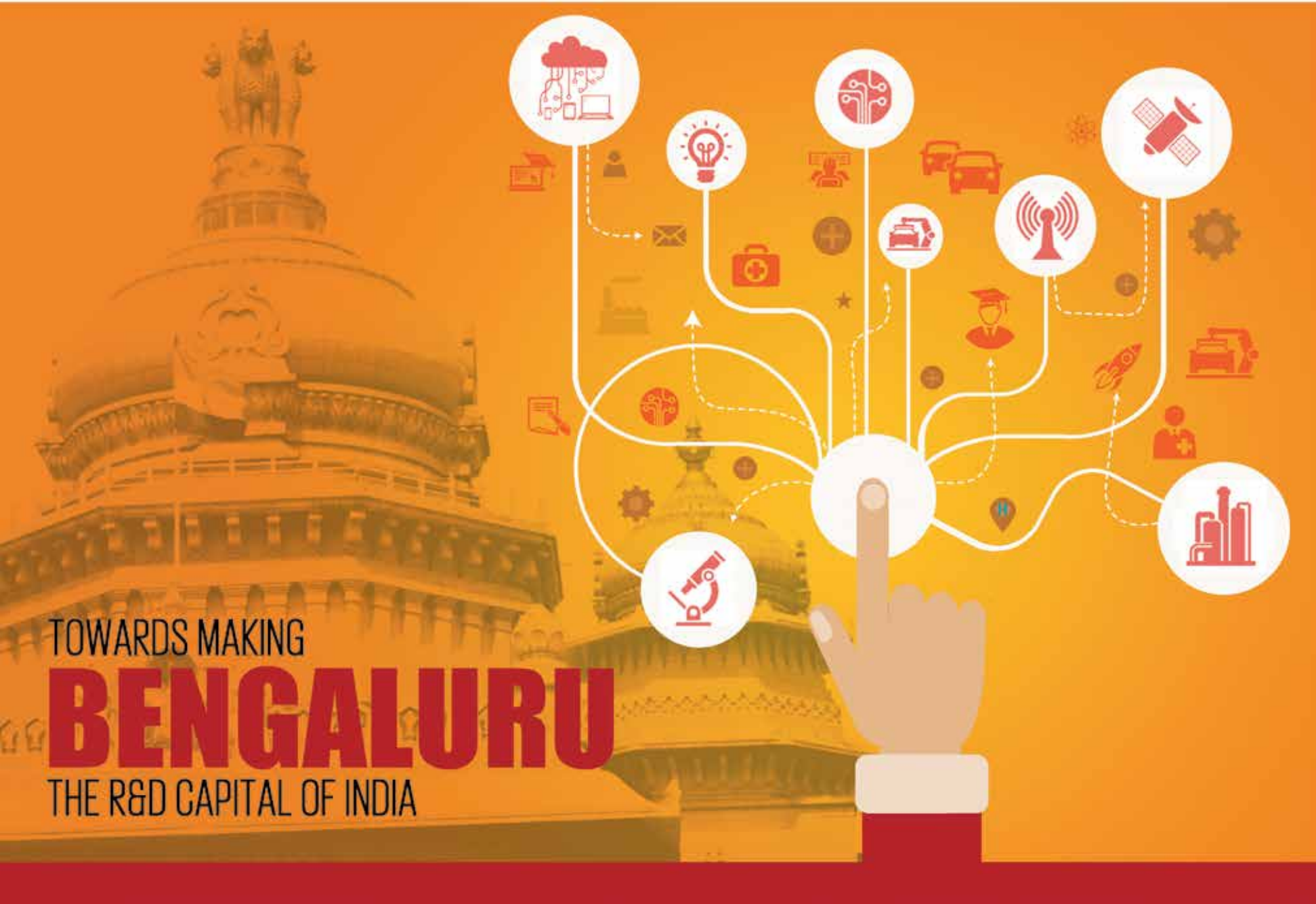
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