



U.S.-India partnership – road to prosperity

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Table of contents

India's transformation journey

- | | |
|-----------------------------------|----|
| 1. A nation on the move | 03 |
| 2. India-U.S. dynamic-aiming high | 07 |

Partners for growth: Sectors and themes

- | | |
|-------------------------------------------------|----|
| 3. Aerospace and defence | 09 |
| 4. Agriculture | 15 |
| 5. People to people ties: education and tourism | 21 |
| 6. Energy and natural resources | 25 |
| 7. Healthcare | 29 |
| 8. Infrastructure | 33 |
| 9. Manufacturing | 37 |
| 10. Digitalisation | 41 |
| Way forward on the road to prosperity | 46 |

Foreword – KPMG in India

The India-U.S. economic engagement is manifestly important to both countries. India is the fastest growing major economy; its growth is being driven by continued foreign direct investment, a renewing cycle of private domestic investment, infrastructure spending and increasing demand across multiple sectors – from consumer durables to air travel. Today's India presents U.S. companies with unprecedented opportunities to trade, invest and grow – and the jobs they create in India are of great value to the economy. Further, as U.S. companies de-risk and diversify their supply chains that are China-dependent, India is a compelling area for them to configure their new sources of supply.

The U.S. will continue to be an important market for India's services and products which contribute to the competitiveness of U.S. corporations. India is playing an increasing role in the innovation and development dimensions of U.S. companies. Large and medium sized Indian companies are investing and operating in the U.S.

India's progress in ease of doing business and the long-term sustainable reforms represented by the Goods & Services Tax and the Insolvency & Bankruptcy Code have been noted by U.S. corporations as well as domestic ones. They will add to the productivity and competitiveness of the economy. Alongside, the growth of the digital economy, especially with regard to payments, are remarkable advances.

The narrative of the Indo-Pacific reflects a shift in global thinking. It expands the pivot to Asia to appropriately include India. The decisions by major

American defence firms to set up production bases in India will not only enhance India's security but also will result in large scale job creation and help India move up the global value chain especially with regard to technology. Of note is U.S. commitment to help India create a blue economy and comprehensive partnership opportunities in energy, technology and infrastructure to enhance India's energy security.

India's growth is inexorable. The energies and aspirations of its companies and citizens, combined with the reforms implemented and to come, will inevitably drive India to the near-term ambition of becoming a USD5 trillion economy.

Prime Minister Modi, in a recent meeting with the USIBC's Board of Directors, urged that U.S. and Indian business leaders collaborate to jointly raise their game by developing ideas to impact critical areas of India's development. This report aims to progress that conversation by identifying areas where India and U.S. can work together towards the ambitious goals of economic transformation articulated by the Prime Minister.

KPMG in India is proud to collaborate with USIBC to share an industry perspective on India's economy and develop an outline for action-based collaboration across key sectors and themes with the objective of seeking transformative results.

Arun M. Kumar
Chairman and CEO
KPMG in India

Foreword – USIBC

In recent years, the commercial relationship between the U.S. and India has matured significantly. Over the past decade, two-way trade has grown significantly to approximately USD120 billion today. With the U.S. Presidential Administration's focus on the Indo-Pacific, the U.S.-India relationship has the opportunity of a century to reset the region's dynamics. And there is every reason to be positive about India's growth story. On the back of its very strong and far-reaching reform agenda, India is now witnessing enhancements in global benchmarks — whether it is in the World Bank's Ease of Doing Business Index, Moody's rating, the Global Innovation Index, or the Global Competitiveness Index.

This report is the outcome of the meeting the U.S.-India Business Council Board of Directors held with the Prime Minister in September 2018. During that meeting, we discussed how industry can work with the government on big ideas and outcomes to show collective impact to our communities.

The Report focuses on seven key areas where the work of industry is naturally complimentary to the Governments objectives: Providing quality healthcare; doubling farmer income and supporting agricultural output; people to people ties through investing in education, tourism and skills of the future; manufacturing and infrastructure for the 22nd century; affordable energy; defence and the aerospace industrial ecosystem; and promoting India's digital leadership.

Over the last four years, India has witnessed significant improvements in doing business— removing red tape and regulatory bottlenecks through steps such as abolishing the Foreign Investment Promotion Board (FIPB) have been welcome moves by the Government of India. India was the only economy in South Asia to join the list of the 10 top improvers in the World Bank's Ease of

Doing business ranking. Then there were other key structural reforms— the Government has repealed 1,420 obsolete laws in the last three years, and focused on overhauling India's infrastructure sector. At a time when foreign direct investment is lower globally, India recorded the highest inflow of FDI in 2016 at USD60.1 billion.

But despite achieving some momentum with these reforms, India still remains shy of a bold trade agenda that can catapult in to the projected USD5 trillion economy by 2025. Although two-way trade and investment between the United States and India has significantly increased in the past decade, there is vast potential to cultivate this relationship not only in Washington and New Delhi but also in states and cities across both nations. That is why I am pleased that USIBC and KPMG in India have collaborated to develop a roadmap on further reforms for the business community.

Prime Minister Modi has laid out an ambitious strategy for continuing India's economic transformation— the 'New India 2022'— a series of milestones for India to achieve by the country's 75th anniversary. The vision is predicated on inclusive growth and development and highlights the role of the private sector in bringing the benchmarks to fruition. American companies and USIBC stand as committed partners to this effort.

Now more than ever, government and industry need to work together to achieve the development goals and outcomes that neither can achieve alone. USIBC is committed to partnership with the Indian Government and to deliver positive outcomes for society.

Nisha Biswal
President,
U.S.-India Business Council

01 India's transformation journey



largest economy in terms of PPP and second largest military base, India is expected to exert significant influence in shaping the international system. Looking ahead, with India leading the digital transformation revolution, it carries the potential to effectively use digital as a tool for economic development and empowerment to connect close to three billion emerging users in the region and neighbouring Africa.

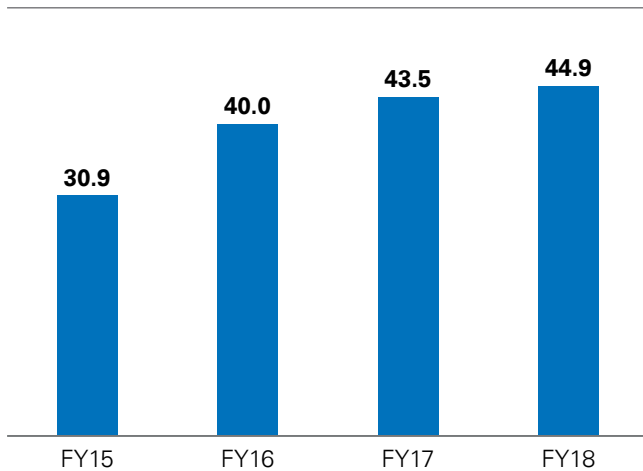
India means business

Sustained efforts have been put in place by the government to drive stability in the new system and ensure compliance through further simplification of procedures to make the Goods & Services Tax (GST) a success. The recent news to further rationalize higher slab rates is an indicator of the promptness with which both Central and State governments are working to simplify the framework. The landmark IBC reform introduced in 2017, which has now begun to bear fruit and has helped further India's mandate to continually make the foreign investment environment in the country more conducive and attractive. While this process has driven a fundamental change in the borrower-lender relationship in India, the sheer number of large assets has increased the attractiveness for global investors. Furthermore, to encourage private investments, several steps have been taken to simplify various compliance procedures and also ease foreign investment rules in numerous sectors such as insurance, defence, railways etc.,. Additionally, reforms across improvements in construction permit systems, consolidation of rules and single-window clearance system have helped India improve its ranking yet again in the 'Ease of doing business' parameters from 100 in 2017 to 77 as per the latest report. This has gone a long way in signalling intent and creating a positive impact in the global arena.

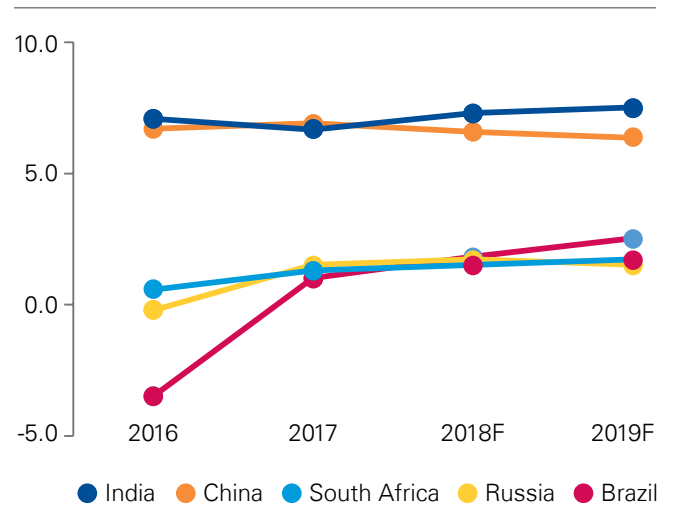
A nation on the move

India today is probably one of the few large emerging economies, where the trajectory of both growth and development seem to cruise at the same pace, making it unique in many ways. Prudent monetary and fiscal policies along with the implementation of several domestic structural reforms have not only strengthened the macroeconomic fundamentals but also raised the reforms bar. Structural reforms in areas of ease of doing business, taxation and bankruptcy have helped the economy build resilience to global shocks and maintain a robust growth rate despite domestic challenges.

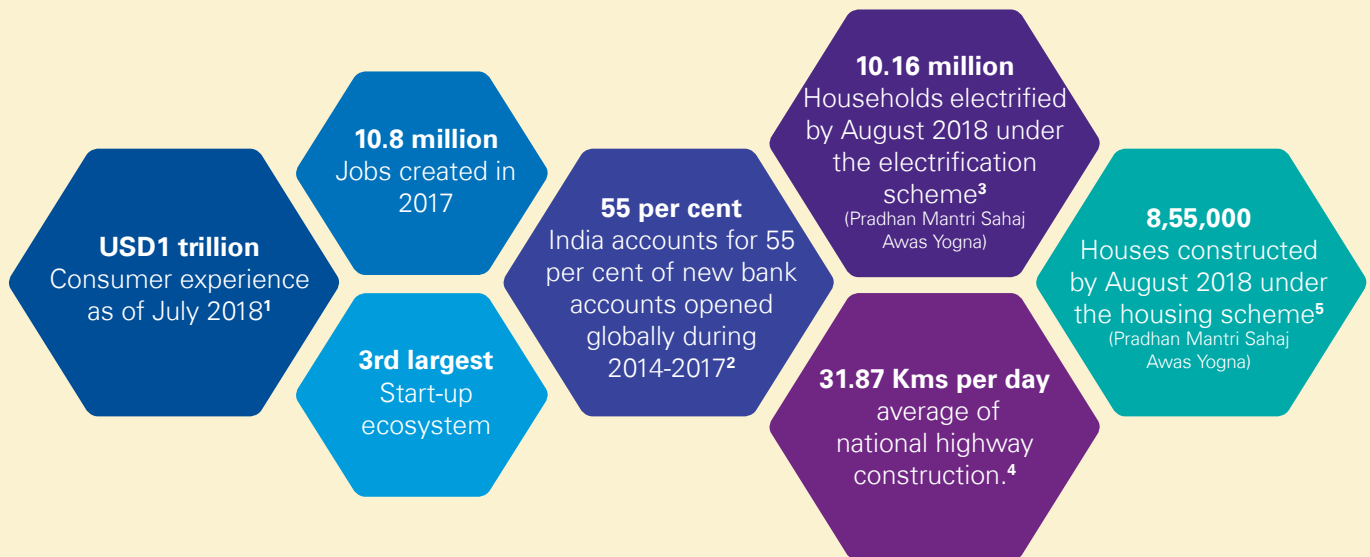
With the economic activity gradually shifting to Asia, India today has become a much larger factor in international geopolitics and economic policy. Despite the shift in global dynamic and growing uncertainty around global macroeconomic indicators, India's transformation story and reforms momentum continues to build traction and find support in long standing natural allies such as the U.S, UK, EU, Japan and others. Boasting of being one of the world's

Significant uptake in FDI inflows (USD billion)

Source: Department of Industrial Policy and Promotion, Accessed on 24 December 2018

India outpaces BRICS nations in GDP growth (per cent)

Source: World Economic Outlook Update, IMF, July 2018

Factors driving the country's growth juggernaut

1. India Consumer Spending, Trading Economics, Accessed on 8 January 2019

2. Number of adult Indians with bank accounts rises to 80%, The Economic Times, 20 April 2018

3. Fact Checking Government claims on Electrification of Villages & Homes, Factly, 26 October 2018

4. National highway construction hits record 31.87 km per day in December - Livemint, 10 January 2019

5. Little over 15% of 5.49 mn houses completed under PMAY(U) in 3 yrs, Business Standard, 16 September 2018



At its core, there are five distinct factors propelling India's growth story.

First, the exuberance of the Indian youth has put tremendous pressure on the government to transform and perform, leading to greater accountability and quicker implementation of reforms. This has led to the creation of an ecosystem of competitive federalism between states which are now competing against each other to become attractive markets for investments and human capital. The blend of national programmes and state specific policy reforms have helped craft unprecedented success stories for many Indian states, some of which have now become multi-million dollar economies. Each state is playing on its competitive advantage with an ambition to turn into regional powerhouses and multibillion dollar economies.

Second, the unprecedented rise in urban clusters across the country is driving the country's urbanisation story. While historically, cities never had the financial resources to scale up, there are early signs of a fundamental change towards cities becoming self-sustaining. As Indians continue to move from villages to cities, there is an increased push in reforms and higher investments, in a bid to make Indian cities globally attractive for doing business. In summary, the great Indian urbanisation run is certainly here to stay and is expected to drive India's future smart cities.

Third, India's start-up ecosystem story is reflective of a start-up attaining unicorn status. The country has provided an ideal platform to promote entrepreneurship right from an early stage to becoming potential unicorns. With over 21 states having a start-up policy and approximately 12,500 start-ups being recognized as unique by the government, the country undoubtedly has become a one of the leading start-up destinations. This phenomenon is helping in not only creating jobs but also bringing innovation for social change.

