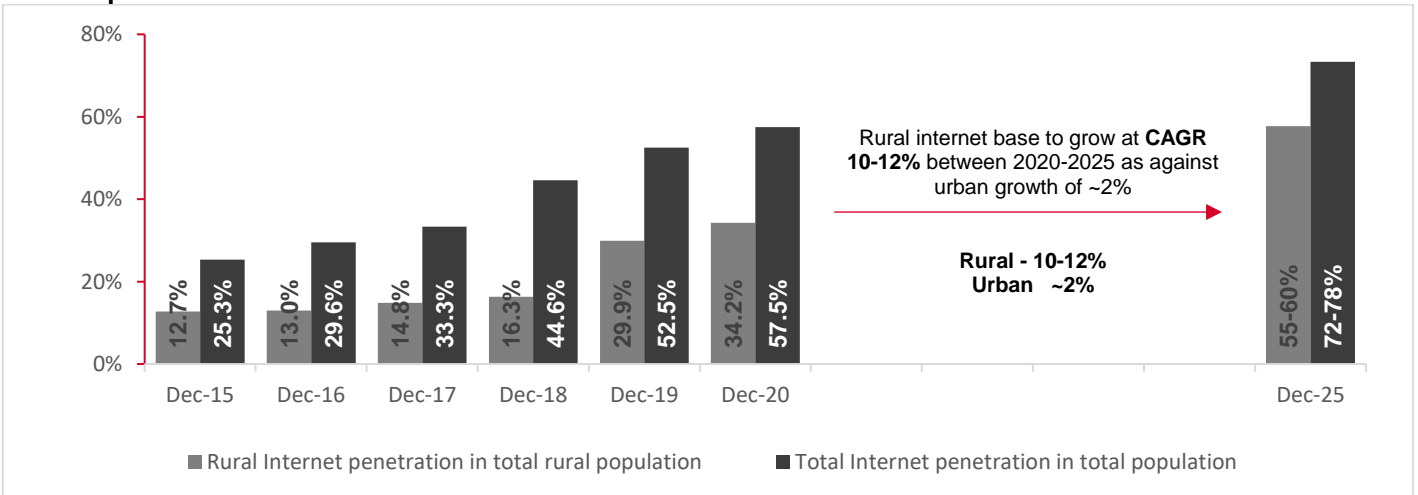
Internet subscriber base and penetration rate

in million
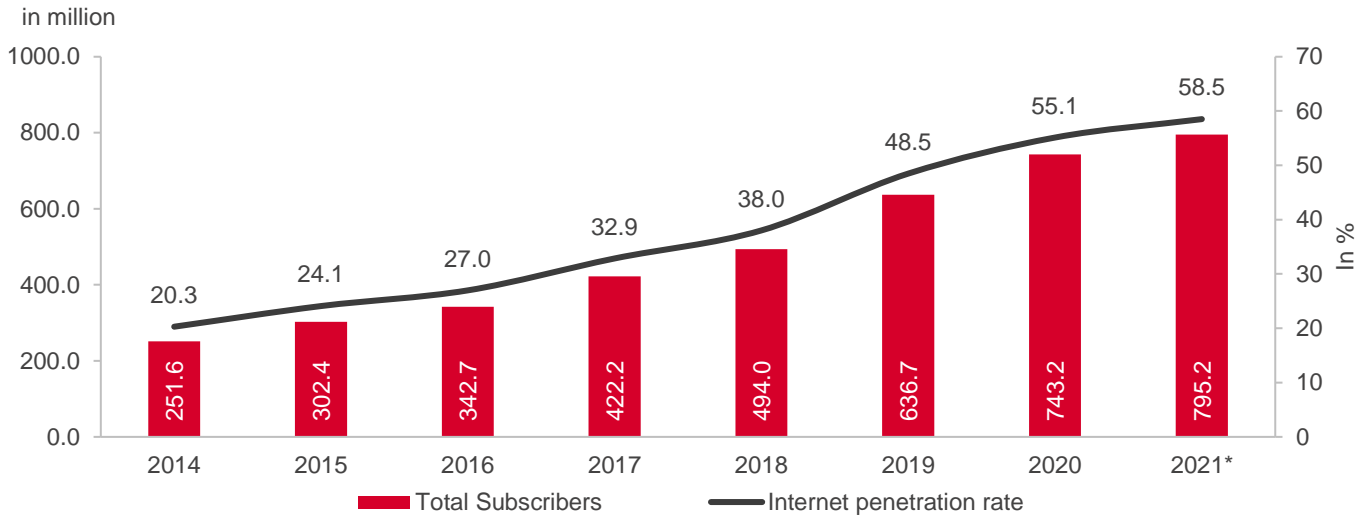
* 2021 data for total subscribers is until December 2020
Source: Telecom Regulatory Authority of India, CRISIL Research

**Internet penetration outlook in India**

Source: Telecom Authority of India, CRISIL Research

Cyber threats continue to evolve at a rapid pace globally, with instances of data breaches increasing each year. Cyber intrusions and attacks have increased dramatically over the past few years, exposing sensitive personal and business information to threat actors, disrupting critical operations, and imposing high costs on the economy. There are even evidences of cyber agents of nations probing rivals' critical infrastructure for political gains. In sectors where competitive intensity is high, cyber criminals operate with criminal intent to commit espionage. In the past, cyber criminals were focused on stealing information and threatening corporates. But now such attacks are aimed at bringing reputational damage, based on power play, which is further compounded by state actors.

Cyber crimes reported in India
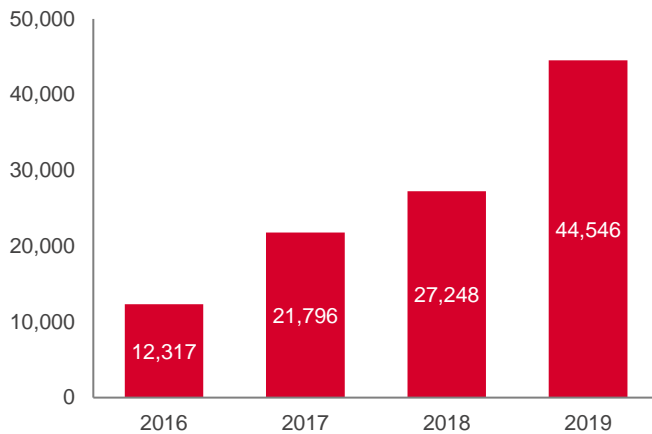
Cyber crimes related to data theft
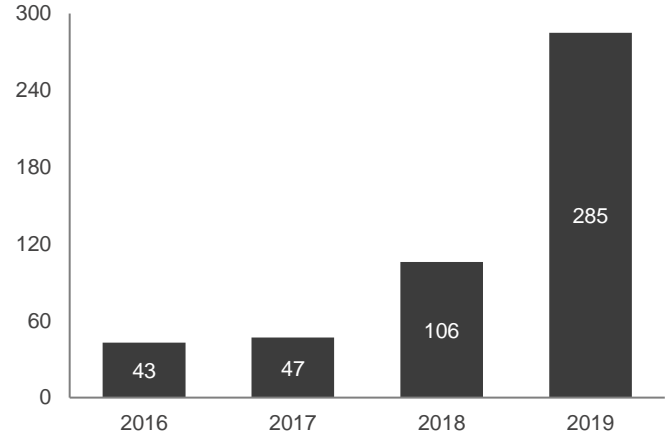
*Source: National Crime Record Bureau (NCRB), CRISIL Research*

In 2019, National Criminal Record Bureau (NCRB) recorded on an average ~5 cyber crime cases per hour, which grew over 3x from the level of 2016. Cyber security breaches across organisations have become commonplace, regularly grabbing headlines that alarm both consumers and leaders. As our reliance on data and interconnectivity increases, developing strong resilience to withstand cyber attacks has never been more important.

COVID-19 restrictions led to jump in security breach cases

The COVID-19 pandemic ushered the nation into a new era of digitisation. A rise in the adoption of cloud platforms, digital payments, e-commerce and internet users' count surging, has led to an increase in cyber threats, targeting individuals and businesses of all sizes. Threat actors were quick to capitalise on the opportunity offered by pandemic by attacking new unprotected surfaces when employees were forced to work from home.