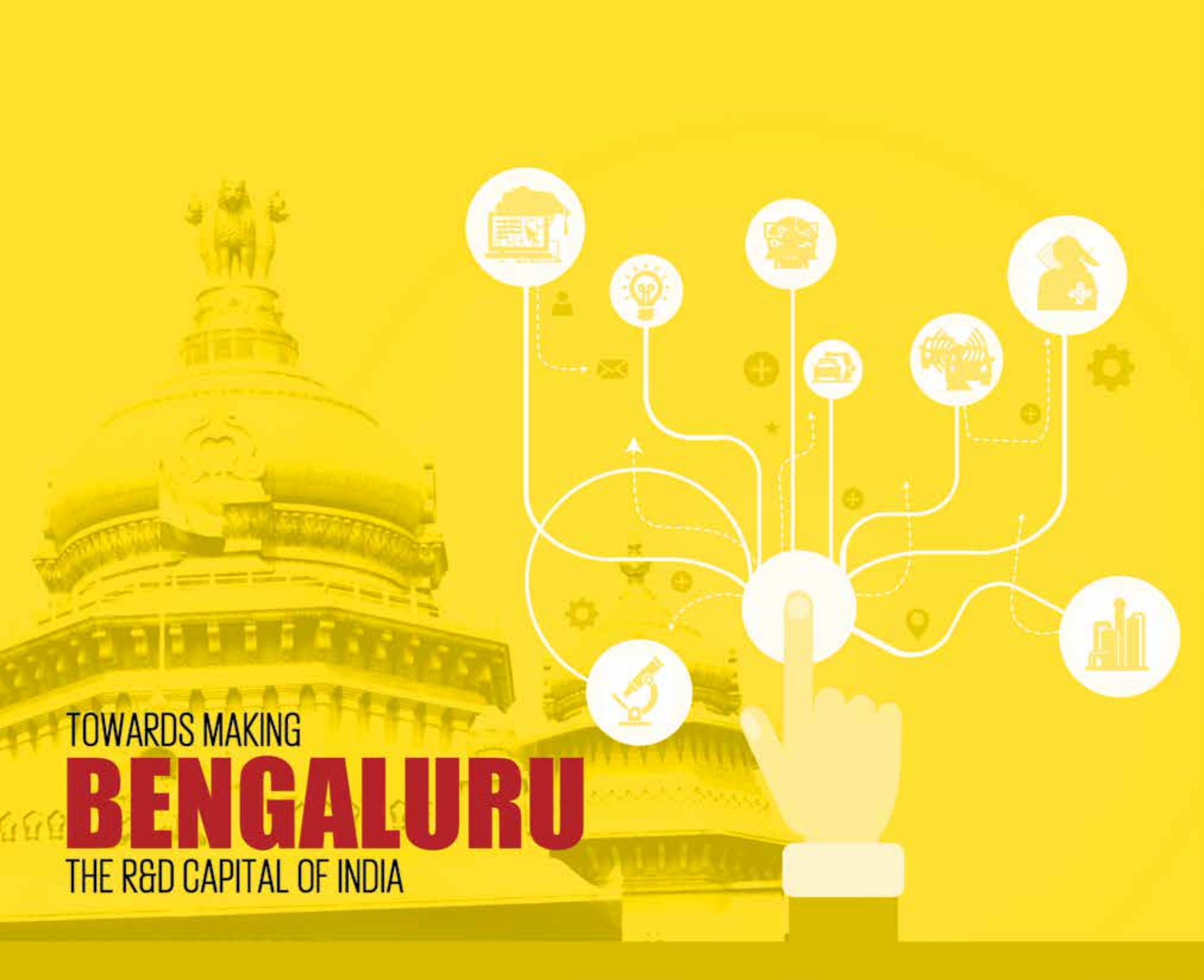
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TOWARDS MAKING