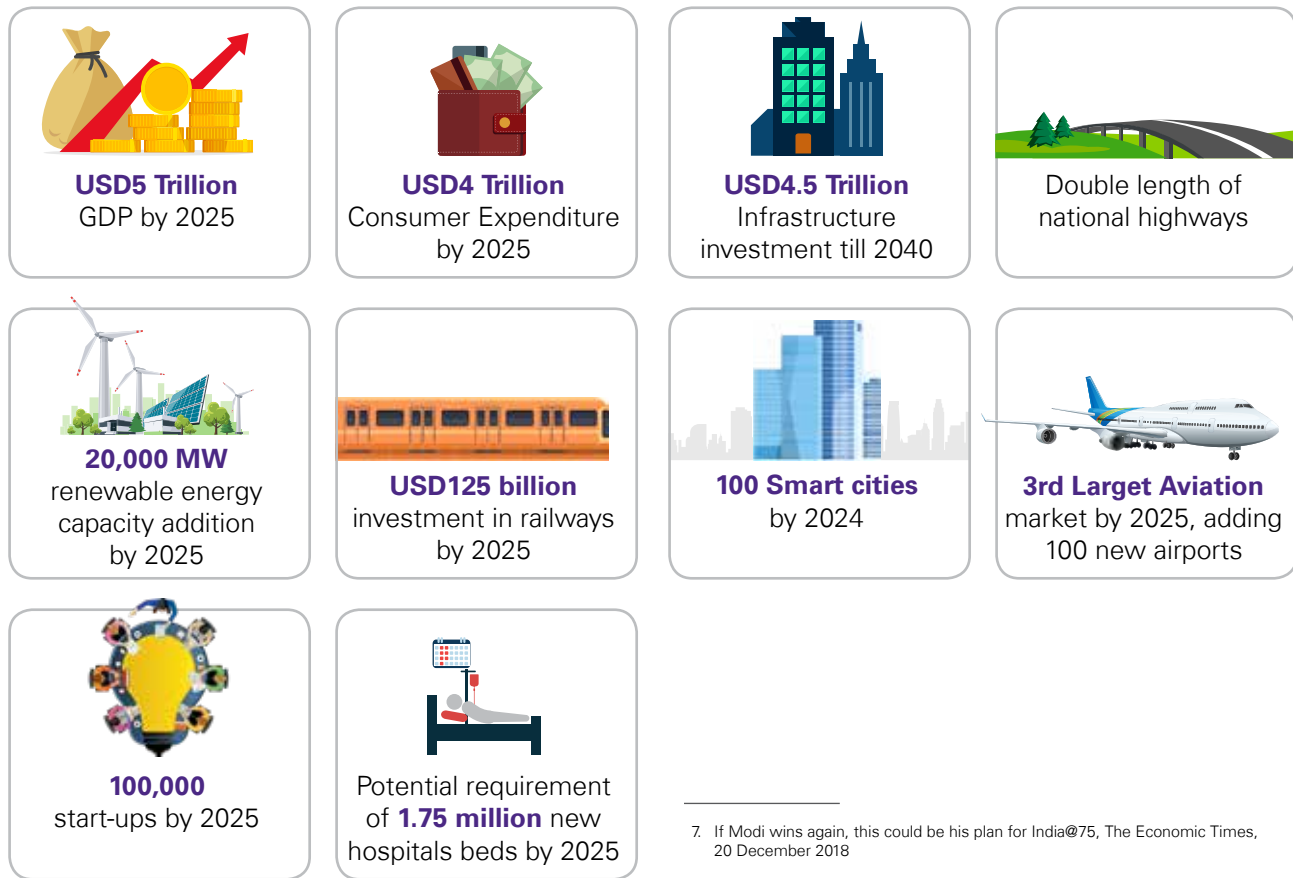
Fourth, the relentless push towards infrastructure development is helping India make a visible impact on service delivery and providing a strong foundation for accelerated and inclusive economic growth in the country. Accelerated road construction award activity for both highways and rural roads along with access to electricity has helped catalyse increased economic activity and generate employment. National highways continue to remain the bright spot where the toll-operate-transfer (TOT) auction model have helped provide a lucrative option for asset monetization and crowding-in of private capital, thereby making the sector even more lucrative. The government also opened up commercial coal mining for companies in the private sector.⁶ This move is expected to create direct and indirect employment in coal bearing areas especially in mining sector, thus furthering economic development of these regions.

Fifth, the rapid growth of the country's digital economy has made India stand out on the world map. On the global stage, India is among the top two countries on many dimensions of digital adoption. Today, India is the second largest market for both smartphones and in terms of app downloads. The country's continued investment in the digital infrastructure has not just made India a major digital hub, but also an attractive market for global corporations. The convergence of government, start-ups and private companies, the confluence of broadcast and mobile networks, the growing prominence of social media platforms and the increasing connectivity of numerous devices has fuelled a digital wave in the country. From improving digital infrastructure to launching numerous initiatives to increase digital literacy in the country, the government of India has played the vital role of a facilitator-cum-provider in steering India towards a digitally empowered society.

6. Govt allows commercial coal mining by private firms - Livemint, 21 February 2018



En route becoming a USD5 trillion economy in the next decade⁷



Focusing on the fundamentals to drive sustainable growth

The visible outcomes of the structural reforms are beginning to show and the positive changes in key metrics of the Indian economy will be visible over a period of time. While the government is focusing on bringing structural changes across sectors, its ambition to become a USD5 trillion economy in the next decade will depend on how the government, both central and state steers development in key sectors such as healthcare and education, which will be key to sustaining the country's growth story. The government also needs to act quickly to mitigate ongoing risks around the restrained ability of the public sector banks to support lending, the risk of

monetary tightening and ongoing tariff wars. There needs to be a focussed effort by the government to address the ongoing labour market rigidities in order to create more jobs and ensure the country's rich demographic dividend is optimally leveraged to further drive the country's consumption story in times to come.

Developing a successful and robust framework is vital for a flourishing environment for cross-border partnerships so that institutions are able to leverage emerging technologies, stay relevant in the era of glocalisation and help India continue its growth story.

U.S.-India dynamic



Aiming High

Today, India and the U.S. demonstrate a global strategic collaboration at the back of common ambition, values and interests. The trajectory of the effort made by the two nations in recent times to align with each other's interests has been simply remarkable, not just in traditional sectors such as technology and financial services but also in emerging sectors such as aerospace and defence, chemicals, dedicated freight corridors, energy and infrastructure. The high powered government to government exchanges, increasing prominence of the role of the Indian American diaspora and gradual convergence of strategic interest on regional and global issues has stepped up the momentum of bilateral cooperation.

India-U.S dynamic – Strategically indispensable, commercially promising

The bilateral trade between the two nations has grown exponentially and there are continued efforts to achieve a more balanced trade relationship in light of the concerns raised by the U.S. Small. Encouraging steps taken by India in that direction has been the recent burgeoning deals in defence and energy which has been able to bring down the overall trade deficit, one of the few countries to achieve that last year. Government of India's continued efforts towards further liberalising the economy is expected to provide greater market access to American exporters. The intent of major American defence firms to set up production base in India is expected to result in large scale job creation and make local defence technology/ component companies move up the global value chain.

U.S's commitment to help India create a blue economy offers comprehensive partnership opportunities including all forms of energy, technology and infrastructure necessary to ensure the country enhances its energy security. Transformative programmes such as Make in India, Digital India, SMART cities, Start-up India, Stand-up India have not only opened up a massive market for U.S. companies to do and grow business in India, but also created a platform for unprecedented collaboration where India can benefit from greater trade and investment flow.

The above points are reflective of the fact that both countries have found common ground to take the relationship forward in a sustainable way.

Strengthening India-U.S. ties

Trade and economics ^{1,2,3}	Defence Cooperation ⁶	Civil Nuclear Cooperation ⁵	Energy and Climate Change ⁴	People to People Ties
<p>Target to increase bilateral trade in goods and services to USD500 billion.</p> <p>The Trade Policy Forum (TPF) enables the U.S. and India to engage on a wide range of policy issues impacting bilateral trade and investment including IP, manufacturing, services, and agriculture.</p>	<p>Aggregate worth of defence acquisition from U.S. has crossed over USD13 billion.</p> <p>India and the United States have launched a Defence Technology and Trade Initiative (DTTI) aimed at simplifying technology transfer policies and exploring possibilities of co-development and co-production.</p>	<p>Culminating a decade of partnership on civil nuclear issues, the two sides have started the preparatory work on site in India for six AP 1000 reactors to be built by the American firm.</p>	<p>Over USD30 billion contracts signed by Indian companies for U.S.-produced LNG.</p> <p>In November 2014, a MoU between U.S. EXIM Bank and Indian Renewable Energy Development Agency (IREDA) was concluded to provide USD1 billion in financing for India's transition to a low-carbon economy.</p>	<p>The two countries have been working together to facilitate travel of their respective citizens, and to this end an MoU has been signed in June 2016 to facilitate India's joining of the Global Entry Programme for expedited immigration for eligible Indian citizens at U.S. airports.</p>

Rejuvenating the fundamentals to prosper together

The need of the hour is to outline the contours for a sustainable trade negotiation which is broad based and encompasses the principles of economic engagements between both the countries. The India-U.S. bilateral dynamic is unique as it rests on both strategic and commercial interests. Amidst the shifting sands of global politics and the emergence of the Indo – Pacific as a critical geopolitical construct, both nations should increase cooperation in strategic interest areas (defence, infrastructure, cybersecurity and energy) to further enhance the relationship and help India become globally competitive. It is important to realise that small and medium businesses (SMBs) can be the lynchpin in this bilateral dynamic and therefore there is a need for India to create an investor-friendly ecosystem in order to attract U.S. SMBs. Cooperation at a subnational level is also expected to be a critical factor for economic growth and state-state with city-city collaboration clearly being the way forward to steer the bilateral economic relationship in times to come.

In essence, both countries have all the essential ingredients for becoming a force multiplier on the global business and investment landscape. What is required is the continued momentum by governments and industry on both sides to drive and inspire a transformative change.



1. U.S.' export to India increases as bilateral trade deficit drop, The Time of India, 4 August, 2018
2. The U.S.-India dynamic – prospering together, KPMG, June 2018
3. Brief on India-U.S. Relations, Ministry of External Affairs, June 2017
4. REDA & U.S.-Exim Bank Signs MoU with Respect to Cooperation on Clean Energy Investment, Ministry of New and Renewable Energy, 18 November 2014
5. NPCIL, Westinghouse agree to begin work on 6 Nuclear reactors, The Indian Express, 7 June 2016
6. India and U.S. must leverage Defence Technology and Trade Initiative for mutual benefit, Hindustan Times, 29 November 2017



Partners for growth: Sectors and themes



03

Aerospace and defence

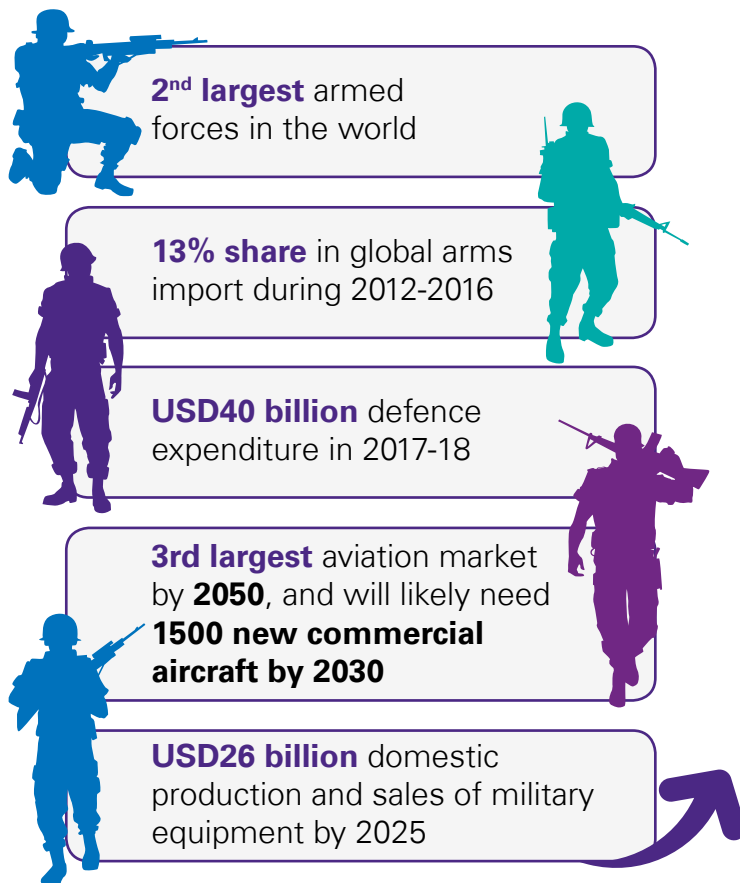


Market overview^{1,2,3,4,5,6,7,8,9,10,11,12,13,14}

The Indian aerospace and defence market currently presents an attractive and substantial opportunity for Indian and foreign companies across the supply chain. The Indian government, which aims to invest USD130 billion on defence industry modernisation by 2023¹⁵, has opened defence equipment manufacturing to the private sector to promote domestic production and thereby enabling FDI and technological collaboration with foreign companies. Consequently, the defence and aerospace manufacturing sector is expected to reach USD70 billion, from USD1.7 billion, over the next 10-12 years¹⁶.

The Indian civil aviation sector is the seventh largest in the world¹⁷ owing to rising demand, cheaper fares and increased regional connectivity. Passenger traffic is set to grow to at a CAGR of 17.2 per cent to reach 421 million with additional 100 airports expected to become operational by 2035^{18,19}. This is giving rise to unprecedented demand for aircrafts and its components and unique opportunities for U.S. companies to tap into the Indian aerospace market across the entire value chain, to leverage India's labour arbitrage and access to skilled engineers and workers.

Snapshot of India's defence and aerospace market^{20,21,22,23}



1. Defense Budget 2018-19, Ministry of Defence, Government of India, 1 February 2018
2. Aerospace and Defense Market in India to hit USD 23bn by 2024: Global Market Insights, Inc, Global Market Insights, 26 September 2017
3. Review of Foreign Direct Investment (FDI) Policy on various sectors Press Note No 1 (2018 Series), DIPP Ministry of Commerce and Industry, Government of India, 2018
4. Defence Manufacturing, Invest India, Accessed on 13 December 2018
5. TRENDS IN WORLD MILITARY EXPENDITURE, 2017, SIPRI FactSheet, May 2018
6. 'Make in India' in Defence Sector, Ministry of Defence, Government of India, 30 July 2018
7. Defence India Startup Challenge, Department of Defence Production, Accessed on 17 December 2018
8. Maharashtra unveils defence and aerospace policy to attract USD2 billion investment in five years, Livemint, 6 February 2018
9. Aerospace & Defence Policy 2016, Government of Haryana, 2016
10. Haryana rolls out Aerospace and Defence Policy, Daily Pioneer, 15 June 2017
11. Projects, Department of Defence Production, Accessed on 17 December 2018
12. New Measures to Spur FDI in the Indian Defence Sector, India Corp Law, 29 October 2018
13. Deck cleared for purchase of 111 naval utility helicopters, Hindustan Times, 30 July 2018
14. The problem with raising India's defence expenditure to 3 per cent of GDP, The Indian Express, 31 August 2018
15. Defence Manufacturing, Invest India, Accessed on 13 December 2018
16. U.S. firms seek opportunities for private partnerships in India's defence market, Business Line, 27 July 2018
17. India's Air Transport Sector: International Air Transport Association (IATA), August 2018
18. India - Civil Aviation, Export , U.S. Government, 10 October 2018
19. India plans to build 100 more airports for 1bn flyers by 2035: Nikkei Asian Review, April 2018
20. 29 Largest Armies In The World, Worldatlas, 12 February 2018
21. India world's largest importer of major arms in the last four years, The Economic Times, 14 July 2018
22. India in aerospace: Vision 2020, Livemint, 29 December 2017
23. The Long And Winding Road To Make In India, Dailyhunt, 21 August 2018

To support this, the central government has spearheaded several policies and reforms to attract investment and innovation in the sector under 'Make in India' such as 'Defence Procurement Procedures: Make-I and Make-II Process' to prototype development of systems and equipment for import substitution and innovative solutions; strategic partnership model to encourage private sector involvement in manufacturing of defence equipment such as fighter aircrafts, helicopters, submarines and Armoured Fighting Vehicles (AFVs)/Main Battle Tanks (MBTs); and Foreign Direct Investment (FDI) Cap raised to 100 per cent under approval route to access modern technology.

Additionally, some of the state governments are taking initiatives to build defence manufacturing hubs and required infrastructure such as special economic zones and promote micro, small and medium enterprises (MSMEs) in the sector. For instance, Maharashtra plans to establish defence hubs across Pune, Nagpur and other cities and aims to attract USD2 billion investment and create 100,000 jobs over the next five years. Similarly, Haryana plans to position the state as a defence and maintenance repair and overhaul (MRO) hub by providing fiscal incentives, access to infrastructure and simplified regulatory environment with an aim to attract USD3.7 billion investment across the value chain and employ 32,000 people by 2020 (*Haryana rolls out Aerospace and Defence Policy, The Pioneer, 15 June 2017*). This presents the U.S. with tremendous opportunities for collaboration at multiple levels i.e. government-to-government, state and private sector.