Below are the number of security incidents handled by CERT-In which show a significant jump in the number of cases in the year 2020. The types of incidents handled are website intrusion & malware propagation, malicious code, phishing, distributed denial of service attacks, website defacements, unauthorized network scanning/probing activities, ransomware attacks, data breaches and vulnerable services.

**Number of security incidents handled by CERT-In**
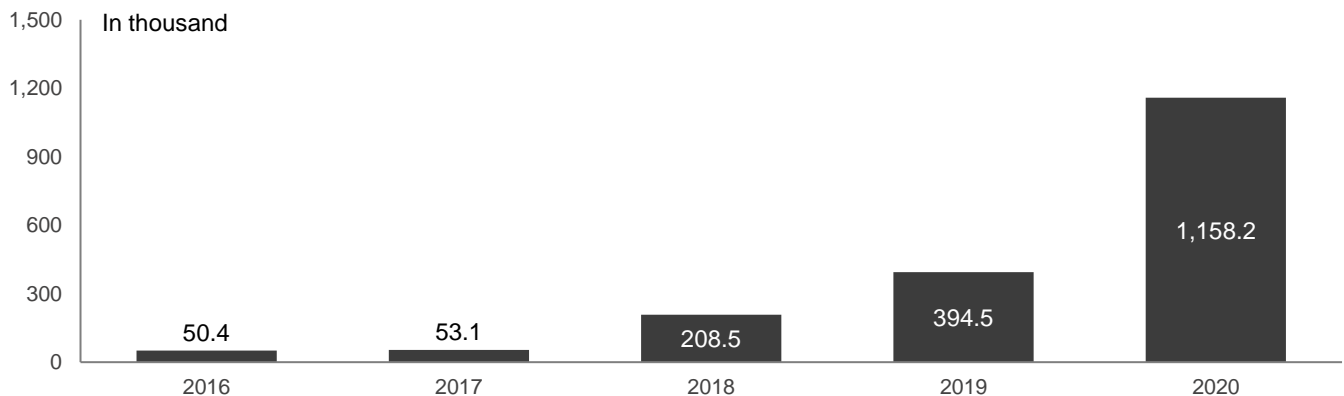
Source: CERT-In annual report

17.2 Products and services

The cyber security products market is estimated to grow faster than the services market

India is an attractive target for cyber criminals due to its impressive growth trajectory and expanding global influence of its enterprises. As organisations strive to bring technology and skilled resources together in the most cost-effective way to counter heightening cyber crimes, demand for cyber security systems is also expected to increase. Based on the type of offerings, the cyber security market can be divided into two segments – products and services. According to an analysis by the Data Security Council of India (DSCI), the cyber security market in India is expected to grow from US$1.98 billion in 2019 to US$3.05 billion by 2022, at a CAGR of 15.6%. Accelerated adoption of digital consumption and more number of inter-connected systems has made organizations focus more on cyber security as a vital investment area. The market is mainly driven by e-commerce and other emerging online platforms. The market for cyber security services was estimated at US$ 948 million in 2019.

**Size of cyber security market in India**
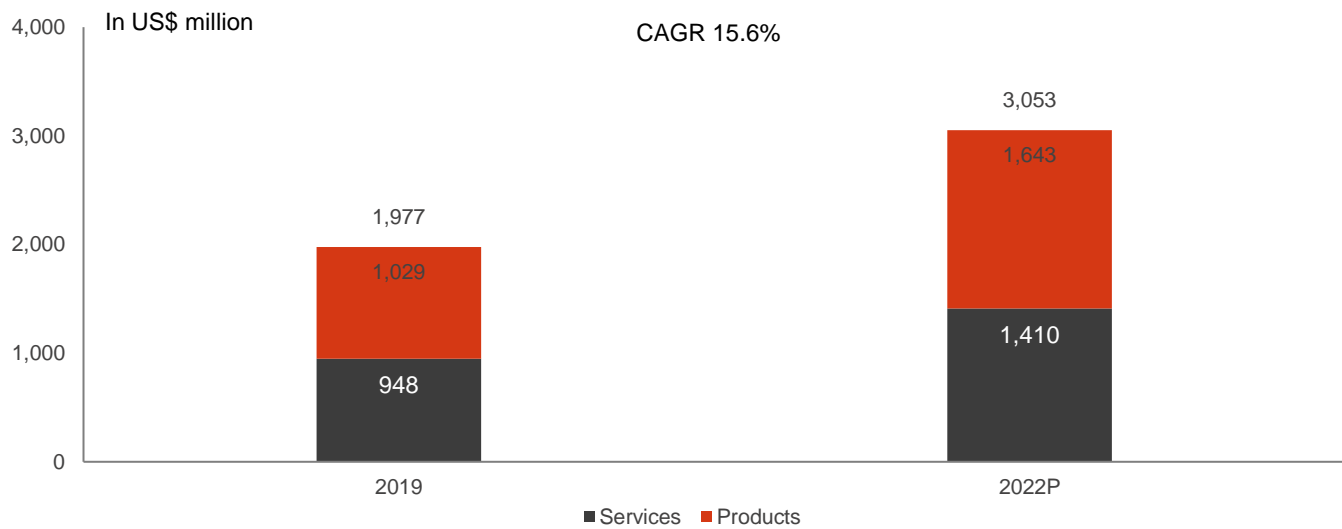
Source: Data Security Council of India (DSCI)

Both the segments are expected to see steady growth, with products logging a 16.9% CAGR and services 14.2%. The products segment slightly dominated the overall portfolio in 2019, and is expected to do so until 2022. This can be attributed to improved product innovations and prescriptive regulations.

Cyber security service market in India

The cyber security services market can be classified into five categories – security consulting, security implementation, security testing, security operations and incident response.
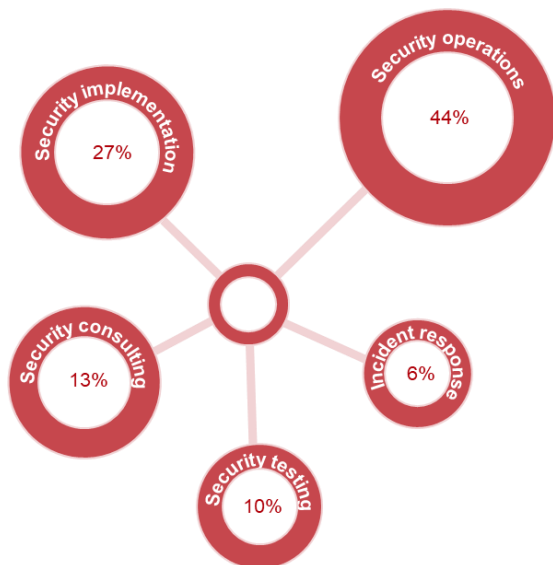
- Security consulting and advisory services include planning of security strategies, policy development, building security architecture, penetration testing, vulnerability management, compliance & risk, security awareness & training, and Chief Information Security Officer (CISO) advisory and support.

- Security advisory services help organizations ensure the security of business-sensitive applications and Information technology (IT) infrastructure.

- These services are provided by highly qualified industry experts and security professionals who help organizations strengthen their cybersecurity strategies.

- New technology-led business models and increasing digitalisation offer a broader surface for potential cyber threats, requiring enhanced cyber risk management.

- Adoption of emerging technologies such as cloud, chatbots, RPA and blockchain would warrant more spending on security consulting by organisations.

- More enterprise boards and senior management are expected to actively consider cyber security risks, leading to the need for structured assessments and benchmarking.

- Both government and private enterprises are expected to actively consider cyber security risks, leading to the need for structured assessments and benchmarking.

- Security consulting services are expected to see a gradual shift from 'optimising existing security' to 'distributing and virtualising security', as more organizations adopt cloud/ virtual environments and extended ecosystems, such as third-party suppliers and vendors.

- BFSI, IT and Telecom, Government and public sector, Healthcare, Energy and Power, and Manufacturing are the major verticals for security consulting and advisory services.