BENGALURU

THE R&D CAPITAL OF INDIA


TOWARDS MAKING
BENGALURU
THE R&D CAPITAL OF INDIA


GOVERNMENT WORK IS GOD'S WORK

Foreword



Research and Development in India has become one of the key growth drivers for the economy. With an increased impetus on bringing investment, the country has seen a steady growth in multi-nationals setting up their facilities, particularly in Bengaluru, Karnataka.

Bengaluru over the years has emerged as the natural R&D capital in India as it presents a conducive business milieu present in Karnataka, as well as the favourable regulatory environment steered by the state government.

Karnataka's research and business milieu has been ahead of times, thanks to Bengaluru's place as the IT/BT capital of India. Between every large Indian and global MNCs in the capital, are hundreds of interesting startups, adding their piece to the Karnataka growth story.

The state will play an important role in India improving India's rankings in the Global Innovation Index in the coming years.

The state of Karnataka has taken research and development as a primary sector to propel growth. This is amply reflected in various policies and initiatives that the state government has been implementing to bring more investments. The current study builds on the various steps taken by the government and adds fresh dimensions to make a strong case for Bengaluru to be the Innovation and R&D capital of India.



Nirankar Saxena
Assistant Secretary General
FICCI


GOVERNMENT WORK IS GOD'S WORK

Foreword



India has emerged as one of the leading destinations for global firms to set up their research and development centres. The State of Karnataka in particular has become one of the preferred destinations for global companies to set-up their businesses in India.

The city of Bengaluru has emerged as the leader in R&D services for verticals like telecom, semiconductor, consumer electronics, computer peripherals, aerospace, software and internet. Bengaluru's ecosystem and the resource pool that it attracts are its strength and the city will continue to be the number one destination in India for global companies.

Over the years, Research & Development Centers, established by Indian and global MNCs in the city, have not just increased in numbers but have also seen a tremendous growth in contributing to the well-being of the state and the nation. A majority of these centers are driving high-end research to develop solutions for issues and problems of global relevance. The conducive policy framework provided by the state government is a major contributor to the Bengaluru's growth story.

The Report is an extensive study on the opportunities that exists in the state and particularly in the city of Bengaluru for R&D enterprises to succeed and flourish. A few key recommendations in terms of novel frameworks that shall catapult Bengaluru to be the innovation and R&D capital of the country, is also an integral part of the Report.

Medha

Medha Girotra
Practice Lead, Public Affairs
Edelman India


GOVERNMENT WORK IS GOD'S WORK

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GOVERNMENT WORK IS GOD'S WORK



Executive Summary

This report has been developed with the intent to promote collaboration amongst diverse stakeholders with an intent to recommend novel frameworks to create a unique Research and Development (R&D) ecosystem that would position Bengaluru as a global R&D hub.

The first section of the report provides an analysis of the R&D landscape in India against the global trends with a sub-section focussing on the R&D infrastructure in the state of Karnataka. Section two and three highlight the advantages presented by India and the State of Karnataka respectively in the context of being potential R&D hubs. Section four provides recommendations on developing a hub and spoke model and special innovation zones in the state of Karnataka and particularly Bengaluru. Section five brings out how the Government of Karnataka has nurtured the R&D ecosystem followed by section six that concludes the key findings of the report and section seven providing reference sources for this report.

In the past, R&D was an attribute explored mostly by the developed countries. However, this is no longer the case as firms are increasingly expanding into developing regions and establishing local R&D centres to tap into new markets.

India's impact on the global research and knowledge economy is comparatively low. Based on World Bank data for 2013, India's R&D spending oscillates between 0.8-0.9 % of its GDP, much lower than countries like China (2%), Japan (3.5%), South Korea (4.15%), and Israel (4.1%). While these nations have massively ramped up their R&D investments from where they stood in 1996, India has witnessed minimal increase in the same window of almost two decades. While the industry and private sector in these countries contribute 60-70% of this research expenditure, India's share fluctuates around 30%. This data indicates that both government and private actors are lagging behind in India.