24. India, U.S. ink Comcasa deal at 2+2 dialogue, Economic Times, 7 September 2018

25. Fact Sheet: U.S.-India Economic Cooperation and People-to-People Ties, U.S. Embassy and Consulates in India, 7 June 2016

26. Joint Statement: Second India-U.S. Strategic and Commercial Dialogue, U.S. Embassy and Consulates in India, 30 August 2016



India-U.S. dynamic

The Indo-U.S. engagement on defence and aerospace industries has expanded significantly over the last few years and is reflective in India being recognised as a major defence partner by the U.S. This opens the door for significant collaboration across areas such as maritime security, domain awareness, counter-piracy, counter-terrorism, humanitarian assistance and coordinated responses to natural disasters and transnational threats. According to the U.S. government, the defence trade is estimated to be over \$16 billion between the two nations.

Communications compatibility and security agreement (COMCASA) in 2018²⁴

The agreement provides Indian military with access to high-end secured and encrypted communication equipment on U.S. platforms such as C-130 J, C-17 and P-8I aircraft, and Apache and Chinook helicopters.

Science and technology (S&T) agreement renewal in 2016²⁵

The bilateral agreement was extended by three years. It includes collaboration between U.S. Department of Defense (DOD) and Indian civilian researchers to share real-time high-quality scientific data and enhance approval processes for bilateral S&T activities.

Civil space cooperation in 2016²⁶

The Indian Space Research Organisation (ISRO) and the National Aeronautics and Space Administration (NASA) established a working group to collaborate on Sun and Sun-Earth system exploration and associated research.

U.S.-India Aviation Summit 2016²⁵

The U.S. Trade and Development Agency (USTDA) awarded a grant to India's Directorate General of Civil Aviation (DGCA). It provides India with access to U.S. technical expertise in international aviation safety regulatory systems and helps the Indian aviation sector understand testing and certification of aviation security equipment.

U.S.-India defence technology and trade initiative (DTTI) in 2016²⁶

DTTI is a bilateral cooperation platform to strengthen defence research, trade, and co-production and co-development of defence equipment.

Collaboration opportunities for the U.S. in India

Opportunities		
Defence ²⁷		Collaboration areas
Electronic systems	U.S. expertise in defence electronics systems can be leveraged in land systems (e.g. infantry combat vehicles, MBTs and artillery/launchers) and naval systems (e.g. conventional submarines, frigates, aircraft carriers/ support vehicles and air systems)	Technology transfer and adoption
Defence equipment	India's need for modernising its weapons and equipment presents significant technology and strategic partnership opportunities with the U.S. - for instance, there are four projects undergoing evaluation i.e. Tactical Communication System (TCS), Battlefield Management System (BMS), Terminal End Secrecy Device and Future Infantry Combat Vehicle (FICV). Another 15-16 projects are at various stages of feasibility studies including Armoured Fighting Vehicles Protection and Counter Measure System, 1000 HP Engine, 125MM APFSDS (Armour-piercing fin-stabilized discarding-sabot for attacking modern vehicle armour) ammunition, Auxiliary Power Unit for Tank T-90 (APU), Advance Pilotless Target Aircraft (APTA), Manoeuvrable Expendable Aerial Target (MEAT) and upgraded assault track way. ²⁸	Technology transfer and adoption
Infrastructure	The new draft policy on establishing defence testing infrastructure (DTI) envisions six to eight DTI clusters to be set up, where Ministry of Defence will fund 75 per cent of the project cost. This will include firing ranges for missiles, artillery and small arms, facilities to test military equipment, laboratories for testing electro-magnetic interference/compatibility of radar and telecommunications equipment, and facilities for testing unmanned aerial vehicles (UAVs), along with forming specialised test-driving tracks, presenting wide scope of areas where India can leverage U.S. expertise. ²⁹	Joint infrastructure development and capacity building
Aerospace ^{30,31,32,33,34,35}		Collaboration areas
Maintenance Repair and Overhaul (MRO) segment to reach USD2.6 billion by 2021	Significant collaboration opportunities exist in positioning India as a global low cost MRO market, especially in the areas of airframe heavy maintenance & modification and line/field maintenance. This is in addition to creating common infrastructure that can be shared by the component manufacturers including special process and testing facilities, warehouse for inventory storage and training centres. For example, a U.S. based aviation services firm announced a JV with an Indian aviation company for the development of a new airframe maintenance, repair and overhaul (MRO) facility in Nagpur. ³⁶	Job creation and skill development

27. Aerospace industry in India - Opportunities and Challenges, MEDCIndia, 1 January 2018

28. To win India's wars with Indian solutions, need collaboration between user, industry, academia, The Economic Times, 13 July 2018

29. Industry wants govt to move fast on draft defence infrastructure policy, Business Standard, 13 June 2013

30. Aerospace, CII, Accessed on 14 December 2018

31. AAR Announces Joint Venture with Indamer for New MRO Facility in India, PR Newswire, 7 February 2018

32. Lockheed Martin to start producing 'made-in-India' F-16 wing, Times of India, 12 October 2018

33. Indian defence companies may get customs duty relief, Business Line, 30 October 2017

34. American firm chosen to help make Indian airports sustainable as passenger numbers rise, International Airport Review, 17 October 2017

35. U.S. India Aviation Co-operation Program, Current Projects, U.S. India ACP, Accessed on 17 December 2018

36. AAR Announces Joint Venture with Indamer for New MRO Facility in India, PR Newswire, 7 February 2018

'Make in India' focus	The government's 'Make in India' push in the defence sector presents opportunities in the military aerospace manufacturing segment, leveraging India's low labour and component costs and U.S.' technical expertise. For example, a U.S.-based defence and aerospace company is expected to manufacture F-16 wings in collaboration with an India-based security integration company over the next two to three years ³⁷ .	Building manufacturing ecosystem for job creation
Regional connectivity	At the back of a government's initiative of regional connectivity scheme (RCS) that is intended to make air travel to tier 2 and tier 3 cities affordable, expansion and modernisation of infrastructure in civil aviation provides tremendous scope for innovations such as developing sustainable airports, body scanner systems and aviation security equipment testing and evaluation programmes.	FDI in infrastructure and technology
Space research	State-run Indian Space Research Organisation (ISRO) is targeting 2022 to launch human space flight. This opens a new area for collaboration with the U.S., which is one of the three nations to have achieved this feat. Collaborations opportunities exists in support across critical technology, testing, training, life support systems etc.	Technology transfer and adoption
Emerging sectors^{38,39,40}		Collaboration areas
Cyber security	India's cybersecurity market is expected to be valued at USD35 billion by 2025. Given India's focus on addressing cyber warfare, U.S. expertise can be leveraged to build capacity and capability across offensive/defensive cybersecurity solutions.	Technology transfer and adoption
Next phase of 'Make in India': Design in India	Utilise India's extensive workforce across civil and defence research laboratories, universities and institutes to develop extensive research & development capabilities (India-specific IP, in compliance to a pre-agreed framework). For instance, U.S. has already established the India Innovation Growth Programme (IIGP) along with Department of Science & Technology, Government of India and Tata Trusts. IIGP aims at helping innovators develop futuristic technologies. ⁴¹ This could further be evolved into development of more sensitive technologies. As an STA-1 cleared partner, this is an area which would allow the U.S. to remain in the Indian defence ecosystem long after India's reliance on imports of defence decreases.	Base technology transfer, localised R&D and innovation
New manufacturing technologies	The U.S. is at the cusp of bringing a transformation in the field of manufacturing of defence products. This includes the scope of 3D printing in defence manufacturing industries. Since 2017, major defence contractors in the U.S. along with their supply-chain partners have been studying and testing multi-material 3D printing to manufacture simpler parts ⁴² . This is a potential new area where both U.S. and India could collaborate, particularly for manufacturing of simpler and smaller parts and components.	Evolution of manufacturing

37. Lockheed Martin teams up with Tata to make F-16 Fighters in India, The Economic Times, 14 July 2018

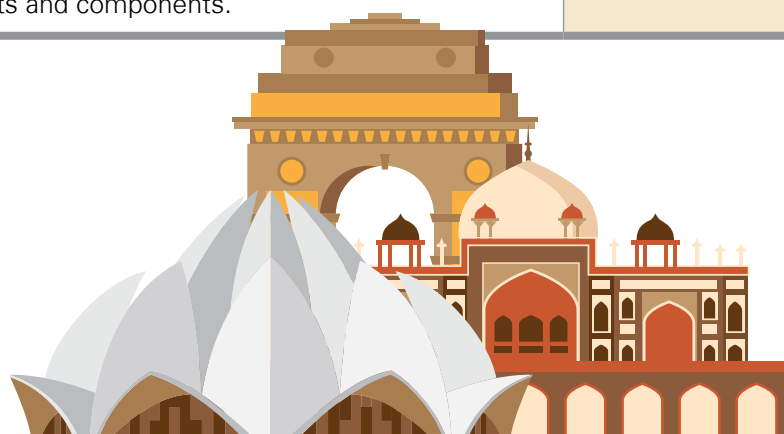
38. Cybersecurity Market worth USD248.26 billion by 2023, Markets and Markets, Accessed on 14 December 2018

39. India is quietly preparing a cyber-warfare unit to fight a new kind of enemy, Economic Times, 14 July 2018

40. In India, Cyber Security market to grow to USD35 billion by 2025, Hindu Business Line, 9 October 2018

41. India Innovation Growth Programme: Department of Science & Technology, Government of India

42. Defence industry moves towards multi-material printing: National Defense



Way forward

India and the U.S. have made considerable progress to push forth the bilateral defence cooperation and the U.S. continues to have a favourable future outlook. As a major supplier of defence and aerospace products to India, the country is keen to look for a way forward in meeting India's needs and aspirations of achieving self-reliance.

This presents significant collaboration opportunities in strategic and technical expertise across defence infrastructure, defence systems and the electronics equipment segment. There are three major areas for collaboration opportunity between India and the U.S.:

1. Establishing and strengthening the manufacturing ecosystem and supply chain from within India;
2. Developing a base for cooperating on advanced current technologies (and their adoption) in India, such as unmanned and autonomous defence technologies, including the use of areas such as artificial intelligence (AI) and machine learning (ML)

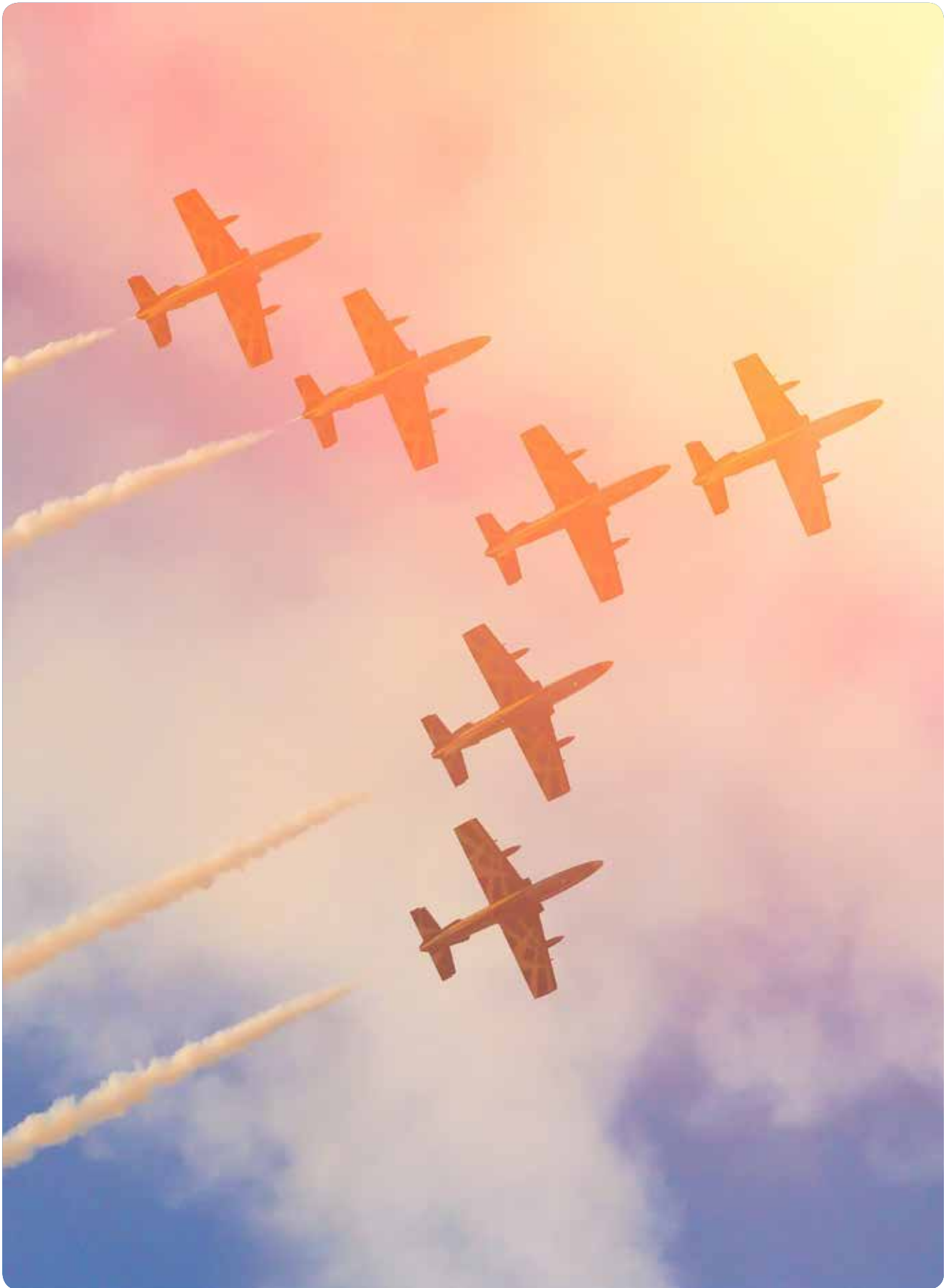
3. Development of futuristic manufacturing and India-specific capacity building to simplify and secure India's long-term indigenous manufacturing plan

One of the mainstays of the future of cooperation between the two countries would be extensive development of localised technologies specific to Indian requirements with technological and manpower inputs from both the countries.

The aerospace sector in India, on the other hand, is at the inflection point and there is massive collaboration opportunities across establishing MRO facilities for civil and military aircraft, overhaul and maintenance of aero engines and production of avionics, components and accessories.

With India's strong inclination for products designed and manufactured in India, it is crucial for U.S. companies to form partnerships as future access to the Indian market will be based on alliances with local players and strong supply chains in India.





04 Agriculture



Market overview

India, predominantly an agrarian economy, with 60 per cent of the rural households' dependant on the sector and its associated industries is witnessing positive reforms in irrigation and crop insurance, infrastructure development and modernisation through the creation of an e-commerce platform to integrate mandis.

While the sector contributes approximately 17 per cent to the GDP, in order for the economy to achieve and sustain the 8% growth trajectory in the medium term, the share of agriculture contribution to GDP will need to grow. The agriculture sector is expected to grow at a CAGR of 12.2 per cent¹ to USD1.26 trillion by 2023.