2019-22 CAGR

12.2%

- Security operation services involve managing and monitoring the configuration and health of security devices.
- Cyberattacks have evolved and increased in volume over the years. They have become sophisticated. Advanced persistent threats (APTs), zero day, malware, and multi-vector attacks have become common and they target core infrastructure such as ATM switches and payment interfaces.
- Security systems have a huge responsibility of reducing response time, and containing and remediating security incidents.
- Niche security technologies are looking to automate repeatable tasks, streamline workflows and orchestrate security tasks due to shortage of staff.

2019-22 CAGR

13.3%

- Security implementation market involves services such as information security architecture design, deployment and support for hardware and software, integration and subsequent functional and performance testing.
- Security implementations are getting increasingly complex given the interplay between hybrid environments such as public and private cloud services, increasing configurations, need to accommodate user context and integration of AI and ML technologies.
- Growth of cyber security implementation service is directly related to the increased adoption of cyber security products.
- Tightened regulatory restrictions with rigid controls will also increase the demand for security implementation.

2019-22 CAGR

13.2%

- Security testing services include penetration testing, web testing, application security, audits and reviews.
- Connected devices and rapid increase of IoT requires better security testing.
- Stringent regulatory mandates related to cyber security have made it essential for organisations to invest in security testing. The Reserve Bank of India (RBI) started this regulatory practice and more regulations are expected across industries.
- Security testing is expected to transform into a highly automated service, operating in real time, with latest intelligence capabilities of threat detection, and perhaps equipped with self-healing capabilities.

2019-22 CAGR

17.4%

- Incident response market involves areas such as incident management, digital forensics, evidence capturing and breach reporting.
- With technology landscape becoming more complex and varied, there is an increased focus on investigation of digital breaches and preservation of evidence.
- Effective incident response is the key to effective cyber security in the era of inevitable cyber breaches.
- Organisations want to ensure they have an active retainership arrangement for incident response services. More organisations are expected to engage on compromise detection to proactively identify breaches.
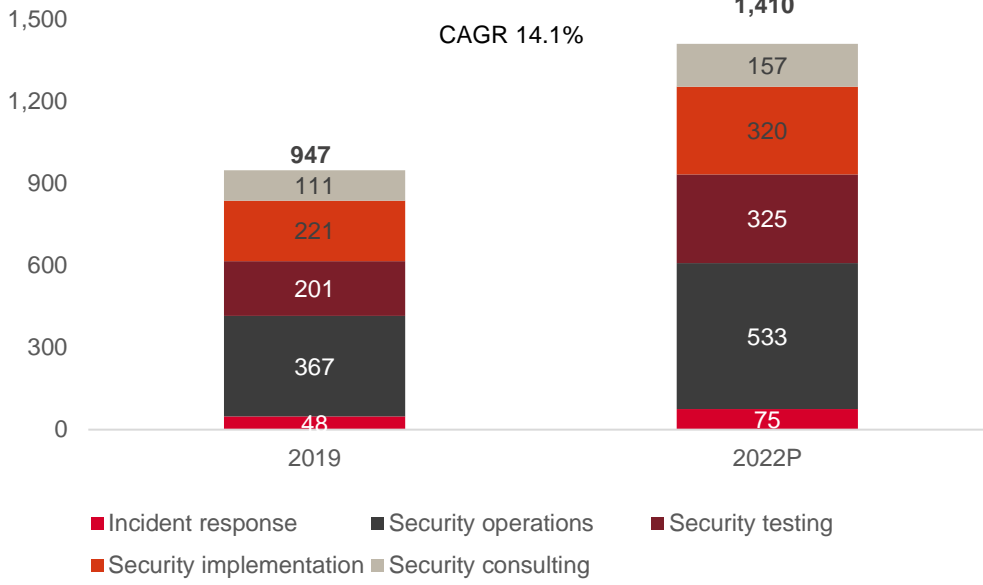
2019-22 CAGR

16.3%

Cyber security service market in India

in USD mn

CAGR 14.1%

Legend:
- ■ Incident response
- ■ Security operations
- ■ Security testing
- ■ Security implementation
- ■ Security consulting

Source: DSCI

Cyber security products market in India

The cyber security products market can be classified into five categories – data security, endpoint security, network security, identity and access management (IAM), and security intelligence detection and response (IDR).
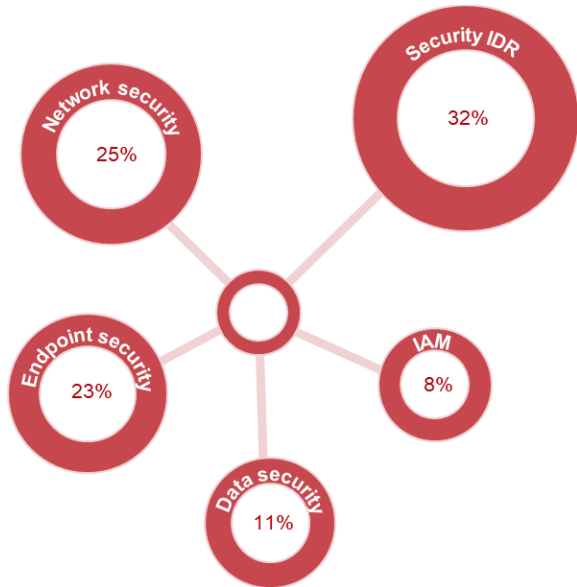
- Security intelligence detection and response (IDR) includes a variety of product categories such as security information and event management (SIEM), threat analytics, forensics, and vulnerability management, among others.
- Quick reporting of breaches in cyber security, and compliance requirements mandated by regulators are prompting organisations to respond quickly once a breach is detected.
- Shortage of staff skilled in handling cyber security is compelling them to use automation and orchestration to strengthen security systems.
- They are expected to move towards using self-healing systems with the help of advanced intelligence, machine learning (ML) -based use cases as opposed to rule-based use cases, and automating and orchestrating the response to a security breach.

2019-22 CAGR

14.8%

- Network security is defined as security measures undertaken by implementing a combination of software, hardware, and networking technologies, such as firewall, unified threat management, network intrusion detection and prevention, virtual private network content inspection and web content security.
- With growing digitalisation, more users, devices, applications, services and data are located outside an enterprise rather than inside.
- Demand of enterprises for security solutions catering to complex hybrid models covering both on premise systems and on cloud services, is on the rise.
- This makes it more important for network security controls to transcend beyond boundaries of physical systems and cloud services.

2019-22 CAGR

15.3%

- Endpoint security market is made up of products such as anti-virus and antispam software, host intrusion prevention software (HIPS), exploit protection, behavioural analysis of memory and continuous monitoring.
- With rapid digitalisation and swelling smartphone and internet users, the number of endpoints have also increased. Attacks against endpoints are rapidly increasing, especially in the form of script-based attacks such as power-shell attacks and file less malwares.
- With growing BYOD ecosystem, the focus has sharpened on native hardening and monitoring of endpoints.
- A gradual shift is expected towards integrated security products, which include multiple endpoint security tools in a single, centrally managed package such as anti-virus, antispyware, algorithmic behavioural analysis, desktop firewall and HIPS.

2019-22 CAGR

19.1%

- Data security products include encryption, tokenisation, data masking, data loss prevention, information rights management, and file and data access monitoring.
- With the number of digital services increasing, both volume and value of data produced is also seeing an exponential growth.
- Regulatory requirements are becoming stringent, as is evident in the government legislations such as the Personal Data Protection Bill (send to the standing committee), the Aadhaar Act, and the proposed DISHA (Healthcare), and the updated IT Act, among others.
- This is expected to prompt enterprises to invest more in areas such as data discovery, data lifecycle management and cryptography, as they will have to take steps to comply with regulations, which can be automated using cyber security products.
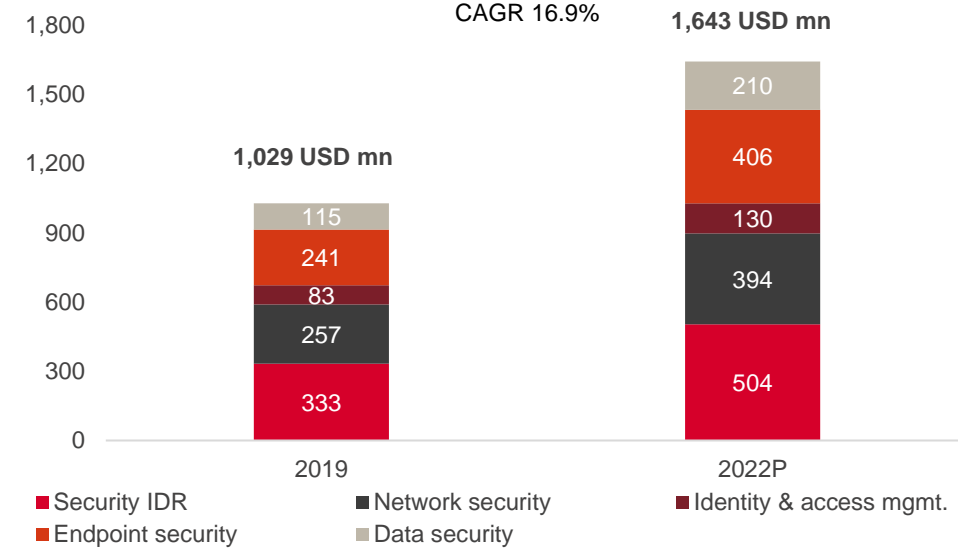
2019-22 CAGR