If we do an intra-country analysis for India, the state of Karnataka has been on the forefront attracting several multinational companies to set up their high end R&D centres in the state. Within India, Bengaluru is home to the highest number of multinational R&D centres and has emerged as the Silicon Valley of the east due to a favourable regulatory environment, strong IPR policy and a young pool of highly talented workforce. The city has led to transforming India's global position.

With the conducive business milieu present in Karnataka, as well as the favourable regulatory environment steered by the Government of Karnataka, Bengaluru emerges as the natural R&D capital in India. However, even with existing knowledge, skills and capability, there is a need for consolidation. In this regard, the report examines and deduces that a research umbrella organization should be established, which would bridge all the research and development labs in the city. Furthermore, to promote synergy between research and industry, it is imperative that this umbrella organization lays down an interconnected framework for all. With an integrated model, all the information would be easily accessible and readily available.



In recognition of the above, the report lays down a framework to consolidate and collaborate research and industry under a hub and spoke model. A Centre of Excellence is proposed to be established in Bengaluru, which would essentially be an academia led initiative designed to lead the research and increase the impact of innovation across sectors. It will be aimed at promoting advancement, leadership and excellence in the pursuit of all areas of research.

Private sector companies, global research institutes, open innovation labs, incubators and government programmes would form spokes by this Centre. In the long run, India can also look to developing world class global infrastructure in certain fields of international consortia.

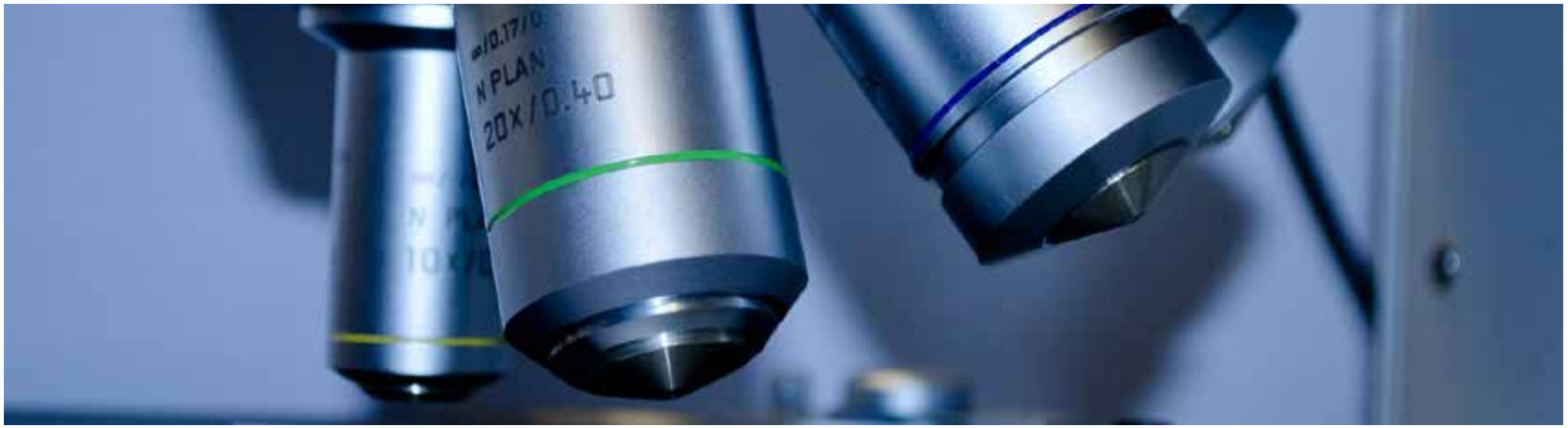
Furthermore, the report recommends that Special Innovation Zones (SIZs) should be developed across Karnataka which foster research and transformation.

1

INTRODUCTION



1. Introduction



Research and Development (R&D) plays a crucial role in economic development and has been the driver of change around the world to provide accessible and affordable solutions to the ever changing consumer needs. While developed countries have given much importance to R&D, this area remains largely unexplored in lesser developed countries.