1. Agriculture Industry in India: Growth and Opportunities, Imarc Group, 2018
2. FAO in India, Food and agriculture organization of the United Nations, Accessed on 8 January 2019
3. India at a glance, Food and Agriculture Organization of the United Nations, Accessed on 10 December 2018
4. Agriculture sector to grow 2.1%: Can it double farm income by 2022?, Economic Times, 29 January 2018

India's standing in global market²



Pulses

Largest producer, consumer, importer



Milk

Largest producer



Rice and wheat

Second largest producer



Cattle

Second largest population



Sugarcane and cotton

Second largest producer



Fruits and Vegetables

Second largest producer

Though, crop yield per unit area has grown, driven by emphasis on agriculture in the government's five-year plans, improvements in irrigation and technology and application of modern agricultural practices³, the sector has not realised its full potential yet. Addressing challenges such as low crop productivity, wastage, decreasing groundwater levels, and inadequate facilities for transportation and storage will be critical.

The government's current policies and initiatives aim to double the average farmer's income by 2022⁴. To this end, the government has launched several new initiatives that encompass activities from seed to marketing, such as Soil Health Card, Input Management, Per Drop More Crop in Pradhan Mantri Krishi Sinchayee Yojana (Prime Minister's Farming and Irrigation Programme), Pradhan Mantri Fasal Bima Yojana (Prime Minister's Crop Insurance Scheme), Pradhan Mantri Annadata Aay Sanrakshana Abhiyan (price and compensation scheme), SAMPADA Yojana (Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters), modernisation of Haats, logistics & storage infrastructure and e-Nam⁴.



USD7 billion to be invested to achieve 'Har Khet Ko Pani'⁵

Facilitating farmers with the installation of solar water pumps in field irrigation⁵

USD700 million dedicated micro-irrigation fund⁵

Pradhan Mantri Annadata Aay SanraksHan Abhiyan (PM-AASHA): Three key components⁶

Minimum Support Price (MSP)	MSP policy of GOI is to set prices and market to the farmers and cushion them from the price fluctuations primarily caused by the variation in supply (largely influenced by the monsoon), information asymmetry and other elements of market imperfection affecting the agricultural markets. This step is expected to encourage farmers for higher investment and in increased adoption of modern technologies. Further, with increased free trade of agricultural commodities across nations, this guaranteed price and assured market aims to protect farmers from the unwarranted fluctuation in prices, provoked by the international level price variations.
Price Support Scheme (PSS)	Price support scheme, physical procurement of pulses, oil seeds and copra will be done by central nodal agencies with a proactive role from state governments. The government to bear expenditure and losses due to procurement.
Price Deficiency Payment Scheme (PDPS)	Farmers to get direct payment for the difference between MSP and selling price.
Pilot of Private Procurement and Stockist Scheme (PPPS)	Private sector to pilot the procurement operations

585 regulated markets with more than 12.7 million farmers and sellers transacted over 200 lakh tonnes of farm commodities worth USD7 billion approximately as of November 2018

5. Ministry of Agriculture & Allied Activities, Accessed on 7 January 2018

6. Explained: Pradhan Mantri Annadata Aay SanraksHan Abhiyan, GKTODAY, 17 September 2017

India-U.S. dynamic

To unlock the sector potential in India, collaboration with the U.S. stakeholders including academia, agri-tech firms and government across technology, knowledge transfer, research and development, innovation and investment will be crucial.

Feed the Future India Triangular Training Program – June 2016⁷

USAID has partnered with National Institute of Agricultural Extension Management (MANAGE) to train 1,500 agricultural practitioners from 11 African and six Asian countries on specialised farming practices to improve productivity and income.

Extended Range Forecast System for Climate Risk Management in Agriculture⁸

USAID has collaborated with India's largest private sector organisation on weather services to expand their network of 'Automatic Weather Stations' across 31 districts in nine states of India, making existing weather data, risk mitigation tools and crop insurance services more accessible to vulnerable farmers.

Scaling Innovations to Build Resilience in India⁹

USAID is partnering with WorldFish, Government of the State of Odisha and private companies to increase the supply of and access to affordable, safe, nutrient-rich fish and fish products through innovative technologies and approaches.

Collaboration opportunities for the U.S. in India

Opportunities ^{10,11}		Collaboration areas
Farm mechanisation	Agricultural workforce would drop to 25.7 per cent by 2050 from 58.2 per cent in 2001. In such a scenario of diminishing manpower, the U.S. expertise in farm equipment and implementations can be leveraged to increase farm productivity and reduce the input cost.	Technology transfer and adoption
Natural Resource Management	The U.S. has been a pioneer in natural resource management technologies – soil and water conservation. India could embrace technologies which can further enable sustainability in agriculture development.	Technology transfer and adoption
Agricultural R&D and agri-tech	The average yield in India is 30 to 50 per cent of the highest average yield in the world, which emphasises that agricultural R&D is the main source of innovation to sustain agricultural productivity growth. Reducing dependency on monsoons, decreasing the lag between crop cycles, effective farm management, improved market access and better logistics have been key drivers behind the increasing adoption of technology in agriculture. U.S. firms can leverage their technological expertise for cost efficiency and effective supply chain management to address the USD200 billion potential opportunity in the agricultural technology industry in India. ¹²	R&D and innovation, Technology transfer and adoption
Biotechnology	IT and biotech enable farmers to access vital information, methodologies and the latest technology to help them in areas such as crop rotation, weather patterns, fertiliser use and organic farming. Biotechnology equips farmers with techniques for developing high-yield crops, controlling pests, channelising waste water and focusing on nutrition, which can essentially transform agriculture by increasing its production levels and outputs, thereby creating tremendous opportunities for U.S. firms.	Technology transfer and adoption

7. U.S.-India Triangular Cooperation, USAID, Accessed on 10 December 2018

8. Strengthening U.S.-India Agricultural Research, Earth Institute – Columbia University, 22 November 2010

9. Partnership For Food Security, USAID, Accessed on 10 December 2018

10. India economic survey 2018: Farmers gain as agriculture mechanisation speeds up, but more R&D needed, 29 January 2018

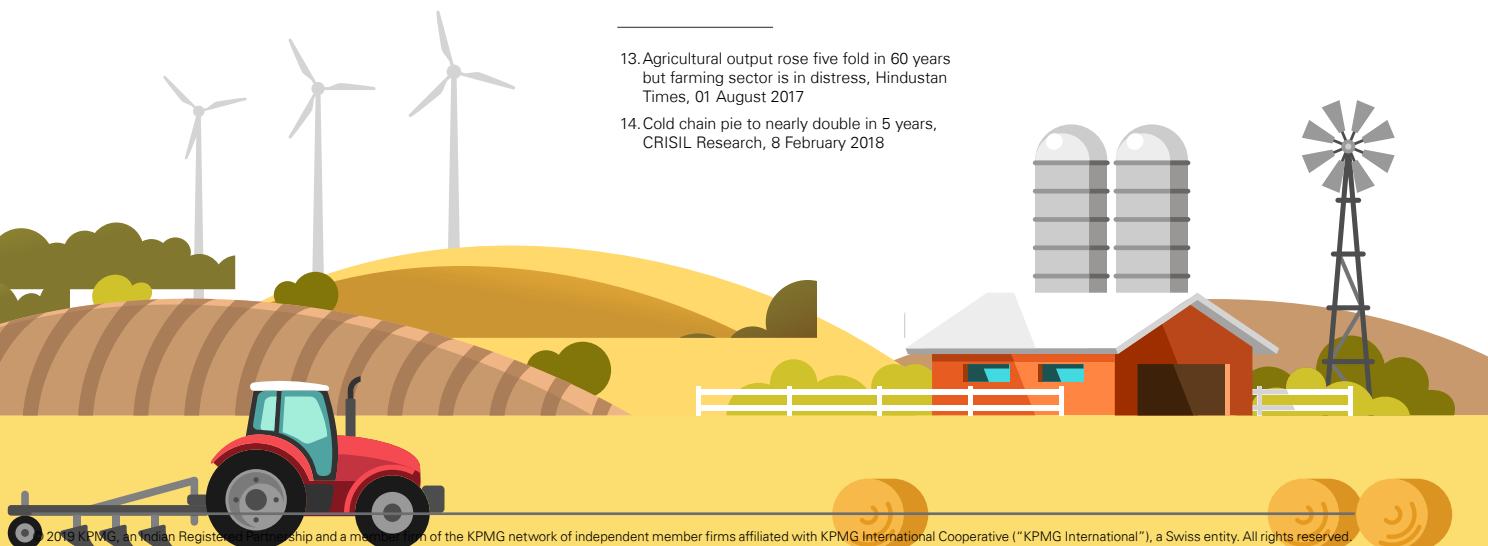
11. 3 ways to boost Indian agriculture, World Economic Forum, 3 November 2015

12. Partnering with Indian Startups – New Opportunities for Foreign Investors, India Briefing, 04 January 2018

Food processing technology	The U.S. has been a pioneer in food processing and packaging technology with well-defined norms on food safety standards. While India is still in its nascent stage of developing food processing units, it could potentially explore learnings from the U.S. to imbibe the policies, frameworks and implementation strategies.	Technology transfer and adoption
Skill development	With the increase in population, there is an increase in demand for food and agricultural produce, but the supply is constant due to low agricultural productivity. Thus, there is a huge scope for U.S. firms to help India implement best practices around skill development of Indian farmers.	Skill development
Farming-as-a-service (FaaS)	The average farm holding size in India has declined over the years - 67 per cent of agricultural land is held by marginal farmers with a farm size of less than one hectare ¹³ . The widespread use of agricultural machinery is beyond the reach of many farmers due to high acquisition and maintenance costs, which have led to the adoption of FaaS as it converts fixed costs into variable costs, thereby making it affordable.	Global best practices
Smarter value chains	Agricultural supply chain infrastructure can be enriched through farm extension services, enhancing price realisation, cutting out intermediaries and improving forward and backward linkages. U.S. firms can help India address twin challenges of information asymmetry and pilferage in the agriculture supply-chains.	Infrastructure and supply chain development
Cold-chain industry	To curb wastage, it is estimated that the cold-chain industry will grow at a CAGR of 13-15 per cent during FY17-FY22 to USD6.7 billion ¹⁴ presenting opportunities for U.S. firms in building cold-chain infrastructure, quality warehouses, temperature sensor-enabled vehicles and related equipment.	Infrastructure and supply chain development
Farm to fork	The Indian government's e-Nam platform has added agri-mandis, thereby enhancing transparent trading and further increasing farmer incomes by 8 to 10 per cent. This is expected to provide opportunities for integrators and other produce-handling companies to procure through the e-platform directly from farmers. Modernisation of rural haats that help linking farms to mandis (agriculture markets) is on the agenda of the government. Modernisation of logistics and storage infrastructure (grain silos) is also on the agenda of the government to curtail supply chain handling losses.	Technology transfer and adoption
Digitalisation and analytics	Digitalisation and analytics is likely to play a critical role in building India's farms by introducing precision farming through integrating field data, weather patterns and yield forecasting, efficient farm lending with electronic applications, disbursement of loans, insurance pay-outs linked to weather, field data and a universal platform integrating farmers and wholesale markets.	Technology transfer and adoption

13. Agricultural output rose five fold in 60 years but farming sector is in distress, Hindustan Times, 01 August 2017

14. Cold chain pie to nearly double in 5 years, CRISIL Research, 8 February 2018





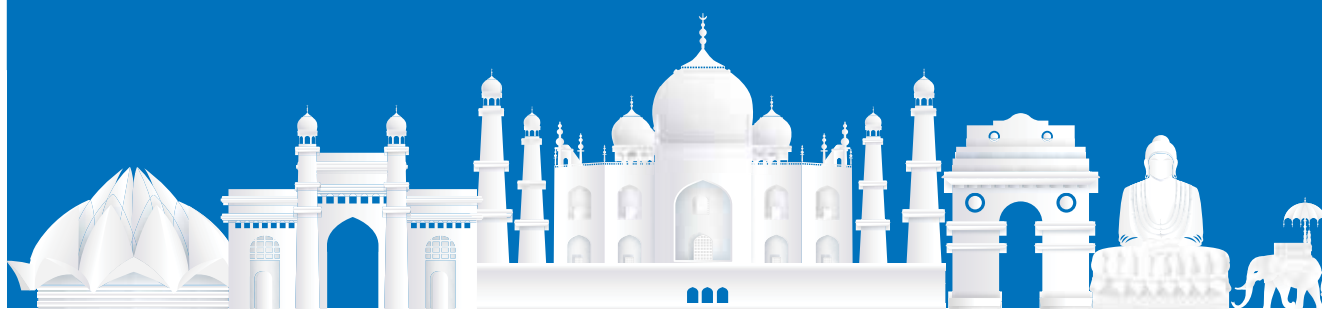
Way forward

U.S. and India could potentially build the bi-lateral trade in commodities like non-BT soyabean, non-BT corn, wheat, apples, almonds, etc. from the United States' perspective and shrimps, processed food, etc. from India's perspective.

The U.S. and India should collaborate and develop a joint framework to address challenges around low crop productivity, soil and water management, crop rotation and food processing wastage. At the

same time, the U.S. can benefit from technology collaborations, knowledge transfer models, R&D partnerships and investment opportunities in India.

Collaboration opportunities exists not just for agriculture firms but also for technology giants for developing and implementing new-age technologies such as AI, data analytics and predictive modelling across the value chain of the sector.





05 Education and tourism



Market overview^{1,2,3,4,5,6}

One of the key pillars of the U.S.-India bilateral relationship is the vibrant people-to-people ties, which are bolstered by the large Indian diaspora in the U.S. Pivotal to these people-to-people ties are education and tourism.

India's tourism industry that had created 14.62 million job opportunities in the last four years, is projected to double by 2027 from USD91.3 billion in 2017. Around 18 million international tourists are expected to have visited India in 2018; the number is projected to reach 30.5 million by 2028. The tourism sector's focus on niche tourism products including heritage tourism, adventure tourism, cruise tourism, rural tourism and wellness and medical tourism presents massive opportunities for India-U.S. collaboration across developing and maintaining monuments and heritage sites across India and skill development centres.

India's destiny, led by its young population, is being shaped in its classrooms, with more and more students enrolling for formal education. The multi-layered education sector, with 260 million students enrolled in around 800 universities and 39,000+ colleges, is expected to grow by 10.2 per cent to USD101.1 billion in FY19 from USD91.7 billion in FY18.⁷

With more than half of India's population under the age of 25, it is imperative for the government to impart high-quality education and skills to the youth to make them employable.

Education reforms^{8,9,10,11,12}

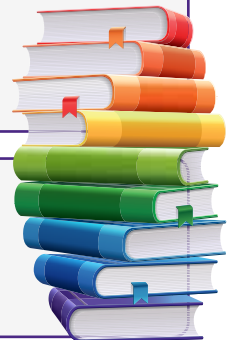
UGC granted autonomy to 60 universities - step towards a liberated regime

20 Institutes declared as 'Institute of Eminence' to promote autonomy

Cabinet approves seven new IIMs and two new IISERs (Science Institutes)

5,000 Atal Tinkering Labs set up to promote innovation amongst students

PM Research scholarship worth USD1,000-1,150 and USD3,000 annual grant for PhD and research work



Apart from higher education, technical, vocational education and training (TVET) has been given a big thrust in recent times. Government schemes such as Pradhan Mantri Kaushal Vikas Yojana (PMKVY) or Prime Minister Skill Development Scheme, that aims to empower youth with industry relevant skills across industries such as retail, automotive, construction and hospitality and National Council for vocational education and training presents wide scope for public private partnership and collaboration with the U.S. firms and universities.