22.2%

- Identity and access management (IAM), also known as identity management, is a framework of policies and technologies for ensuring that right users have appropriate access to technology resources.
- With increasing IoT devices and machine-to-machine interactions, managing non-human identities has become crucial for organisations.
- Further, with federated identities becoming a norm, IAM products are expected to utilise mobile and cloud computing technologies to manage new identities.
- The next generation of adaptive access services combine rules with ML and advanced analytics.
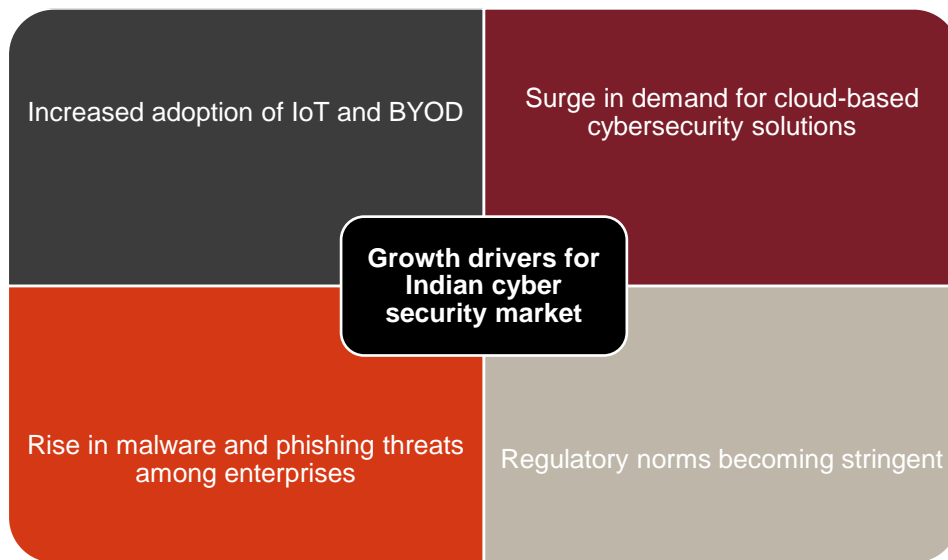
2019-22 CAGR

16.3%

Cyber security product market in India

in USD mn

CAGR 16.9%

1,029 USD mn

1,643 USD mn

- ■ Security IDR
- ■ Network security
- ■ Identity & access mgmt.
- ■ Endpoint security
- ■ Data security

Source: DSCI

17.3 Growth drivers for cyber security market

Source: CRISIL Research

Increased adoption of IoT, BYOD

The emerging trend of increased adoption of IoT and BYOD by organisations has made devices and applications more vulnerable to APTs. In addition, the increase in usage of mobile devices by organisations makes it difficult for IT teams to manage and track the data flow in various systems. COVID-19 pandemic has caused changes in workplace-culture, data flow and infrastructure of the organizations. Therefore, they are adopting cyber security systems to protect crucial information by monitoring, classifying, and resolving all kinds of attacks. Thus, as organisations increasingly adopt IoT and BYOD, the need for deployment of cyber security solutions also rises, thus boosting the cyber security market.

Surge in demand for cloud-based cyber security solutions

Enterprises are using cloud computing more due to its powerful and flexible infrastructure. Many are shifting their preference to cloud solutions in order to simplify data storage, as it provides remote server access on the internet, which further allows access to unlimited computing power. Moreover, implementation of cloud-based model empowers them to manage all applications, as it provides exceptionally challenging analytics that runs in the background. In addition, cloud allows them to combine supplementary infrastructure technologies such as software-defined perimeters to create robust and highly secure platforms.

Enterprises face a rise in malware and phishing threats

As systems become more interconnected, the industry is also grappling with a spike in number of breaches and sophisticated cyberattacks, driven by different motives. Moreover, prolonged work from home arrangement has made the security systems even more vulnerable. The power and threat of malware, including viruses and Trojans, to infiltrate, manipulate, or damage entire electronic information networks have increased significantly of late. Cyber attackers often use malware to take control of devices or machines to conduct fraudulent transactions or malicious activities. Further, industries such as banking, financial services and insurance (BFSI), healthcare, and the government sector are more vulnerable to such attacks due to the criticality of data generated by them. Therefore, increase in risk of malware and phishing threats is a key factor that notably contributes toward the growth of the cyber security market.

More stringent regulation

Owing to the increasing frequency and sophistication of cyber threats, regulators are beginning to play an active role in ensuring security of IT systems by tightening regulatory controls and increasing supervisory coverage across sectors. Regulatory institutions are taking cognisance of evolving risks and technological advancements, and integrating these into directives and guidelines. The RBI's controls for cloud, multi-factor authentication (MFA) for secure card payments (card-not-present transactions) and the Securities and Exchange Board of India's (SEBI) cyber resilience framework directives are some examples of such guidelines.

17.4 Key players operating in Indian cyber security market

ACL Digital *an ALTEN group company*	**Alten Calsoft Labs (ACL)** is a technology consultant, enterprise IT and product engineering services company; offers business digital transformation, innovation and amalgamation through disruptive technologies such as SMAC (social-mobility-analytics-cloud), IoT and Big Data.
AVG	**AVG India** is a global security software maker, offering an extensive range of security shelters. It offers privacy solutions for consumers and businesses and has laboratories for detecting and preventing all types of cyber crimes.
CYBEROPS INFOSEC LLP	**Cyberops Infosec** offers digital security to tech companies and provides a range of information protection services, including mobile and web application penetration testing, wireless penetration testing, network penetration testing, source code review, firewall and router set review, and security enhancement
eSEC FORTE	**eSec Forte technologies** is a CMMi level-3 certified global consulting and IT services company, which offers information security services, forensic services, malware detection, security audit, mobile forensics, vulnerability management, penetration testing, risk assessment, DDOS assessment, etc
HICUBE INFOSEC PVT. LTD.	**Hicube infosec** has expertise in cyber crime consultancy, penetration testing, vulnerability assessment, and online malware scanning. It offers customised and specialised products and services to their customers. Hicube also offers certified training programs in information security
Quick Heal *Security Simplified*	**Quick Heal Technologies** has been doing R&D in computer and network security solutions for two-and-half decades. Its clientele includes home users, small offices, and also corporate industries. Its international products are certified by AV-Test, ICSA Labs, and many such standard agencies
SECONIZE	S**econize Technologies** helps companies de-risk themselves by remediation, proactive risk assessment, and identification; it serves in AI/ML-enabled, cloud-based, automated security solutions to customers who are surrounded by all the information digitalisation about the company on drives or cloud.
Skylark	**Skylark Information Technologies** provides a range of IT security solutions from application and database security to next-gen firewall and endpoint mobile security solutions to cloud security solutions which are fully customised for clients' needs. Its also offers a range of services in blockchain technology
Valency Networks	**Valency Networks** offers professional cyber security and IT infrastructure management services. These include vulnerability assessment and penetration testing services for web apps, cloud apps, mobile apps, and IT networks
Wi-Jungle *Unified Network Security Gateway*	**Wi-Jungle** is an unified network security gateway that enables organisations to manage and secure their entire network through a single window; It specialises in the unified threat management (UTM), next-gen network security firewall (NGFW), and hotspot gateway that are all cautiously combined in one appliance

Overview of private investments in cyber security space

Due to the pandemic many companies shifted to work from home practice. This scenario made it easier for cyber criminals to attack networks with targeted malware and resulted in an increase in cyber-attacks across India, forcing organisations to strengthen their security frameworks. However, contrary to expectations, private investments in cybersecurity companies in 2020 were the lowest in the last six years.