Despite being the hub for several multinational organisations, India's Gross Expenditure on Research and Development (GERD) as percentage of Gross Domestic Product (GDP) is less than 1% as compared to the developed and other emerging economies. The role of R&D and Innovation in increasing economic growth and raising the standards of living, can be seen in the case of South Korea, for instance, which has significantly improved its economic status since the 1980s by simply promoting the inward transfer of foreign technology, followed by significant investments in R&D. Similarly, Taiwan's spending on research and development (R&D) totalled NT$483.5 billion (US$14.65 billion) in 2014, accounting for about 4 per cent of Taiwan's GDP. Therefore, it is important for Indian firms to reorient themselves to R&D based innovation to compete with advanced products of other countries.

1.1 The Indian Landscape

India already has a strong recall value amongst multinational companies. Many companies have preferred establishing their R&D centres in India due to favourable demographics, simpler access to young science and engineering talent pool, and due to an opportunity to reduce the cost of R&D. Other factors such as fluency in English language, strong intellectual property regime and a well established judicial framework, also help in instilling faith in these companies. But to be claimed as a world class innovation destination, there are several challenges that need to be tackled.



India has a rapidly growing middle class population of more than 9 crores that increases consumer spending and aspires to procure new products. This has created a huge market that has attracted several domestic and foreign companies. However, the demand for products in India is mostly at very low costs. Although this creates a challenging ecosystem, it could also be an opportunity for companies to innovate to create advanced products and technologies at low costs to meet the needs of the Indian population.

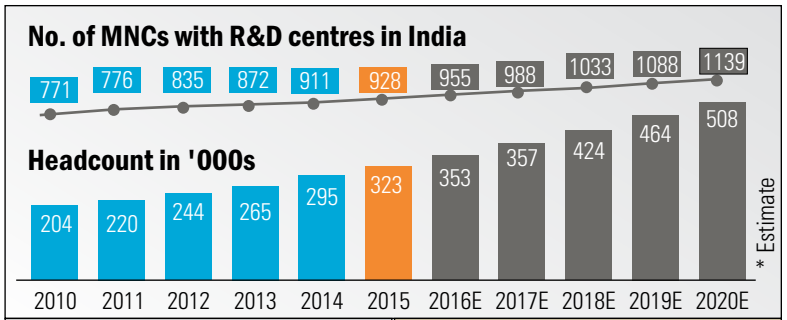
Within India, Bengaluru is home to the highest number of multinational R&D centres and a talent pool of young engineers. A study by research firm Zinnov Consulting in 2015 estimated that nearly 48%, or 155,000, of the MNC R&D workforce of 3,23,000 in India resides in Bengaluru. Pune follows with 40,300 people working in a R&D center for an MNC, a quarter of that in Bengaluru, while NCR falls in the third position with a workforce of 31,000. Bengaluru also accounts for 456 of the 1,165 MNC R&D centres in India (there are 928 MNCs, with some operating multiple centres).

Zinnov also estimates that by 2020, the number of MNCs with centres in India will climb to 1,139, from the current 928, and their workforce will increase by 57% to reach 508,000, from 323,000. All this indicates that India does not just possess R&D expertise but has been recognized globally as the destination for R&D.

1.2 Bengaluru: Emerging R&D Capital of India

The state of Karnataka takes pride in its tech expertise and is one of the most industrially advanced states in India, driven by its entrepreneurial spirit, innovative outlook and a stable, approachable government. Over the years, Karnataka has come to signify successful partnerships and comprehensive and sustained developments. Furthermore as well as Karnataka Udyog Mitra, a Government of Karnataka undertaking, has been appointed as a "single point of contact" for project proposals with investments over INR 15 crores. Project proponent can contact Karnataka Udyog Mitra to understand the salient features of Karnataka, its unique advantages and discuss project identification, suitable location, human resources, approvals required, procedures involved etc. Working on the single window clearance mechanism, Karnataka Udyog Mitra has streamlined and incentivized investments in the state.