1. All India Survey on Higher Education (2015-2016), MHRD, 2016
2. Educational statistics at a glance, MHRD, 2018
3. Education & Training Industry in India, Indian Brand Equity Foundation, November 2018
4. Overview of the Indian Education Industry, CARE Ratings, 25 June 2018
5. India's Tourism Sector: New Investment Opportunities Emerge as Market Segments Widen, India Briefing, 01 May 2018
6. 53 Months of Transforming India, Transforming India, 16 November 2018
7. New Digital Horizons, KPMG, October 2018
8. More autonomy a big boost for expansion: Universities, The Economic Times, 22 May 2018
9. Modi government is firming up a plan to create India's own Harvard, The Economic Times, 22 May 2017
10. Year End Review- 2018: Cabinet & CCEA, Government of India - Cabinet, 5 September 2018
11. Big move to promote innovation among students: 5,000 Atal Tinkering labs to be set up by March 2019, Financial Express, 10 May 2018
12. Modi government rolls out Rs 80,000 a month PhD grant to plug brain drain, The Economic Times, 9 February 2018

India-U.S. dynamic

India-U.S. bilateral relationship can be bolstered by an estimated 2 lakh Indian students in U.S. universities¹³ that has the potential to make significant contribution in the areas of science, business, health and agriculture. Even bigger opportunity is the role that U.S. universities, community colleges and other education institutions can play in the Indian market. With a slew of forward-looking regulations, the Indian higher education and vocational education market is more receptive for collaborations and joint programme/s.

U.S.-India 21st century knowledge initiative¹⁴

Aims to strengthen collaboration and build partnerships between U.S. and Indian institutions of higher education. Each project receives an award that can be utilised over a two-year period for promoting mutual understanding, encouraging educational reform and economic growth, and developing junior faculty at U.S. and Indian institutions of higher learning.

Passport to India website¹⁵

In 2014, the U.S. Department of State launched the new Passport to India website in cooperation with the Ohio State University. The Passport to India initiative encourages young American leaders to seek out study and internship opportunities in India. The new website will serve as a portal to help students identify these opportunities.

Global Initiative of Academic Networks (GIAN)¹⁶

In 2014, the Ministry of Human Resource Development (MHRD) of India and the National Science Foundation (NSF) of the United States of America launched this programme to tap the talent pool of scientists and entrepreneurs in the U.S. to engage with institutes of higher education in India.

13. 2,11,703 Indian students in U.S. universities, The Times of India, 2 May 2018

14. United States-India Educational Foundation – U.S. India 21st Century Knowledge Initiative Awards

15. India-U.S. Higher Education Dialogue, 17 November 2014

16. Press Information Bureau, Gov. of India - <http://pib.nic.in/newsite/PrintRelease.aspx?relid=109981>

Collaboration opportunities for the U.S. in India

Opportunities		Collaboration areas
Vocational training	Increasingly, Indian students are enrolling in vocational training institutes to improve their employment prospects, presenting tremendous opportunities for U.S. institutions (community colleges, polytechnics, private skill providers) to collaborate across various technology-specific skill courses.	Skill development
Higher education institutes	With a 25.2 per cent enrolment rate ¹⁷ , India's higher education system is the third-largest in the world. The government's effort to increase the enrolment rate offers massive opportunities for foreign universities to participate in the Higher Education market through joint programs, advisory, offering specific courses including setting up campuses in collaboration with Indian institutes.	Universities/ Higher Education
Research programmes	There is scope for launching joint research programmes between Indian and U.S. universities to promote collaborative research and provide opportunities to young researchers in areas such as clean energy and bio-technology. The rich Indian talent and the dependable university environment in India can be leveraged for low-cost research programs especially for emerging market requirements.	Research and development
E-learning	India's online education industry is growing exponentially and is expected to grow almost eight times from USD247 million in 2016 to USD1.96 billion by 2021 ¹⁸ . In recent developments, University Grants Commission (UGC) in India has allowed Indian universities to offer on-line courses all the way to on-line varsities. Many technology start-ups have entered the market using AI, AR/VR, Big Data, IoT and blockchain technologies and wide scope for collaboration exists in areas such as technological skill development centres, developing customised learning programmes and tie-ups with start-ups.	On-line varsities /MOOCs/ Technology transfer
Faculty training	According to the draft NPE 2016, there is a shortage of over 5 lakh teachers in elementary schools. ¹⁹ Given the highly skewed student-teacher ratio, huge opportunities exist for the U.S. in the areas of training courses/certifications and classroom effectiveness. This is relevant both in higher education and technical education (Trainers).	Teacher Training/Faculty Development/ sharing best practices
Travel and tourism start-ups	Technology start-ups is the key growth driver shaping the tourism sector and various international and domestic firms are introducing innovative services and products for personalised experiences. Given the growth potential, huge tie-up opportunities exist for U.S. firms, especially as the technology partner.	Technology transfer and adoption
Village-based tourism model	The village-based tourism model can boost tourism by USD25 billion, creating 100,000 village-level entrepreneurs in the process. ²⁰ Though initiatives need to be taken by local state governments and collaborate with social organisations to identify development issues and international firms to plan, build and modernise heritage sites and monuments in villages.	Research and development and skill development

17. Investing in India's Higher Education Sector, India-briefing, 21 June 2018

18. New Digital Horizons, KPMG, October 2018

19. Emerging Investment Opportunities In The Indian Education Sector, Trak.in, 20 July 2017

20. Incredible India 2.0 India's \$20 Billion Tourism Opportunity, World Economic Forum, Accessed on 8 January 2019

Way forward

Once seen as a philanthropic activity, education in India has come a long way to develop as a high-growth industry. The country's demographic dividend and increasing incomes are key drivers of the industry. Despite the government's considerable focus on digitalisation and technology adoption, various challenges such as a lower gross enrolment ratio and a skewed student-teacher ratio have to be overcome, thereby opening avenues for U.S. universities to collaborate with Indian institutions in areas of science, healthcare, agriculture and technology.

On the strategic front, India is likely to emerge as the key supplier of manpower for global requirement in the next two decades. U.S. industry – directly and/or through academic institutions can look at shaping the young talent in India to cater to U.S. industry requirements not just in the U.S., but across the globe where U.S. organisations are present.

The current opportunity can be classified in two categories. At one end is the need for quality in education – which will include bringing in deep research capabilities, options for specialised courses and quality pedagogy, access to cutting-edge technology, innovation and developing high-end resources. On the other hand, there is an even larger opportunity to bring education to the masses – where technology-led pedagogy, industry-led courses for employment, vocational education and skill development courses will play a major role.

There is an acute awareness of these requirements in India and we believe this is the right time for U.S. institutions to look at India as a long term strategic market to strengthen their educational institutions and also build lasting business and academic institutions in India.



06

Energy and natural resources



Market overview^{1,2,3,4,5}

As per BP Energy Outlook 2018, while gross GDP is expected to double over the next 20 years, energy demand is expected to grow by only 35 per cent over this period. Technology and productivity improvements globally are resulting in better efficiency and lower energy intensity of demand. Half of the growth in energy demand is expected to come from India and China at the back of rising urbanisation, economic growth and improving per capita incomes.

India today ranks as one of the top energy consumers in the world and with the country's population and GDP expected to grow in the future, energy demand is expected to witness a significant rise. The country today is the third-largest producer of electricity in the world⁶ and the electricity demand is expected to grow at a CAGR of 7.1 per cent during FY17-FY22⁷. As a result of the rising energy demand, the Government of India has announced several initiatives for building power generation capacity, promoting energy efficiency, and increasing clean energy sources in the overall power mix. As a result, India is gradually shifting towards a higher share of renewable sources.⁸

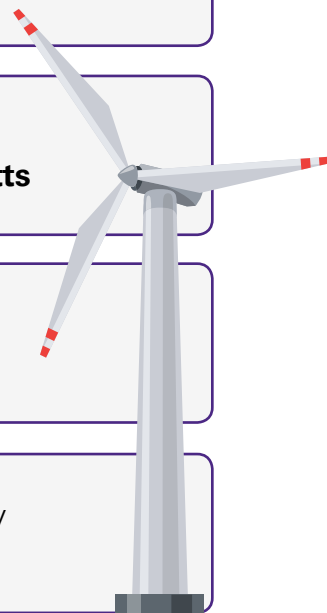
India's energy market snapshot^{9,10,11}

India's energy consumption by 2040:
1921 million tonnes of oil equivalent (Mtoe)

India's renewable energy target by 2027: **275 gigawatts**

India's projected share of renewable energy mix by 2040: **22%**

India's share of global energy consumption by 2040: **11%**



Structural reforms and initiatives to address rural and urban electrification challenges includes Pradhan Mantri Ujjwala Yojana that aims to provide 50 million households with free liquefied petroleum gas (LPG) connections over the next five years; Pradhan Mantri Sahaj Bijli Har Ghar Yojana where 91 per cent households have been electrified; and Deen Dayal Upadhyaya Gram Jyoti Yojana that aims to electrify every village.

Additionally, energy efficiency reforms have saved energy worth approximately USD3 billion during 2017-18 and is expected to save over 500 million units of electricity and 0.5 million-ton equivalent of CO₂ in Green House Gases (GHGs) in 2019.

1. BP Energy Outlook Country and Regional Insights, India, BP, 2018
2. National Energy Policy, International Energy Agency, Accessed on 10 December 2018
3. Why the energy sector is key to India's growth, World Economic Forum, 9 March 2016
4. India Country Commercial Guide, U.S. Export, 10 October 2018
5. Future Forward: India May Reach Key Paris Climate Goals 10 Years Before Deadline!, Better India, 4 December 2018
6. India is now the world's third-largest electricity producer, Quartz, 26 March 2018
7. India's New 227 Gigawatt Renewable Energy Target Is Ambitious, Challenging, But Possible, Says IEEFA, Clean Technica, 12 June 2018
8. BP Energy Outlook, Accessed on 8 January 2018
9. Electricity consumption in India: powe
10. INDIA WILL OVERTAKE CHINA AS LARGEST MARKET FOR ENERGY BY LATE 2020S: BP ENERGY OUTLOOK, IEA, 23 February 2018
11. India's New 227 Gigawatt Renewable Energy Target Is Ambitious, Challenging, But Possible, Says IEEFA, Clean Technica, 12 June 2018

India-U.S. dynamic

The energy cooperation between India and the U.S. has evolved over the last few years as both the countries pursue an all of the above energy strategy. There exists tremendous potential in energy access, energy security and emerging sectors such as biofuels, hydrogen energy, and ocean energy, in addition to infrastructure and energy efficiency areas.

U.S.-India state and urban initiative in October 2018¹²

The government of Madhya Pradesh and the University of Central Florida signed an MoU for collaboration in sustainable energy pilot research projects such as sensors, rooftop solar and energy efficiency as well as training on energy construction technologies.

Greening the grid – U.S.-India joint partnership in 2018¹³

USAID and India's Ministry of Power collaborated for conducting a pilot research in grid integration analysis and capacity building of state load despatch centres (SLDCs) and independent system operator (ISOs) utilities.

U.S.-India gas task force in 2018¹⁴

Set up a joint task force on natural gas to promote strategic and economic interests with the private sector by growing the gas energy market.

Joint Clean Energy Research and Development Center (JCERDC) in June 2016¹⁵

Promote clean energy innovations across both the countries, with a total funding of USD50 million from both governments. Mission Innovation was also launched to double clean energy research and development investment over five years. The two countries announced a USD30 million public-private research effort in smart grid and grid storage.

Partnership on women's entrepreneurship in clean energy (wPOWER) in 2016¹⁶

The U.S. State Department and USAID, in collaboration with Swayam Shikshan Prayog (SSP), rolled out a clean energy (solar lanterns) programme called the Partnership on Women's Entrepreneurship in Clean Energy (wPOWER) across 200,000 households.



Collaboration opportunities for the U.S. in India

Opportunities		
Oil & gas ^{17,18,19,20}		Collaboration areas
USD2.8 trillion investment needed to modernise India's energy grid	India aims to increase its share of the natural gas energy mix to 15 per cent by 2022, creating new possibilities for the U.S. in areas such as strengthening its energy ecosystem and building infrastructure such as pipelines, LNG terminals, city gas distribution networks and smart grid facilities.	Technology transfer and adoption
Additional storage facilities needed for India's energy security	The U.S. can share its experience and expertise in managing strategic crude oil reserves. Additionally, the U.S. can support India's bid to join the International Energy Agency's (IEA) oil-sharing mechanism for developing its energy security.	R&D and innovation
Shale gas extraction	There are significant opportunities for sharing the United States' expertise in low water-based fracking technology for developing India's 96 trillion cubic feet of recoverable shale gas resources.	Technology transfer and adoption

12. The U.S.-India State and Urban Initiative Announces a Partnership between the Government of Madhya Pradesh and the University of Central Florida, Centre for Strategic and International Studies, 23 October 2018

13. Greening the Grid: USAID GTG-RISE Initiative in India and Ancillary Services from Battery Energy Storage Systems, Renewable Integration & Sustainable Energy Initiative, 8 June 2018

14. U.S. India Gas Task Force designed to help India unleash its own natural gas reserves: Perry, 31 July 2018

15. India – United States Relations, MEA Government of India, January 2016

16. NGOs bring clean power to dark homes, India Climate Dialogue, 9 February 2018

17. Immense opportunities of cooperation between India, U.S. in energy sector: official, Times of India, 29 March 2018

18. India Ready To Import More U.S. Oil And Gas, Oil Price, 14 November 2018

19. Official: Oil from existing strategic reserves cannot be used for commercial purposes, 12 October 2018

20. Time to Act on U.S.-India Energy Cooperation, Brookings Institute, July 2017

Market opportunities for the U.S. in India

Coal ^{21,22,23}		Collaboration areas
India's coal consumption will reach 1,076 million tonnes by 2023	Collaboration opportunities exist in the technical transfer of clean coal technology, specifically in advanced technologies such as Integrated Gasification Combined Cycle (IGCC) and Pressurised Fluidised Bed Combustion (PFBC), aimed at increasing thermal plant efficiencies.	Technology transfer and adoption
Carbon capture storage technology to mitigate carbon emissions	The key to meeting India's energy needs will be the adoption of and research on commercial coal gasification and development of carbon capture, storage and utilisation technology while addressing climate change challenges.	Technology transfer and adoption
Nuclear energy ^{24,25,26}		Collaboration areas
India aims to increase the share of nuclear sources in its fuel mix to 25% by 2050	India's expansion of its civil nuclear programme presents opportunities in sourcing reactors and fuel and exchanging critical technologies.	Technology transfer and adoption
Technology ²⁷		Collaboration areas
Digital technologies	Massive tie-up opportunities with start-ups across artificial intelligence (AI), internet of things (IoT), big data and machine-to-machine (M2M) learning technologies to enhance energy efficiency, develop modular and domain-independent renewable energy products and address affordability issues.	Entrepreneurship /promoting start-ups
Smart grid	Smart grids seamlessly manage variable supply of green energy unlike traditional grids. The United States' expertise in grid optimisation and energy storage presents marked opportunities for collaboration.	Technology transfer and adoption
Power and energy efficiency ^{28,29}		Collaboration areas
Increasing focus on energy efficiency due to decarbonisation initiative	India's energy efficiency market is estimated at USD23 billion with a focus on super-efficient technologies. Potential collaboration areas are implementation of binding energy standards, distributed generation for electricity and standards for housing.	Technology transfer and adoption
Emerging sectors ^{30,31,32}		Collaboration areas
Electric Vehicles	India aims to increase the share of electric vehicles in total vehicles to 30 per cent by 2030, creating significant opportunities for battery manufacturers.	R&D and innovation
Hydrogen energy	The United States' expertise can be leveraged in India's hydrogen energy market, which is projected to reach USD720 million by 2030, driven by growing demand for hydro-treating plants in the refinery and petrochemical sectors.	R&D and innovation