Private investment in cyber security space
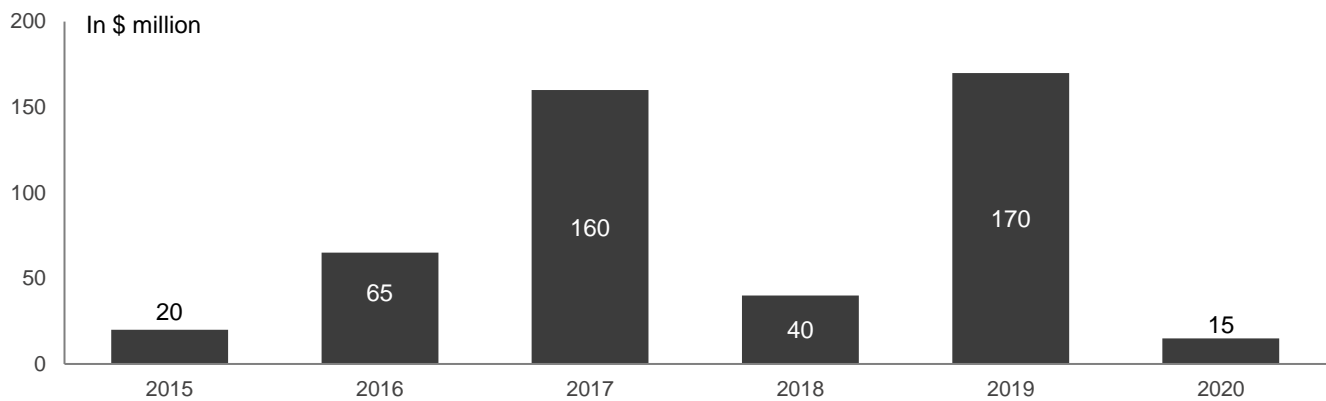
Source: Industry article, CRISIL Research

18 Overview of Education Loan scenario in India

Over the years, given the rising cost of education across the institutions, Education loan plays a prominent role in providing the required capital to harness the growth of human capital. In a country like India with majority of its population being young, the need for educational funding is being fulfilled by both Government, at central and state levels, and private sector organisations.

In order to make education loan available to all the sectors of the community, Government of India has taken several policy measures such as removal of service area norms, inclusion of education loans up to certain prescribed limit within priority sector lending, establishment of credit guarantee fund for provision of guarantee cover against education loan default and subsidies on education loan interest rate. With these measures in place the overall education lending in India during fiscal 2020 stands at Rs.748 billion.

18.1 Types of Education Loans schemes in India

In India, banks offer various types of educations loans which are as per Indian Banks' Association (IBA) model education loan scheme. These can be broadly divided into four categories based on the borrower and the institute one is seeking to study in.

1. Education loans up to Rs 0.4 million do not require any collateral to be provided, education loans up to Rs.0.75 million can be obtained with collateral in the form of suitable third-party guarantee, while education loans above Rs.0.75 million require tangible collateral.

2. The second category of education loans are sanctioned to those students who obtain admissions to colleges/universities through management quota who satisfy minimum required criteria

3. The third category of education loans is for the students who pursue education courses run by industrial training institutes (ITIs), polytechnics, training partners affiliated to National Skill Development Corporation (NSDC)/sector skill councils, state skill mission/corporation, in order to obtain a certificate/diploma/degree issued by such organisation as per National Skill Qualification Framework (NSQF) and any other institutions recognized by either the central or state education boards or university.

4. The fourth category of scheme specifically caters to the requirement of students studying in premier institutions like IITs/IIMs/NITs/IISc or courses abroad, with demand for a higher quantum of loan amount.

18.2 Education loan scenario in India

Banks stand as major lender for Education loans compared to NBFCs

The total outstanding education loans in India have grown at a CAGR of 1% from fiscal 2017 to fiscal 2019. However, during the next two fiscals (FY20 and FY21) the educations loans have seen a decline due to disruption caused by pandemic.

Commercial banks form a major share of total educational loans outstanding in the country. As of fiscal 2021, commercial banks occupy a share of 88% of total outstanding educational loans.

Education loans outstanding trend
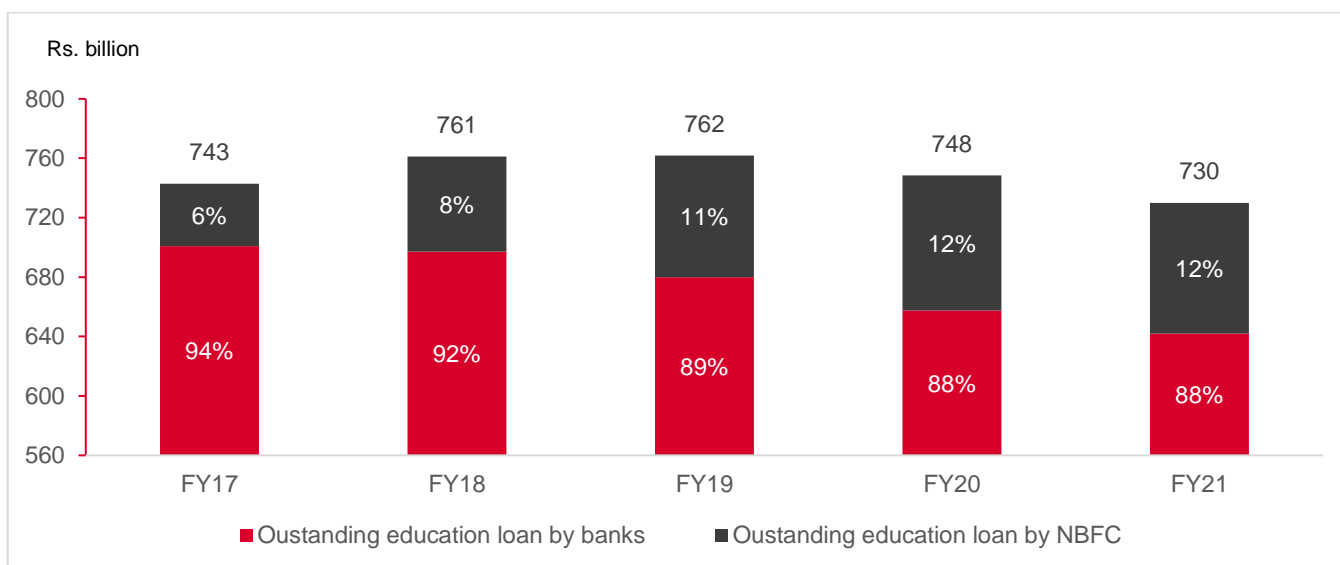
Source: RBI, CRISIL Research

Ticket size of NBFCs is higher than banks due to its focus on high end education loans

Since education loans up to a limit of Rs 10 lakh fall under the category of priority lending for the banks, they have higher share of small ticket size loans in their portfolio. NBFCs, on the other hand, focus more on higher-end of the spectrum and prefer giving loans above Rs 10 lakh duly secured by collaterals. Their average ticket size is Rs 17-18 lakh. In addition to this, NBFCs majorly focus on foreign education loans whereas the Banks have a higher share of domestic educational loans among overall educational loans outstanding in their portfolio

Share of loans disbursed

| Parameter	UoM	Banks	NBFCs
Domestic education loans (as of FY20)	%	90	10
Foreign Education loans (as of FY20)	%	10	90
Average interest rate	%	10-13%	12-16%

Source: RBI, Company Reports, CRISIL Research

Educational loans occupy only ~1% share of non-food credit deployed by banks

Over the past decade from fiscal 2010 to fiscal 2021, only ~1% of total non-food credit has been disbursed to educational loans by banks. As of fiscal 2020, of the total non-food credit outstanding (Rs. 1,08,883 billion) only Rs. 642 billion has been deployed under education loans.