R&D TALENT GROWTH IN MNCs IN INDIA



TOP 5 VERTICALS			TOP 5 LOCATIONS		
1	Software/Internet	121,650	1	Bengaluru	155,000
2	Electrical & Electronics	33,057	2	Pune	40,300
3	Telecom & Networking	31,043	3	NCR	31,000
4	Automotive	30,757	4	Hyderabad	30,700
5	Semiconductors	23,333	5	Chennai	27,900

Source Zinnow Analysis

Source: Zinnov Analysis, 2015

Minister of State for Information Technology and Bio-Technology, Priyank Kharge has reiterated the Karnataka government's commitment to create a conducive business atmosphere for start-ups that is better than any other state in the country. Karnataka has been an early state to formulate a progressive start-up policy and a corresponding start-up cell to encourage young entrepreneurs. In July 2016, the Karnataka government launched several initiatives to mobilise up to Rs. 2,000 crore ($333 million) by 2020 to invest across startups, operating in ranging from technology to social impact. Other startup investment vehicles by the Karnataka government include KITVEN Fund (Karnataka Information Technology Venture Capital Fund), AVGC (Animation, Visual Effects, Gaming and Comics) fund and a social impact initiative named 'Channelising Innovation for Social Impact.' Over 2,500 start-ups are flourishing in Bengaluru.

Karnataka has emerged as a leader not just in the field of information technology and biotechnology but also in developing technologies like artificial intelligence and internet of things.

Additionally, the Government of Karnataka also announced a $1.5 million (Rs. 10 crore) fund for women entrepreneurs on International Women's Day in March 2017. As part of this initiative, women entrepreneurs can participate in an open house, where they can discuss their issues and problems. This fund would be provided to any women innovator looking for funds for proof of concept validation, certification, and for costs incurred in manufacturing pilot devices.

1.3 Global Trends in R&D

The growth in R&D is currently driven by Asian countries. China, Japan, India and South Korea account for more than 40 per cent of all global R&D spends, while North America is investing less than 30 per cent. Similarly, European countries are spending only slightly more than 20 per cent on their R&D. These countries are losing out to Asian countries on a yearly basis as the Asian market is increasing its expenditure on R&D.

Share of Total Global R&D Spending

	2014	2015	2016
North America	29.1%	28.5%	28.4%
U.S.	26.9%	26.4%	26.4%
Caribbean	0.1%	0.1%	0.1%
All North America	29.2%	28.5%	28.5%
Asia	40.2%	41 .2%	41.8%
China	19.1%	19.8%	20.4%
Europe	21.5%	21.3%	21.0%
Russia/CIS	3.1%	2.9%	2.8%
South America	2.8%	2.6%	2.6%
Middle East	2.2%	2.3%	2.3%
Africa	1.0%	1.1%	1.1%
Total	100.0%	100.0%	100.0%

Source: 2016 Global R&D Funding Forecast, Industrial Research Institute

China's R&D investments, until recently, had witnessed an annual growth of over10 per cent since the 1990s, but these have mellowed to less than 7 per cent for 2016. This slower growth, however, is still several times the growth rates of both the U.S. and Europe, whose annual growth rates are in the 2% to 3% range. The rest of the world (ROW, Russia, Africa, South America and the Middle East countries) account for a combined 8.8% of the global R&D investments with a combined average growth of only about 1.5% per year.

India's share in global R&D spending has increased over the last five years. According to Battelle, India is estimated to have had the eighth largest annual R&D investment in the world in FY10, with its share in global R&D spending estimated to have risen to 2.8 per cent in FY11 from 2.6 per cent in FY10.



2

ADVANTAGE INDIA



2. Advantage India



Economists like Adam Smith had long established a relationship between scientific research and economic growth. Over the last few years, the Government of India has realized and recognized the importance of investing in R&D for the economy's growth and is partnering with established leaders globally for improving the local R&D capabilities. For instance, India and Russia have partnered for military hardware, wherein the latter would be constructing 12 nuclear power plants over the next 10 years for India. Similarly, India and UK joined hands to work as R&D partners in Solar Alliance and Nano Material Research.