21. India's thermal coal consumption to reach 1,076 MT by 2022-23: CRISIL, Energy World, 20 August 2018

22. U.S. keen to collaborate with India on clean coal technology, Hindustan Times, 11 June 2017

23. U.S. govt agency to help India build carbon capture storage, utilisation tech, Business Standard, 1 September 2018

24. Nuclear Power in India, World Nuclear, November 2018

25. India Increases Its Massive 2022 Renewable Energy Target By 28%, Clean Technica, 10 June 2018

26. Electricity to all: India racing to connect thousands of villages with power, Economic Times, 1 January 2018

27. 10 Startups in India that are leading the race of Artificial Intelligence – 2017, Analytics India, 14 July 2017

28. Getting around India's energy efficiency conundrum, Livemint, 28 February 2018

29. Indian Energy Market Development: Opportunities for Collaboration with the U.S., Brookings, 27 August 2014

30. Government finally wakes up: Sets a realistic goal of 30% electric vehicles by 2030 from existing 100% target, Financial Express, 8 March 2018

31. Growing Demand from Hydrotreating Plants to Fuel India Hydrogen Market to Over \$ 720 Million by 2030, Techsci Research, November 2018

32. Fuel Cell Market Expected to Reach \$8,643 Million, Globally, by 2022, Allied Market Research, Accessed on 12 December 2018

Way forward

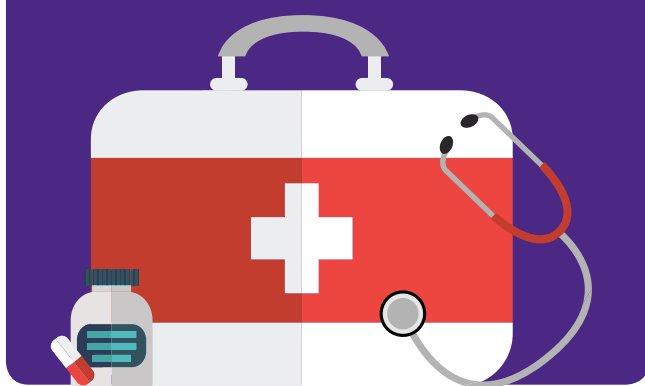
Given India's massive energy requirements for becoming a USD5 trillion economy, enormous opportunities exist for Indo-U.S. collaboration in areas such as developing a robust natural gas economy and infrastructure, sharing strategic and technical expertise across energy sectors. While both countries are focussed on growing all segments of the energy sector, there has been a recent focus on increasing engagement on oil and natural gas. Renewable energy will increasingly present significant opportunities at the sub-national level in areas of innovative policy frameworks and incentive schemes. The rising penetration of renewable energy at a utility scale will further necessitate digital technologies to be interleaved efficiently. U.S. companies can support India through increased technology


transfer which can enable better forecasting and scheduling through advanced analytics and AI technologies, better asset management techniques enabled by IoT and enable demand side participation to bring flexibility in the grid.

Further, emerging sectors of biofuels, energy storage, smart grids, hydrogen energy, electric vehicles, fuel cells and ocean energy offer ample scope for collaboration between the two countries. To supplement this, greater participation from private sector and research institutions across energy efficiency, electric mobility, grid optimisation and renewable energy are critical and is likely to take the India-U.S. partnership to the next level.




07 Healthcare






Hospital industry is expected to grow at a CAGR of 16-17 per cent to reach USD132 billion in 2023 from USD~62 billion in 2017



Pharmaceutical industry is projected to grow to USD55 bn by 2020 from USD36.7 bn in 2017



Medical devices industry, which is the fourth-largest industry in Asia, is estimated to grow at a CAGR of 9 per cent during 2017-2021 to USD5.7 billion


Market overview^{1,2,3}

The healthcare industry in India is experiencing accelerated growth with an increasing number of hospitals, roll out of Indian government's ambitious health insurance scheme to include a large section of society in the healthcare space and reducing prices of medical devices. Further, factors such as rapid economic growth, rising middle class incomes, and a surge in lifestyle diseases may thrust India's healthcare market to grow three-fold to USD372 billion by 2022, making the country a top-three healthcare market.


However, the Indian healthcare market's sheer scale throws up distinctive challenges. According to the World Health Organization (WHO), countries should have health public spend of 4-5 per cent⁴ of their GDP to achieve universal healthcare and out-of-pocket expenditure should be ~20 per cent of total expenditure on health (5-6 per cent of GDP). In contrast, India's government health spend is just ~1.2 per cent of the GDP even though the total expenditure on health is around 4 per cent. Though, the government's National Health Policy (NHP) envisage an increase the expenditure to 2.5 per cent of GDP by 2025⁵.

The government has implemented various reforms to make healthcare accessible and affordable by everyone.^{6,7}


National Health Protection Scheme (NHPS): Ayushman Bharat (Launched on 23 September 2018)*



Health insurance cover of up to INR5 lakh/family/year



Covers secondary and tertiary care hospitalisation



Free treatment in any public or empanelled private hospitals across the country

1,500,000 persons have been treated in more than 14,000 empanelled hospitals and over INR1,500 mn claims paid so far

*Ayushman Bharat Is A 'Game Changer', Quint, 1 January 2019



Affordable and quality healthcare programmes including price control regime that brought 1,084 essential medicines under the regime with benefits worth USD1.5 billion; PM Bhartiya Jan Aushadhi Kendra opening 4,300 centres; and Amrta Pharmacies providing drugs for cancer and cardiovascular diseases at a discount of 60-90 per cent.

India-U.S. dynamic

India and the U.S. have displayed strong commitment towards healthcare cooperation across various areas including R&D, communicable and non-communicable diseases, improving the health systems, low-cost innovations to address issues of health security⁸.

USAID-India End TB Alliance in September 2018⁹

The US Agency for International Development (USAID) announced the formation of 'USAID-India End TB Alliance'. USAID is making an initial USD30 million commitment, subject to the approval of the U.S. Congress

The 2nd India-U.S. health dialogue held in September 2017¹⁰

The health dialogue touched upon various issues of bilateral importance such as communicable and non-communicable diseases, health systems, biomedical research and low-cost innovations, science and health data, food and drug regulations, traditional medicine and access to medicines.

President's emergency plan for AIDS Relief (PEPFAR) in 2016¹¹

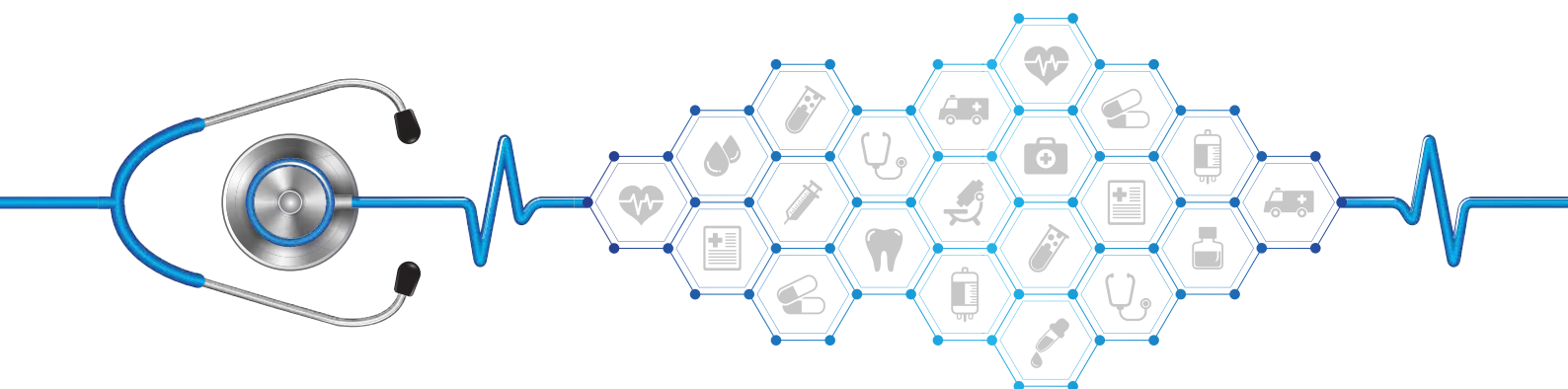
The two countries reaffirmed their collaboration to address HIV and AIDS, under the PEPFAR strategy. They renewed the bilateral arrangement between the Centers for Disease Control and Prevention (CDC) and India's National AIDS Control Organization.

India epidemic intelligence service (EIS) expansion in 2012¹²

The two countries decided to expand the EIS initiative to involve more national Institutes and other organisations as training centres under the coordination of the Ministry of Health and Family Welfare.

Cooperation in cancer research IN 2016¹³

The Indian Council of Medical Research, Department of Biotechnology, and the All India Institute of Medical Sciences signed an MoU with the U.S. National Cancer Institute (NCI) for scientific exchange on cancer research and training on topics such as cancer screening implementation, research methods, and cancer education and prevention.



8. India and U.S. renew commitment to joint collaboration on health, Express Healthcare, 28 September 2017

9. USAID-India End TB Alliance to eliminate TB announced, Financial Express, 27 September 2018

10. India and the United States Renew Commitment to Joint Collaboration on Health, Ministry of Health and Family Welfare, 27 September 2017

11. Partnering to Achieve Epidemic Control in India, PEPFAR.gov, Accessed 13 November 2018

12. India epidemic intelligence service: Advocating for a unique mentor-based epidemiology training program, Apr 2018

13. Joint Statement: Second India-U.S. Strategic and Commercial Dialogue, 30 August 2016

Collaboration opportunities for the U.S. in India¹⁴

Opportunities		
Hospitals		Collaboration areas
National Health Protection Scheme (NHPS)	Announced as part of Budget 2018, NHPS is expected to enrol an additional 100-200 million individuals, upgrade/create 160 tertiary care centres and develop 150,000 new primary health centres ¹⁵ . There would be demand for innovative and technology based models to deliver care at primary health centres.	Technology transfer and adoption
Medical infrastructure to receive enormous investment	India currently faces a chronic shortage of healthcare infrastructure, especially in rural areas and Tier II and Tier III cities. The country is likely to have a potential requirement of 1.75 million new beds by end-2025 ²¹ and presents massive opportunities for the U.S. firms in building healthcare infrastructure.	Technology transfer and adoption
Plans to create 1 million skilled healthcare providers by 2022	As of December 2017, the current allopathy doctor: population ratio in India is 1:1596 ¹⁶ , which is way below WHO-recommended figure of 1:1000. This presents collaboration opportunities for U.S. universities to set up campuses in collaboration with Indian institutes.	Skill development
Pharmaceuticals		Collaboration areas
Bio-pharmaceuticals	India has not yet realised its potential to develop a strong, research-based pharmaceutical industry that can produce innovative medicines. India can leverage U.S. expertise in research and has an opportunity to build on its strengths in generics and move up the value chain by enabling innovations and new drug discovery. ¹⁷	R&D and innovation
Medical devices		Collaboration areas
High-end medical equipment	The new specialty and super-specialty hospital facilities will depend on the import of high-end medical equipment, accounting for over 65 per cent of the entire market. ¹⁹ With low customs duty rates (9.2-15 per cent) and increasing number of healthcare centres specialising in advanced surgery, India offers opportunities for the direct supply of high-technology, specialised medical equipment, products and systems.	Technology transfer and adoption
Make in India's focus on medical devices	Make in India's focus on increasing R&D efforts in medical devices within India has led to global medical device companies investing in R&D, design and development of low-cost products through innovation, localisation and training in India. ¹⁸	R&D and innovation
Technology		Collaboration areas
E-healthcare/ Telemedicine	Due to low accessibility of healthcare expertise outside larger cities and technology-based solutions finding wider public acceptance, telemedicine is expected to become an acceptable and viable business proposition. By 2020, the healthcare information technology market is expected to grow 1.5 times from USD1 billion currently ²⁰ , presenting opportunities in technological collaborations.	Technology transfer and adoption

14. India – Healthcare, Export.gov. Accessed 6 December 2018

15. National Health Protection Scheme: Now let the meds kick in, The Economic Times, 26 February 2018

16. With 1:921, India has healthy doctor-patient ratio, Times of India, 3 April 2018

17. Pharma Conclave 2018: Strengthening Indian Pharmaceutical Industry through R&D and Innovation, ASSOCHAM, Accessed on 10 December 2018

18. More Price Caps on Medical Products in India, Pacific Bridge Medical, 01 February 2018

19. Govt may hike custom duty on medical devices by 15-20% to boost indigenous production, Pharmabiz.com, 18 December 2018

20. Healthcare IT now a \$1 billion market, says Nasscom, The Economic Times, 30 April 2016

21. India – Healthcare, export.gov, 10 October 2018

Increasing focus on providing digital solutions	Digital revolution, offers significant scope for U.S. firms to bring the best of artificial intelligence based systems in area of diagnostics, primary care, cancer care and mental health.	Technology transfer and adoption
Emerging sectors		Collaboration areas
Health and wellness centres	The wellness industry grew worldwide by 10.6 per cent, to USD3.72 trillion between 2013 and 2015 ²² . India, still in its nascent stage, with plans to open 150,000 new centres, can leverage U.S. experience and expertise in planning and building the infrastructure along with implementing global best practices.	Infrastructure development

22. Global Wellness Institute Releases “Global Wellness Economy Monitor”, 31 January 2017

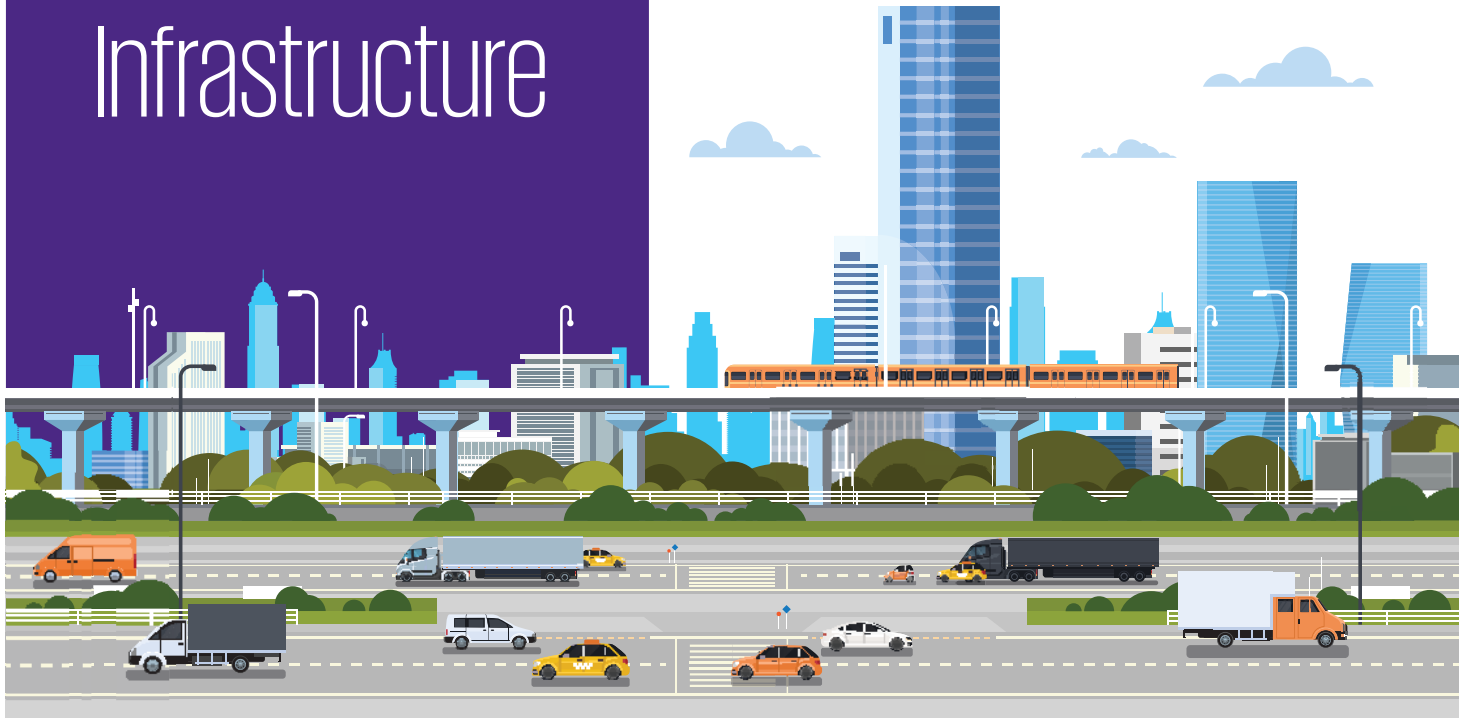
Way forward

The healthcare market in India is mainly driven by the triad of affordable medical procedures, low-priced drugs and cost-effective infrastructure. Growing demand for quality and affordable healthcare and the absence of matching delivery mechanisms present opportunities for the U.S. across hospital design and engineering, collaboration in R&D in the area of bio-pharma and medical devices and provision of skilled healthcare services.