In addition to this, for fiscal 2021, of the total personal loans deployed by banks educational loans account for only 2% of the share while majority of the share is occupied by other category of loans such as housing (51%), credit vehicle loans (10%), card outstanding (4%), and other personal loans (28%).

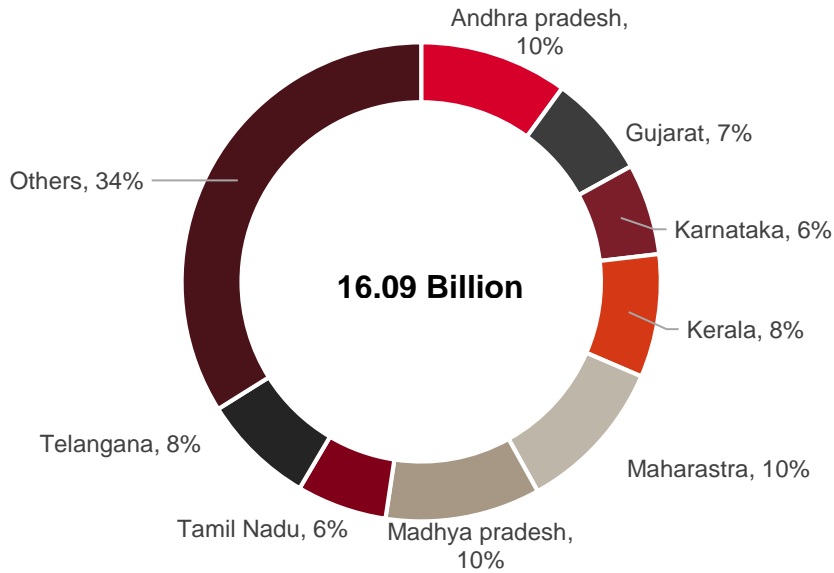**Share of educational loans among non-food credit by banks**

338
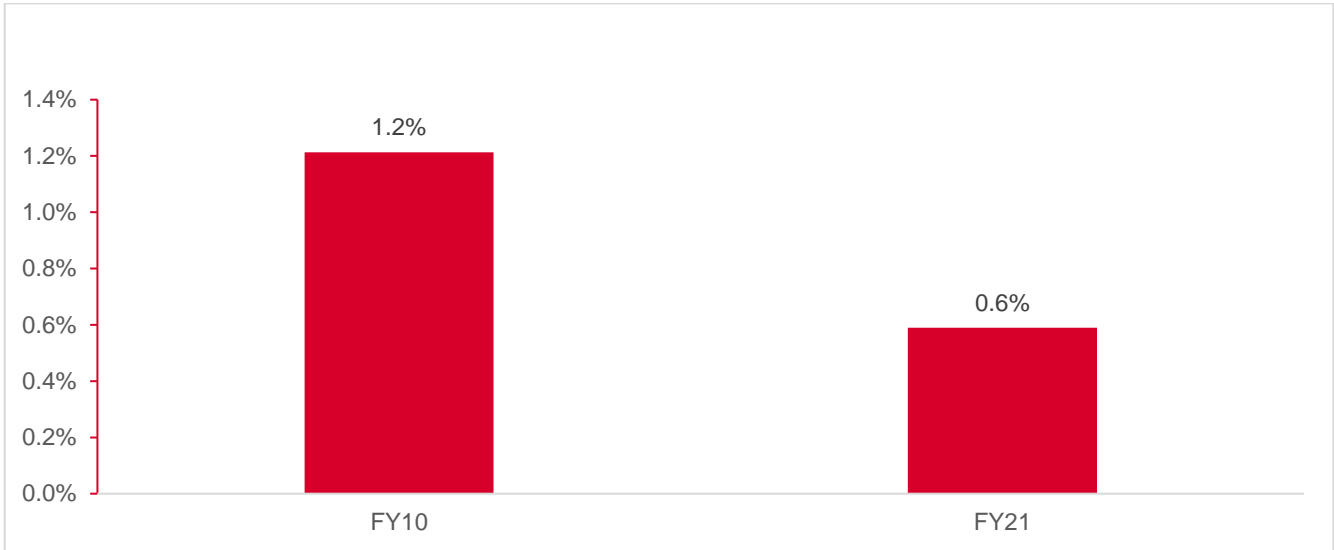
Andhra Pradesh, Maharashtra and Madhya pradesh stand among the major contributor's domestic education loans

Among the Rs. 16.09 billion education loans, for studying in India, disbursed by State Bank of India (SBI) in fiscal 2019, Andhra Pradesh (10%) Maharashtra (10%) and Madhya Pradesh (10%) occupy the major share. These are closely followed by Kerala (8%) and Telangana (8%)

**Domestic Education loans disbursed by SBI (2019)**

Maharashtra and Madhya Pradesh stand among the major contributor's foreign education loans in India

Among the Rs. 14.65 billion foreign education loans disbursed by State Bank of India (SBI)in fiscal 2019, Maharashtra (14%) and Madhya Pradesh (14%) occupy the major share. These are closely followed by Andhra Pradesh (13%), Karnataka (10%) and Telangana (10%)

Foreign education loans disbursed by SBI (2019)
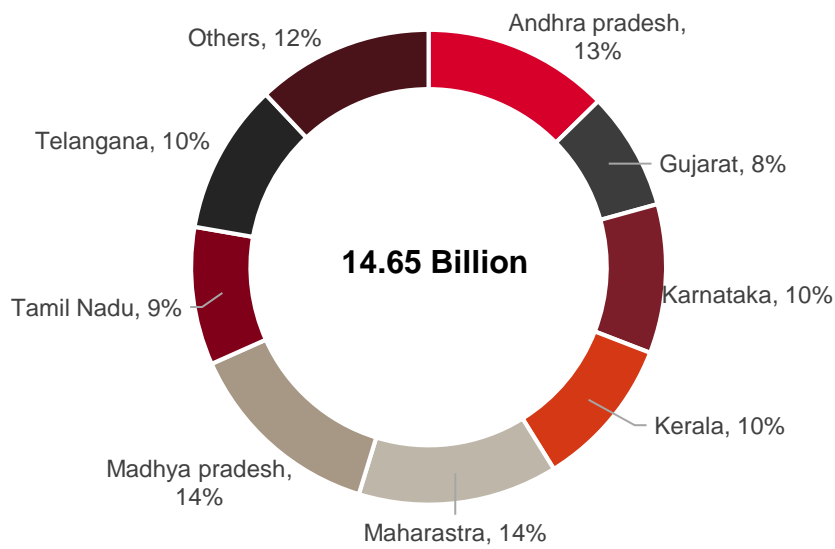
Source: SBI, CRISIL Research

19   Overview of Scholarship scenario in India

Scholarship is a financial assistance provided to a student based on various factors such as merit, need, athletic abilities. In general, every scholarship that is granted has a qualifying criteria of its own to be met by the applicant during the time of application. Scholarship can be broadly defined as grants allocated on the basis of criteria defined which need not be repaid. In India, scholarships are awarded by various government ministries, state authorities, as a part of CSR activity by private organisations and educational institutions.

In most of the developing countries, only a small percentage of the education funding is attributed to external funding mechanisms but access to these initiatives are limited. Therefore even though basic educational qualifications hold a lot of importance while determining career prospects, fulfilling the aspiration of specializations and upskilling comes with a huge financial burden. Courses from top colleges and universities need more than just talent. Education funding solutions are therefore important and aim to provide a common platform to bridge the existing gap between students, academic institutions, and education fund providers.

19.1 Types of scholarships

Merit based scholarships

Merit based scholarships are the most common type scholarships awarded with academic achievement being the eligibility to be met. Academic performance may include performance in internal examination in an academic institution or a competitive examination among others.