Huge Market for Indian Manufacturers

The sheer size of the Indian market makes the country a strategic location for large foreign firms to expand their operations. In the last few years, India has emerged as a huge market for international manufacturers. Furthermore, with the increased focus on manufacturing in India, growth in the sector has accelerated. India has also evolved from a public sector dominated setup, to a more private sector-driven economy with global ambitions. As per the United Nations Industrial Development Organisation (UNIDO), India is currently the second largest producer (after China) of textiles, chemical products, pharmaceuticals, basic metals, general machinery and equipment, and electrical machinery. These developments have made India an attractive destination for R&D.



Well-established Intellectual Property Rights (IPR) policy

IPR policies of a country play a crucial role for businesses planning to setup their R&D centre in other countries. These include areas like patents, copyrights, trademarks and industrial designs. The WTO requires all its member countries to abide by the minimum IPR standards as stated under the agreement 'Trade-related Aspects of Intellectual Property Rights' (TRIPS). Since India is a WTO member, it is automatically obligated to abide by TRIPS.

India's National Intellectual Property Rights (IPR) Policy announced in 2016 aims to incorporate and adapt global best practices to the Indian scenario. The Policy recognizes that India has a well-established TRIPS-compliant legislative, administrative and judicial framework to safeguard IPRs, which meets its international obligations while utilizing the flexibilities provided in the international regime to address its developmental concerns.

A recent WIPO report has indicated that India has emerged as one among the top 15 origins which have shown a strong growth rate of PCT filings in 2016. According to the report, India filed 1,529 applications in 2016 compared to 1,412 applications in 2015.

Highly-skilled and low-cost workforce

India adds 6000 PhDs, 200,000 engineers, 300,000 non engineering postgraduates, and 2,100,000 other graduates to its workforce annually. It is this talented pool of workforce available at low cost that becomes the key differentiator between India and other countries. For instance, the cost of hiring a researcher in India is one-fifth of that in the US. Similarly, the annual salary of a senior engineer in the US is in the range of USD150,000–200,000 compared to USD30,000–40,000 in India. Moreover, Indian graduates work for longer hours. Compared to US and German counterparts, who work for 1,900 and 1,700 hours, respectively, an Indian graduate works on average for 2,350 hours a year.

Furthermore, the business language in India is English, which adds to the comfort for foreign firms setting up their base in the country.

Policy Support

All R&D activities involve huge risks and therefore, it is imperative that the government undertakes relevant initiatives to decrease the burden on companies by offering them incentives. These incentives may be in the form of financial incentives (direct funding of R&D projects by the government) or fiscal incentives (tax holidays, import tariff exception), but it is essential that these are offered on equal terms irrespective of a business' domestic or foreign origin.

Apart from these incentives, which are more generic in nature and are applicable to all industries, R&D is promoted in a bigger way in industries like biotechnology, pharmaceuticals, telecom equipment, chemicals and automotive.

Educational Institutes

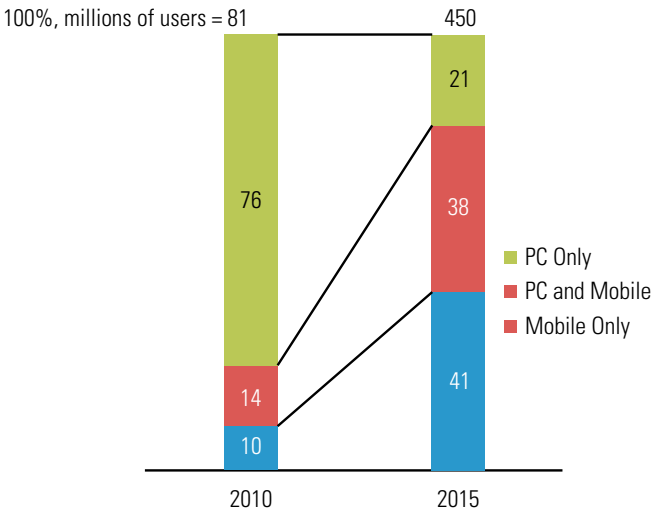
India has highly acclaimed educational institutes like the Indian Institutes of Technology (IITs), Indian Institutes of Management (IIMs) and Indian Institute of Science (IISc). Most of these institutes conduct R&D in collaboration with central and state governments as well as industry players on a regular basis. These institutes, with highly qualified

academicians and talented students, can help propel India to become a global R&D hub.