Additionally, there is wide scope for refining current procedures, developing therapeutics and policies, and adopting global best practices. Of course, favourable government policies to boost public-private and cross-border partnerships will be very critical to reach the last mile in healthcare.



08 Infrastructure



Market overview¹

India is at the cusp of major transformation and is set to become the third-largest economy by 2030, with manufacturing and infrastructure sectors acting as key growth engines.

India's development trajectory is expected to go higher at the back of continuous growth in terms of urban population. It is estimated that 40 per cent of the total population of the country will reside in urban areas by 2030. This has created immediate need to build urban India in terms of infrastructure, basic services, transport infrastructure including roads, railway networks, freight corridors, ports, electrification, renewable energy such as solar power systems, ICT interventions in governance and service delivery. India's aspirations to become a key global manufacturing hub, also hinges on the quality of infrastructure that is available to businesses. Against this backdrop, infrastructure lending has increased three-fold since 2014. Further, India requires investments of USD4.5 trillion by 2040 for infrastructure development² across power, bridges, dams, roads and urban areas. India also has immense opportunity in energy sectors including

renewable energy, allied infrastructure such as charging infrastructures for electric vehicles, batteries, manufacturing of EV and hybrid vehicles with an estimated value of USD200 million by 2020.

India also intends expanding and upgrading the existing railway network of about 62000 kms³, providing high-speed rails with world-class facilities to improve the connectivity between various economic centres and cutting the travel time for goods and passenger.

The government has significantly beefed up investments in connecting rural India and inaccessible regions such as north-east, through road, rail and air connectivity. Building infrastructure for ongoing and upcoming industrial parks, special economic zones, sector specific clusters, industrial corridors and country specific zones is likely to catapult India in becoming a robust manufacturing hub and lay the foundation for rapid and inclusive economic growth in the country.

1. The Next Manufacturing Destination, Make in India, Accessed on 12 December 2018

2. India needs \$ 4.5 trillion by 2040 to develop Infra, The Economic Times, 29 January 2018

3. STANDING COMMITTEE ON RAILWAYS (2017-18), Ministry Of Railways, March 2018

Energy

- Envisioned huge demand and investments in renewable energy (Solar PV) and other green energy systems
- Prophecy to develop one-grid system to eradicate power deficiency

Transportation

- Up gradation of existing networks of roads, envisioned construction of expressways improving connectivity at regional level.
- Up gradation of the existing railway networks as well as the railway services improving the quality and reducing the travel time.
- Development/up gradation of at least 100 new airports, making them functional for commercial purposes, connecting the smaller cities with aviation.

Basic urban infrastructure

- Improvement and up gradation of water supply networks and interventions of ICT overlaying these networks.
- Up gradation and expansion of electricity distribution network in rural areas.

EV and allied infrastructure

- Development of EVs and charging infrastructure for the same has immense potential in the immediate future. Possible investments of USD385 billion.

ICT connectivity

- Envisioned IT connectivity through laying of high capacity fibre networks throughout the mainland as well as through sea routes providing seamless IT connectivity.

Infrastructure and construction activity constitutes around 10 per cent of India's GDP, providing direct or indirect employment to more than 30 million people. In this regard, the government has massive investment plans including USD120 billion in road-widening projects and another USD60 billion in India's ports by 2020⁴.

Of the USD4.5 trillion investment requirement till 2040, an estimated investment gap of USD526 billion⁵ presses on the need for alternate source of financing of infrastructure projects and their efficient implementation.

To attain the said developments, the government has already made essential requirements in terms of policies and reforms and has envisaged key areas of development for the next few decades in meeting the infrastructural need of India. Various collaborations and investment requirements of the aforesaid visions in diverse sectors is likely to create immense opportunity for investment in technology, construction, aviation, energy and allied infrastructure.

India-U.S. dynamic⁶

Bilateral trade between India and the U.S. has grown significantly and both countries are expanding this collaboration across core areas of manufacturing and infrastructure, which is expected to have large scale impact on job creation, technology transfer and skill development. In the recent past India – U.S. had various collaborations in technology adoption, procurement, knowledge transfer and technical assistance for delivering the envisioned infrastructure in India.

India smart city development – 2016

U.S. Trade and Development Agency (USTDA) has been supporting India's Smart City Initiative by providing support in the form of private sector expertise, technology solutions and best practices to mobilise smart city development in Ajmer, Allahabad, and Visakhapatnam.

Indo-pacific economic corridor (IPEC) – 2016

A U.S.-India-Japan Joint Working Group on regional connectivity was formed to explore potential areas for trilateral cooperation, broader economic integration and private sector investment. The same is being supported by Commercial Law Development Program (CLDP), an initiative by the U.S. Department of Commerce. It focuses on increasing private investor interest in cross-border projects.

Transportation infrastructure commercial deals – 2015

U.S. private sector participation in Indian infrastructure helps create employment in both countries. The Ministry of Railways (India) awarded a large U.S. multi-billion dollar conglomerate a USD2.6 billion commercial contract to provide locomotive engines and one of the largest Indian airlines placed an order for 75 Boeing 737 MAX 8 jetliners, valued at USD8.25 billion.

4. India's Top 10 Construction and Infrastructure Projects of 2018, Infra Bazar, Accessed on 12 December 2018

5. For Quality Infrastructure, India Needs USD4.5 Trillion: Niti Aayog CEO, NDTV, 01 November 2018

6. Fact Sheet: U.S.-India Economic Cooperation and People-to-People Ties (June 7, 2016), USAID, Accessed on 10 December 2018

Collaboration opportunities for the U.S. in India

Opportunities		
Infrastructure ⁷		Collaboration areas
Urbanisation – Housing for All	According to the UN, World Urbanisation Prospects report, the largest urban growth will take place in India, which is projected to add 416 million ⁸ urban dwellers by 2050. India would need to construct 43,000 ⁹ houses every day until 2022 to achieve the vision of 'Housing for All' by 2022. This has the potential to catapult India to the third-largest construction market globally	Construction, technology transfer
Industrialisation	Five industrial corridors and 21 new nodal industrial cities have been planned, with planned communities, ICT-enabled infrastructure, sustainable living and road & rail connectivity ¹⁰ , presenting tremendous opportunities for India-U.S. collaboration at government-to-government level and private sector	Technology transfer and adoption
Smart Cities	The 'Smart Cities Mission' in India is expected to offer IT opportunities of around USD25 million per city – IoT and M2M technologies are expected to be prime areas of investments for enabling intelligent transportation systems, multimodal planning, safety, infrastructure financing, public security, health, networking, ICT and waste management	Technology transfer and adoption
Airport	The government has allocated USD110 billion in civil aviation expansion and modernisation projects through 2020 across 250 brownfield and greenfield airports. U.S. construction companies and airport operators will play a major role in strengthening airport infrastructure. ¹¹	Technology transfer, construction and equipment procurement
Water management	Special focus on water management, waste disposal, and the Clean Ganga campaign has led to investments such as SCADA installation, desalination, and smart water meters. Huge investments in waste water management such as recycling of waste water, construction of sewerage treatment plants has become one of the most essential needs of the country.	Technology transfer and adoption
Ports and waterways	The Sagarmala project is expected to modernise existing ports and develop new ones for better cargo and freight movement. The government also initiated a USD798.5 million project to develop the National Waterway-1. ¹²	Procurement, technology transfer & adoption
Rail modernisation	Significant technological collaborations are required for modernisation plans such as revamping the entire signalling systems, electrifying the network, expanding Wi-Fi and installing escalators at busy stations ^{13,14} . For example, free Wi-Fi at speed of 20-40 Mbps at 400 railway stations across the country was made available in collaboration with an American technology giant, who had provided the technical support and set up the wireless infrastructure ^{15,16}	Technology transfer and adoption
ICT Infrastructure	Laying of optical fibre network throughout the country including the Indian islands through sea. The vision is to provide seamless connectivity throughout the country and providing uninterrupted IT connectivity across the cities.	Technology and procurement

7. Opportunities and Growth-drivers of Infrastructure Development in India: Union Budget 2018, Mainstream Weekly, 17 February 2018

8. 2018 Revision of World Urbanization Prospects, United Nations, 16 May 2018

9. Urban Indian real estate - Promising opportunities, KPMG, 19 August 2016

10. New Initiatives, Make in India, Accessed on 12 December 2018

11. India - Civil Aviation, Export.Gov, Updated on 10 October 2018

12. Govt approves Rs 5,369-cr waterway project on NW-1, The Hindu Business Line, 03 January 2018

13. Indian Railways, French firm tie up for high-speed rail corridors development, Zee Business, 16 May 2018

14. Indian Railways back to the drawing board on many key modernisation plans after Modi rider, Economic Times, April 13, 2018

15. Railways targets 100% Wi-Fi enabled stations across India by 2019 at cost of Rs 700 crore, Business Today, 8 January 2018

16. Google: Wi-Fi now available at 400 railway stations, Business Line, 7 June 2018

Economic corridors	Nine of the 44 economic corridors planned under the Bharatmala scheme will soon be linked through expressways including Delhi-Vadodara, Chennai-Salem, Ambala-Kotputli, Amritsar-Jamnagar, and Raipur-Vizag, ¹⁷ presenting significant opportunities for technology collaboration with the U.S. Additionally, various industrial zones and hubs are being planned on these corridors. For e.g. a Centre of Excellence and Innovation is being planned on the Mumbai-Bengaluru corridor which creates opportunities for U.S. firms to help MSMEs by providing technology up-gradation as well as up-skilling across sectors.	Technology transfer, construction and adoption
E-mobility	National Electric Mobility plan of India launched in 2013 has launched the FAME scheme i.e. Faster Adoption and Manufacturing of hybrid and Electric Vehicles initiated by the Ministry of Heavy industries and Public Enterprise. The project aims creation of charging infrastructure for EVs as well as manufacturing of the Electric Vehicles in India. Automobile manufacturers and battery industries have a huge potential of investment in research and manufacturing of such infrastructures.	Technology transfer, manufacturing and adoption.

17. Nine of 44 economic corridors to be connected via expressways soon, Business Standard, 7 August 2018

Way forward

The growth in infrastructure development, over the next 25 years, will be driven by rapid urbanisation, rising incomes and economic prosperity. Infrastructure sector is a key driver for the economy and is highly responsible for propelling India's overall development and hence enjoys immense focus from the government, which is likely to bolster the government's 'Make in India' initiative.

On the other hand, India is emerging as a regional powerhouse with strong bilateral relations within and outside Asia. Connectivity projects with ASEAN countries such as India Myanmar Thailand

trilateral highway and its proposed extension to Laos and Cambodia is reflective of its growing prominence. The country's effort towards improving infrastructure and digital connectivity in Africa through the Asia Africa Growth Corridor shows encouraging signs of India's growing role in international development.

Plethora of opportunities for partnerships with the U.S., primarily in funding, resources, technology and knowledge-sharing. Though, in order to support this, a robust ecosystem comprising of favourable reforms will be essential.



Manufacturing



Market overview^{1,2,3}

India currently produces approximately USD9.4 trillion in goods and services⁴ and manufacturing accounts for around 17 per cent of the country's GDP in 2017⁵. The sector is estimated to contribute 25 per cent by 2025⁶. The growth in the domestic market is led by demand across sectors including automobiles, textiles, engineering, consumer durables and petroleum products. As Industry 4.0 continues to gain traction, while India is well-positioned to become the global manufacturing hub, the need of the hour is to make substantial investments in up-skilling and re-skilling the current workforce.

Snapshot of the sector

Ranked 30th on a global manufacturing Index by the World Economic Forum

In terms of gross value add (GVA), **manufacturing grew by 5.7 per cent in FY18** as compared to 7.9 per cent in FY17

It contributed **16.8 per cent to the total GVA in FY18**

Apart from reforms like Goods and Services Tax (GST) and Insolvency and Bankruptcy Code (IBC), the government has initiated sector specific reforms which resulted in improvement of Ease of Doing Business ranking - India moved to the 77 spot in 2018 from 142 in 2014⁷. The government's development of industrial corridors is geared towards creating a conducive environment for the industrial development and promote advance practices in manufacturing. Additionally, initiatives such as 'Make in India', 'Digital India' and 'Skill India', as well as a more liberal foreign investment policy framework are all aimed at making India a global manufacturing hub. These government efforts and the country's favourable consumer demographic have already led India on the path of becoming the hub for hi-tech manufacturing as global companies are increasingly setting-up manufacturing plants in India.

1. The Next Manufacturing Destination, Make in India, Accessed on 12 December 2018
 2. India ranks 30th on WEF global manufacturing index; Japan tops ranking, The Indian Express, 14 January 2018
 3. Highlights of Provisional Estimates (PE) of GDP, 2017-18 and Estimates of GDP for the Fourth Quarter, January-March (Q4), 2017-18, Ministry of Statistics & Programme Implementation, 31 May 2018
 4. India's Economy, Its Challenges, Opportunities, and Impact, The balance, 13 December 2018

5. KEY MACRO ECONOMIC INDICATORS, Central Statistics Office, 21 December 2018
 6. Manufacturing sector should grow, contribute 25% to GDP, Business Line, 12 January 2018
 7. India moves up 23 spots in 'ease of doing business' ranking, Business Line, 31 October 2018
 8. Fact Sheet: U.S.-India Economic Cooperation and People-to-People Ties (June 7, 2016), USAID, Accessed on 10 December 2018

India-U.S. dynamic⁸

Bilateral trade between India and the U.S. has grown significantly and both countries are expanding this collaboration across manufacturing sectors.

Economic and financial partnership (EFP) – 2016⁹

Policies to promote strong, sustainable growth, greater investment, capital market development, including municipal bond market development; continued resolution of outstanding tax disputes; increased collaboration on anti-money laundering and combating the financing of terrorism.

Trade policy forum – 2014 (TPF)¹⁰

TPF solves issues, supports economic growth, development, job creation and tracks bilateral trade and investment between the two countries across agriculture, trade in services and goods, manufacturing and Intellectual Property.