Need based scholarships

Need based scholarships are majorly awarded to economically weaker sections of the community with family income, costing of living among others being the criteria for awarding the scholarships under this category

Athletic scholarships

As the name suggests these kind of scholarships are to the individual for excelling in the field of sports

Fellowships

Scholarships can also be provided in the form of fellowships where cost of research or course is covered for an individual who purses for advanced studies or research in one's field

Ethnic / Minority and Religious Scholarships

These kind of scholarships are generally provided to individuals of particular ethnicity to help purse their education

19.2 Scholarship scenario in India

Disbursement under government scholarships grew at 11% CAGR between FY19-21

In India, scholarships at central level are provided by various ministries or departments under ministries catering to a particular set of population meeting the criteria. Scholarships provided by under central government schemes have grown at a CAGR of 11% from fiscal 2019 to fiscal 2021

Disbursement under government scholarship schemes

Rs.Billion

CAGR 3%

	FY19	FY20	FY21
	23	25	29
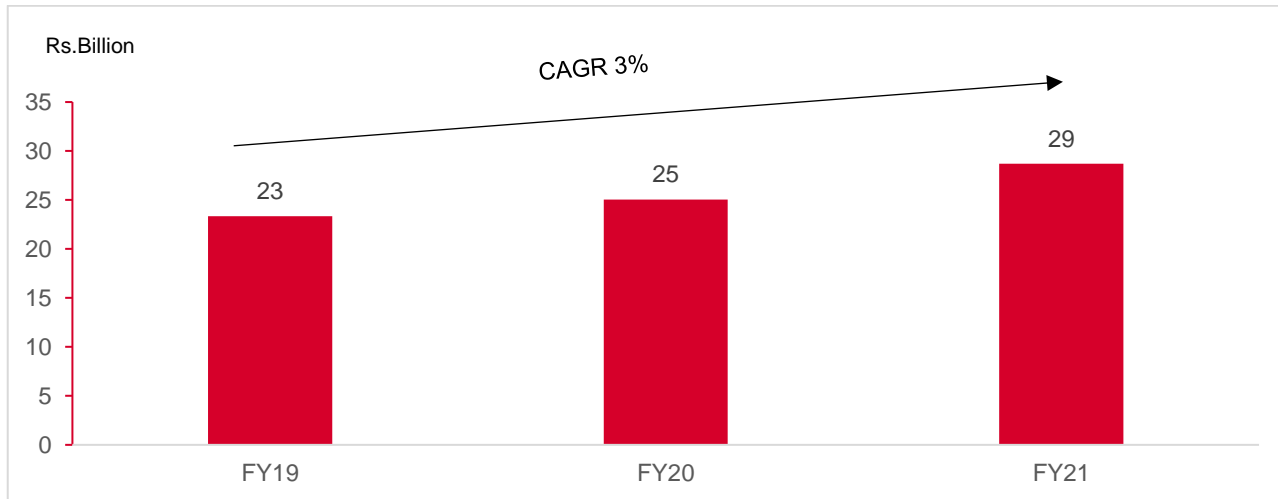
Source: National scholarship portal, CRISIL Research

Various central government scholarships are listed below along with their ministries

Various scholarships provided by central government

| Scholarship	Ministry
NEC Merit Scholarship	Ministry of Development of North Eastern Region
Prime Minister's Scholarship Scheme For RPF/RPSF	Ministry of Railways
Prime Minister's Scholarship Scheme For Central Armed Police Forces And Assam Rifles, and	Ministry of Home Affairs
Prime Minister's Scholarship Scheme For Wards Of States/UTs Police Personnel Martyred During Terror/Naxal Attacks	Ministry of Home Affairs
Central Sector Scheme Of Scholarships For College And University Students	Department of Higher Education
National Means Cum Merit Scholarship	Department of School Education and Literacy
National Fellowship and Scholarship for Higher Education of ST Students	Ministry of Tribal Affairs
Financial Assistance for Education of the Wards of Beedi/Cine/IOMC/LSDM Workers – Post-Matric	Ministry of Labour and Employment
Financial Assistance for Education of the Wards of Beedi/Cine/IOMC/LSDM Workers – Pre-Matric	Ministry of Labour and Employment

Scholarship	Ministry
Aam Aadmi Bima Yojna Scholarship for Andhra Pradesh	Ministry of Labour and Employment
Top Class Education Scheme for SC Students	Ministry of Social Justice and Empowerment
Pre-matric Scholarship for Students with Disabilities	Department of Empowerment of Persons with Disabilities
Post-matric Scholarship for Students with Disabilities	Department of Empowerment of Persons with Disabilities
Scholarships for Top Class Education for Students with Disabilities	Department of Empowerment of Persons with Disabilities
Pre Matric Scholarships Scheme for Minorities	Ministry of Minority Affairs
Post Matric Scholarships Scheme for Minorities	Ministry of Minority Affairs
Merit Cum Means Scholarship For Professional and Technical Courses	Ministry of Minority Affairs

Note: The list is not exhaustive
Source: CRISIL Research

CSR grants for education grew at CAGR of 22% between FY15-20

CSR grants provided by various organisation for education grew at 22% from fiscal 2015 to 2020 to reach 70 billion by the end of fiscal 2020. As of fiscal 2020, education CSR grants occupy a share of 29% among the total CSR grants provided
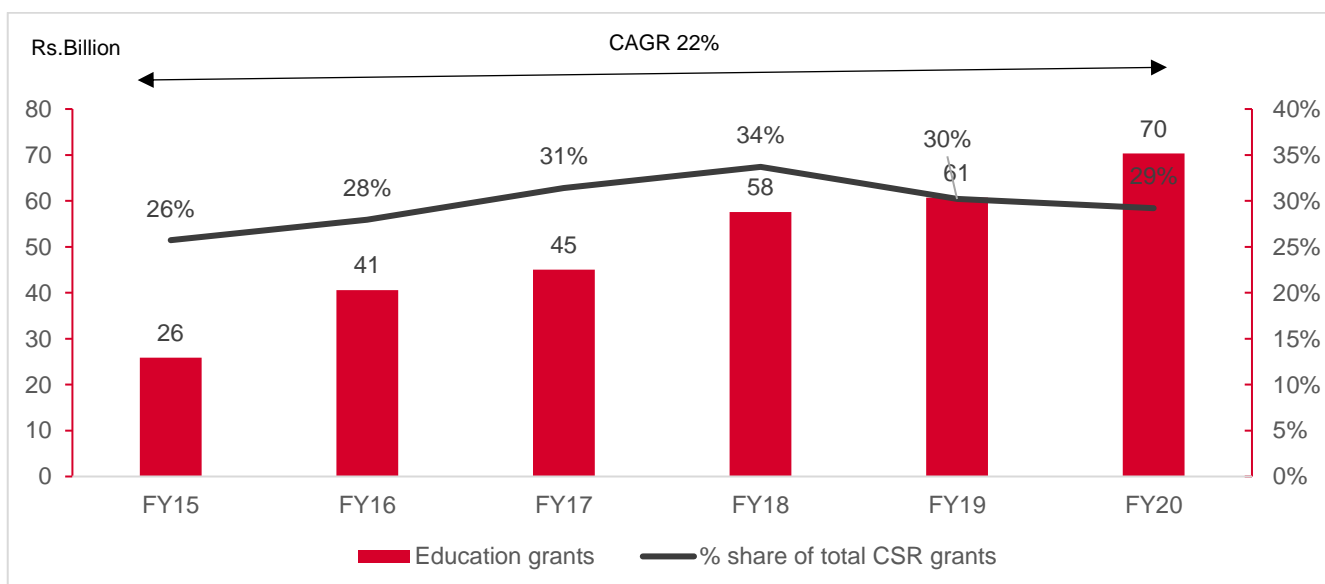
Source: National CSR data portal, CRISIL Research

Notable CSR education grants by various organisations

Name of the company	Education grants as of FY20 (In Rs. Million)
HDFC bank	703

Infosys limited	814
Mahindra and Mahindra	387
Piramal group	124
Reliance Industries	2585
TATA consultancy services	1140
Wipro	1321