Collaboration opportunities for the U.S. in India

Opportunities		
Manufacturing		Collaboration areas
Industry 4.0 – smart manufacturing	For fostering excellent manufacturing infrastructure in India, the 'Make in India' initiative is spearheading wider adoption of 'Industry 4.0', with manufacturing industries incorporating artificial intelligence (AI) and Internet of Things (IoT) technology to reap productivity gains from automation in areas such as labour flexibility, better finish, demand forecasting, and agile supply chain and inventory optimisation. ¹¹	Technology transfer and adoption
'Make in India'	With the 'Make in India' initiative, policies are framed to promote the adoption of Industry 4.0 such as 'National programme on Artificial Intelligence' and 'Mission on Cyber – Physical systems', which are focussed to develop and create the road map for AI, robotics and digital manufacturing. The initiative is designed to turn India into a global manufacturing hub with a renewed focus on ten champion sectors, including capital goods, auto, defence, pharma and renewable energy and generate 100 million jobs by 2021 ¹² . Expansion of manufacturing activities under this initiative is expected to increase demand for warehouses and logistics sector. The U.S. companies can support with this mission by establishing Center of Excellence centres for training in emerging technologies.	Technology transfer and skill development
Global best practices	By adopting and customising global best practices in operations, India's manufacturing companies can improve their productivity, specifically in areas such as production planning, supply chain management, quality, and maintenance. The U.S. companies can support with implementing world-class quality and lean processes on the shop floor, process discipline through a zero-tolerance approach and provide robust product designs and manufacturability.	Innovation and R&D
Labour skill development	In the next 20 years, India's labour force will increase by 32 per cent ¹³ , with a pressing need to provide its workforce with required skill sets and knowledge. Manufacturers should establish in-house training centres for vital roles, including those of fitters, machinists, maintenance engineers, and welders.	Skill development

9. India and United States Joint Statement on the Trade Policy Forum, Delhi, USAID, Accessed on 10 December 2018

10. India and United States Joint Statement on the Trade Policy Forum, Ministry of Commerce & Industry, 25 November 2014

11. Towards smart manufacturing: industry 4.0 and India, Make in India, Accessed on 12 December 2018

12. How Make in India Can Lead The World With Disruptive Innovation, CXOtoday.com, 24 September 2018

13. Skill Development Sector: Achievement Report, Make in India, Accessed on 12 December 2018

Engineering, Research and Design centres	India has emerged as the preferred location of choice for offshoring business since 1985 when one of the leading American technology company had set up its R&D centre in Bangalore ¹⁴ . While initially the work involved low-end transaction processing and IT, today these centres have become the central innovation hubs which are taking ownership of the multinational's future bets. The vast pool of competitive engineering talents and the large domestic market continues to encourage MNCs to set up high end and cost intensive eR&D facilities in India	Innovation and R&D
Start-up India	Manufacturing start-ups today are driving innovation and widening the frontiers of the industry, creating innovative products using robotics, artificial intelligence and analytics. Providing impetus to start-ups and international collaborations can significantly boost the manufacturing sector. ¹⁵	Entrepreneurship/ promoting start-ups

14. Centre of gravity of MNCs shifting to India as tech becomes, Times of India, 8 June 2018

15. Towards Smart Factories: Manufacturing Start-ups, Make in India, Accessed on 12 December 2018

Way forward

India is becoming one of the most lucrative investment destinations in the manufacturing sector, with favourable government programmes such as 'Make in India', development of industrial corridors, smart cities, enhanced strategic partnership model and ease of doing business.

While India has certain core strengths that could position it as a manufacturing powerhouse to reach USD1 trillion by 2025¹⁶ including a large

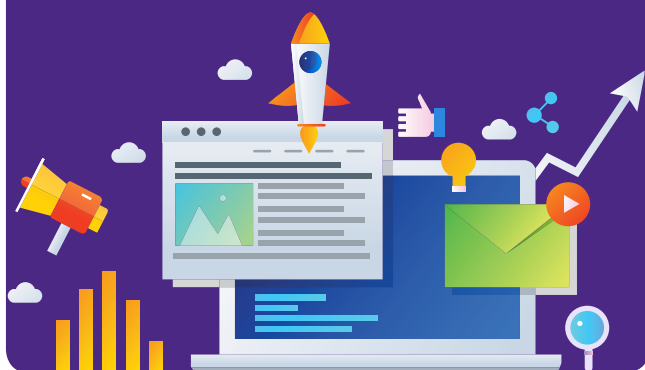
pool of engineers, young labour force, low wages and significant domestic consumption, the key growth driver is likely to be the convergence of digital and manufacturing. Collaborations with the U.S. in areas of IoT, sensors, robotics, predictive analytics, industry best practices and skill development can usher India in the era of numerous opportunities.

16. India aims to grow its manufacturing GVA to \$1 trillion by 2025-26, Financial Express, 13 December 2018





10 Digitalisation



Market overview

Convergence of connectivity and emerging technology such as artificial intelligence (AI), machine to machine (M2M), internet of things (IoT), optical fibre networks have created a new paradigm to develop sophisticated, sustainable and scalable infrastructures to pave the way for 'digitalisation'. In 2017, ~4 per cent of India's GDP was contributed from digital products and services which were created directly through the use of digital technologies.¹

India is en route to becoming a USD1 trillion digital economy by 2023, which is supported by measures to boost financial inclusion (Jan Dhan), a universal biometric identification system (Aadhaar) and rising smartphone penetration, coupled with Goods and Services tax (GST) system. Such economic vibrancy is expected to create 60 to 75 lakh new jobs².

1. Digital transformation to add \$154 billion to India's GDP by 2021, The Time of India, 11 April 2018
2. India to be \$1 trillion digital economy in 5 years: Ravi Shankar Prasad, Economic Times, 20 February 2018
3. New Digital Horizons, KPMG, October 2018

India's current digital drive³

Total population: **1339.1 million**

Total telecom subscriber: **1206.22 million**

Total internet subscribers: **493.96 million**

Active social media users: **250 million**

E-commerce penetration: **20%**

M-wallet transaction volumes:
3025.98 million (2017-18)

Mobile banking transaction volume:
1872.26 million (2017-18)

Number of digital buyers:
224 million (2018F)

Transaction value of digital payments made in 2018: **USD51,756 million**

3856 government department agencies integrated with the mobile seva platform

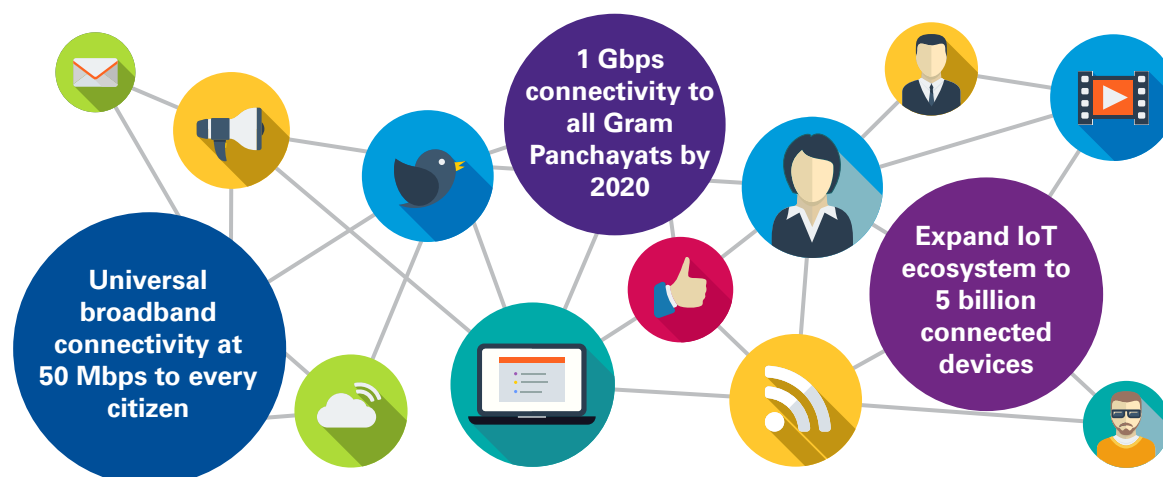
1,10,848 gram panchayats connected via high speed broadband connectivity

3142 crore transactions recorded in FY18 on eTaal



The government of India (GoI) is focussing on policies and technology initiatives to establish extensive internet infrastructure that would accelerate digital inclusion of the non-digital natives enabling businesses across industries to reap benefits from the growing digital infrastructure. Additionally the government is extensively using data analytics and technology to improve the economy and public policy. Even the RBI is planning to setup a data analytics lab for in-house analysis.⁴

National Digital Communications Policy (NDCP) 2018⁵:



Major milestones achieved through government initiatives⁶:

Aadhaar	1.2 billion Aadhaar cards enabled real-time direct benefit transfers (DBT)
BharatNet	Connected around 12 million gram panchayats with an optical fibre network till date
BHIM App	Touched a high of 913 million transactions worth USD15.5 billion in FY18
Digital Payments	Total digital payments worth USD51.7 billion in FY18
Mobile Seva Platform	Integrated 3,856 government departments and agencies

India-U.S. dynamic

India-U.S. bilateral relationship can reach newer heights with growing partnerships across building digital infrastructure in India while providing access to digital technologies across sectors.

Recently, an American multinational technology conglomerate signed an agreement with Niti Aayog to take forward the Atal Innovation Mission (GoI's flagship initiative to promote a culture of innovation and entrepreneurship) along with one of the largest state run Indian telecom operators to develop use cases for 5G in citizen services & transport modernization⁷.

Financing Support for Broadband Expansion – 2016⁸

Overseas Private Investment Corporation (OPIC), the U.S. government's development finance institution, announced a financial support of USD121 million for the expansion of low cost and rapidly scalable wireless broadband networks across India, and further the goals of the Global Connect Initiative. The project is expected to provide fixed wireless Internet access to at least 6.5 million residential subscribers.

India-U.S. Cyber Relationship – 2016⁹

Formed to promote cyber security, combat cyber-crime, advance norms of responsible state behaviour in cyberspace, improve cooperation amongst technical and law enforcement agencies and promote cyber R&D and capacity building.

4. RBI enters the exciting new world of Big Data analytics, Livemint, 11 April 2018

5. 53 Months of Transforming India, Transforming India, 16 November 2018

6. New Digital Horizons, KPMG India, October 2018

7. Pace, breadth of digitalisation in India is unmatched: Cisco, The Times of India, 21 September 2018

8. Fact Sheet: U.S.-India Economic Cooperation and People-to-People Ties (June 7, 2016), USAID, Accessed on 10 December 2018

9. Joint Statement: Second India-U.S. Strategic and Commercial Dialogue, US Embassy, Accessed on 10 December 2018

Collaboration opportunities for the U.S. in India

Opportunities		Collaboration areas
Infrastructure upgrade	With around 67 per cent of the Indian population living in rural areas where internet penetration is still low at around 19.5 per cent ¹⁰ , U.S. has a huge opportunity to revamp backhaul connectivity and fiberisation.	Technology transfer and adoption
Continued focus on reskilling	Technology implementation and digital projects are more skill intensive than labour intensive and therefore demands continuous reskilling. India can leverage U.S. expertise in developing sector-specific training material and adopting global best practices.	Skill development
Budding start-ups	Start-ups have evolved as key stakeholders in the digital ecosystem and thus it is critical to focus on mentoring teams, nurturing ideas, extending technical support and providing funding access through domestic and international collaboration.	Entrepreneurship /promoting start-ups
Cyber security	Increasing e-commerce penetration and cloud adoption by government agencies and digital wallets are expected to drive robust demand for cyber security investment ¹¹ . In this regard, U.S. companies can collaborate with India's central and state governments for providing cyber security services.	Technology transfer and adoption
Digitalisation of banking industry	U.S. firms can help Indian banking and securities industry in adoption and implementation of emerging technologies such as AI and blockchain. ¹²	Technology transfer and adoption
Connectivity alternatives	Confluence of networks is the key to faster connectivity and India can leverage U.S. expertise in innovative business models and products such as small cells, Femtocells, Li-Fi, connected smart hubs and distributed antenna systems.	Technology transfer and adoption
Blockchain technology	Though the government does not consider cryptocurrency as legal, it is all set to leverage blockchain to mitigate corruption and fraudulent activity in state and national governments. For instance, Telengana government is planning to implement blockchain technologies in six or seven government applications. ¹³ This presents massive opportunities for the U.S. firms to partner with central and state governments across multiple areas such as land registry, revenue departments, etc.	Technology transfer and adoption
Biometrics	Aadhaar, India's digital Identity Document initiative – world's largest biometric database is being leveraged by the government at various levels such as linking bank accounts and then transferring subsidies, Aadhaar linked KYC, GST, eSignature and digital locker to name a few. There is tremendous scope for collaboration with the U.S. firms across sectors specifically in big data analytics	Technology transfer and adoption
Digital Payments	The government of India has laid down several guidelines and reforms such as granting multiple licences for differentiated banking to small finance banks, payment banks and introduced the unified payment interface to include the unbanked population in the formal financial services folder thereby strengthening the payments ecosystem. This has certainly opened up unprecedented partnership opportunities with U.S. technology firms across lending, wallets, account service (AISP) and payment service (PISP).	Technology transfer and adoption

10. New Digital Horizons, KPMG, October 2018

11. Information security spending in India to grow 12% to \$1.5 billion: Gartner, The Economic Times, 29 August 2017

12. IT spending by Indian banks to reach \$9 bn in 2017, Business Standard, 13 November 2017

13. Indian State Government to Implement Blockchain Technology, Coin Central, 30 July 2018

USTDA's support in Smart City	The U.S. Trade and Development Agency (USTDA) is connecting officials from central and state government of India with established U.S. players in the areas of smart city technology, planning and development, specifically across best practices and technologies that can help cities and urban areas become more efficient, sustainable and smart by developing interconnected infrastructure, communications and data systems.	Technology transfer and adoption
Satcom policy	Massive opportunities for the U.S. in satellite communication technologies, when India is advocating greater participation by private players in commercial satellite operations, especially in providing broadband in remote areas.	Technology transfer and adoption

Way forward

India is on its way to become a trillion dollar digital economy through growing consumer demand, expanding digital infrastructure and adoption of emerging technologies. Significant opportunities are likely to manifest across the industry value chains where all the sectors will participate with varying degree of adoption and contribution to the digital economy.

Increasing use of data analytics and linking various government departments have helped improve government data mining capabilities, contain corruption, improve efficiency, robust transactions and lending framework, identify shell companies, strengthen banking system and policies. The U.S. has massive opportunities for collaboration with the central and state governments for efficient use of data analytics at various government departments and sectors.

To build a sustainable digital ecosystem, tremendous opportunities exist for U.S. firms for strategic partnerships to facilitate exchange of technologies, building and modernising infrastructure, academic/research tie-ups and scaling up niche skills, which can set the stage for India's emergence as a digital leader.





Way forward on the road to prosperity

A strong foundation has been laid already for the India-U.S. relationship over the years enabling both the countries to hold geo-political, economic and commercial significance. Today, the two country dynamic has gone much beyond the relationship today has gone much beyond trade and is evolving into a multi-layered partnership at government, industry, academic and sub-national levels. Increasing cross border activity across strategic and commercial sectors at the back of Gol's inclusive policies and reforms, technology-based alliances, solution-oriented innovations and SME level integrations, have further pushed the two-country collaboration agenda.

Needless to say, a highly integrated ecosystem that brings expertise, experience, technology and innovation through cross-border partnerships is paramount. To facilitate this, there is a need to set up a central implementation body with representatives from both the governments, USIBC and the industry to help contribute, connect, engage, innovate and collectively push forward the collaboration agenda across the identified sectors and themes. This is likely to be a critical enabler to usher both the countries in a new world of unprecedented economic and strategic possibilities and help India achieve its USD5 trillion aspiration by 2022.



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