Source: National CSR data portal, CRISIL Research

20 Addendum I- 7th February 2022 to the report "Outlook for GDP growth in India"
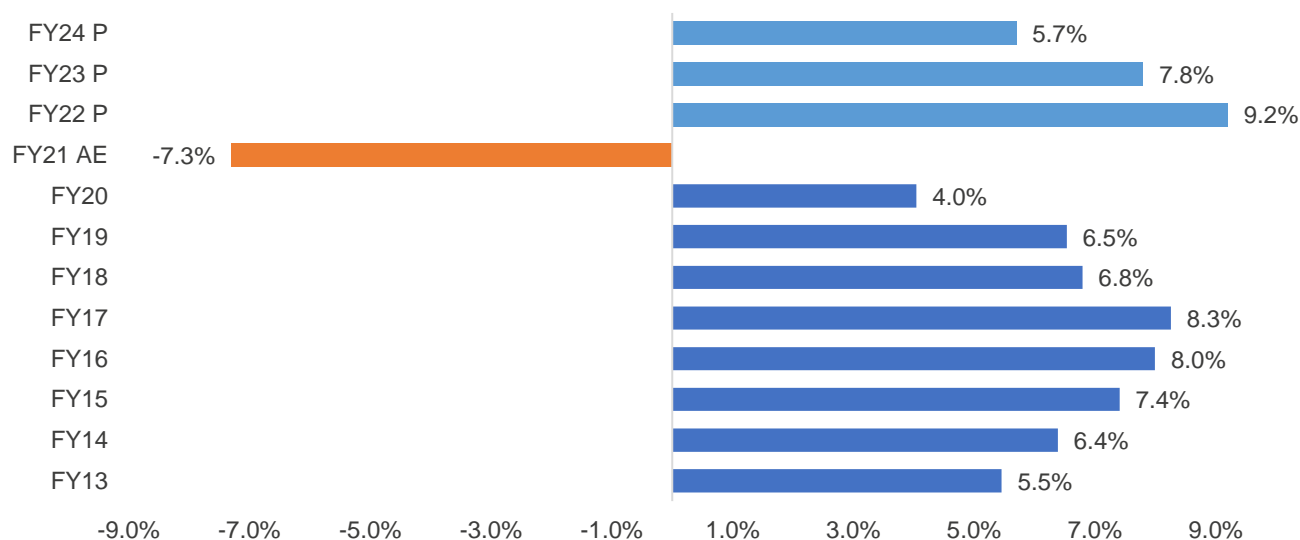
20.1 Outlook for GDP growth in India

Fiscal 2022 real GDP growth expected to be 9.2%

India is getting back on its feet slowly, with divergent growth trends. Though data suggests there has been some pick-up in recent months, recovery is weak and uneven. And indeed, the scars of the pandemic continue to run deep for small businesses, the urban poor and most of the services sector.

Fiscal 2022 is also seen emerging as a story of two halves. The first half will be characterised by a base effect-driven recovery amid the challenge associated with resurgence in Covid-19 infections. But the second half should see a more broad-based growth, as vaccine rollout and herd immunity support sectors that are lagging. The gains made by the economy in the fourth quarter of fiscal 2021 seem to have fizzled out in the first quarter of fiscal 2022 because of the fierce second wave of Covid-19, leading to localised lockdowns in most states. At the same time, monetary policy has begun normalising, and some tightness in domestic financial conditions is inevitable. Against this backdrop, policy support remains critical, apart from action in the external environment.

In fiscal 2021, the policy response to the pandemic focused more on damage control and measures to support the economy. In the current fiscal, the government is expected to normalise some of the extraordinary or unconventional policy moves, while trying to ensure there is smooth revival in growth. This will pertain to most of the services sectors, especially contact-based travel, tourism and entertainment. Also, stronger global growth should support India's exports to some extent. Revival will not be uniform across sectors, though. So far, the rural economy has been more resilient than the urban.

Real GDP growth (% on-year)

Fiscal Year	Growth (%)
FY24 P	5.7%
FY23 P	7.8%
FY22 P	9.2%
FY21 AE	-7.3%
FY20	4.0%
FY19	6.5%
FY18	6.8%
FY17	8.3%
FY16	8.0%
FY15	7.4%
FY14	6.4%
FY13	5.5%

AE: Advanced estimates; P: Projected by CRISIL Research; GDP calls updated as of June 2021;
Source: Advanced estimates of national income 2020-21, CSO, MoSPI, CRISIL Research
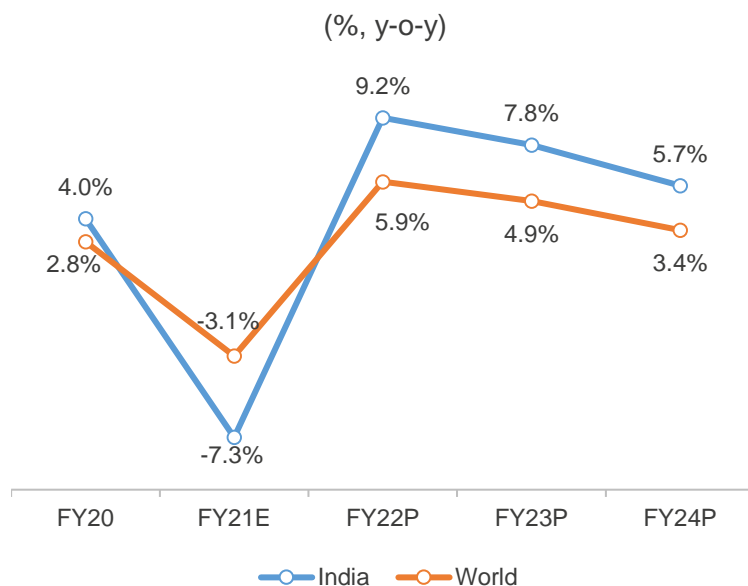
CRISIL forecasts India's GDP growth to rebound to 9.2% in fiscal 2022 as following drivers converge:

- **Weak base:** A 7.3% contraction in GDP in fiscal 2021 will provide a statistical push to growth next fiscal.

- **Global upturns**: Higher global growth in 2021, i.e., world GDP up by 5.0%, advanced economies 4.3%, emerging economies 6.3%, should lift exports.

- **Fiscal push**: Stretch in the fiscal glide path and focus of the Union Budget 2021-22 on capex are expected to have a multiplier effect on growth.

Risks to the fiscal 2022 forecast

- **Elongated duration of third wave:** India started experiencing impact of third wave of covid from the month of December 2021. However, with increase in reported cases, the death rate and hospitalization rates remained lower compared to rates observed in second wave. To control the spread of wave, state governments took restrictive measures in the geographies wherever intervention was required. Elongated wave duration will lead to continuation of restrictive measures which in turn harm the economic growth.

- **Elevated inflation:** Significant cost-push pressures on account of surging international commodity prices and supply disruptions has raised cost of production for manufacturing firms. Pass-through to consumer prices could further pose as a headwind to recovery in demand.

- **Premature tightening of global monetary policies**: Resurgence of inflation globally could lead major central banks to unwind their extraordinary easy monetary policies sooner than expected. This could hit sentiment, possibly leading to capital outflows f rom the Indian economy and some tightening in domestic financial conditions.

India to surpass global GDP growth in next three fiscals

(%, y-o-y)

India: 4.0% (FY20), -7.3% (FY21E), 9.2% (FY22P), 7.8% (FY23P), 5.7% (FY24P)

World: 2.8% (FY20), -3.1% (FY21E), 5.9% (FY22P), 4.9% (FY23P), 3.4% (FY24P)

FY20 | FY21E | FY22P | FY23P | FY24P

—○— India —○— World

GDP growth to rebound to 9.2% this fiscal on the back of a very weak base and the rising-global-tide effect

CRISIL sees India's GDP growth rebounding to 9.2% this fiscal due to a very weak base, flattening of the Covid-19 curve, rollout of vaccinations, investment-focused government spending, and benefit from the 'rising global tide lifts all boats' effect. Yet, the economy is expected to reach pre-pandemic levels only by the second quarter of this fiscal. Services will take longer to recover than manufacturing. Beyond fiscal 2022, India is seen growing faster than the world. Over fiscals 2023-25, growth is seen averaging at ~6.0% annually.

Note: Forecasts for World are for calendar year; FY20 corresponds to 2019 and so on; P: Projected; updated as of June 2021; India numbers for FY20 and FY21 are based on MoSPI's latest GDP estimates and FY22 onwards are CRISIL Research's forecast. World GDP growth rates are from IMF world economic outlook update as of April 2021.
Source: S&P Global Ratings, CRISIL

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