Share of Internet use in India

India has a colossal market for technologies and the middle-class segment greatly contributes to the demand for electronic gadgets, automotive, fast moving consumer goods, etc. Therefore, the digital consumption of this segment is also growing at a rapid pace. Despite of high number of Internet users, India ranks third in the world by internet connectivity with low penetration, which indicates that the growth opportunity is tremendous.

Share of Internet use by channel in India, %



Source: Mckinsey digital consumer survey, 2015

All these factors contribute towards a singular goal of positioning India as one of the top R&D destinations in the world.

Key Imperatives of Indian Economy

Various studies and experts have highlighted the strong correlation between innovation and economic growth. The current government in the country envisages India as one of the leading countries in the world but to reach its goals, India will need to blaze a new path. The challenge is to expand this mind-set across key sectors of the Indian economy.

Globally, the pattern for innovation is fast moving towards more consumer-centric solutions, delivered through the adoption of technology and asset-light business models. Such a trend is expected to have wide-reaching implications for emerging markets such as India. Given the complexity and scale of the challenges facing the country, the resources required and the urgency of demands for change from Indian citizens; market players will need to develop similar quality-focussed and innovation-driven mind-sets to become competitive in today's globalised environment.

To achieve rapid growth, India needs to view its many economic and social challenges as opportunities for growth and renewal. Companies need to challenge conventions, invest in innovation and R&D, and unlock vested interests embodied in the antiquated infrastructure, which continues to hamper India's growth.

India is in the midst of a socio-economic upheaval where reforms and policies that target the marginalzied population are on a rise. Everybody recognises that given the scale of the problems facing this vast nation, slow reforms cannot be

an option. India's youth wants to make an economic and social difference. Members of a growing middle class are looking for new customised solutions to address unmet needs. Citizen organisations are pushing to ensure that economic growth is accompanied by improvements in human development. Furthermore, the present government's increased focus on development and growth could also be considered as an immediate signal for this desire.

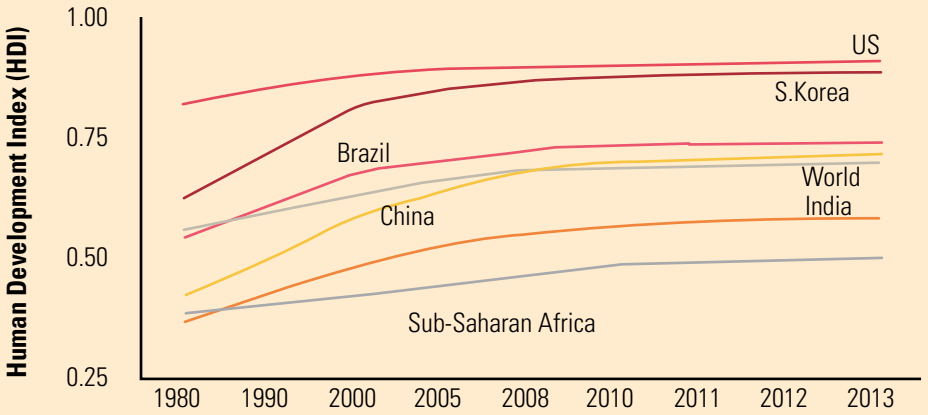
In recognition of the above, following points becomes important to considered:

I. India is a young country with rising expectations

II. Growing middle class seeks new value propositions

III. There is a need for a balanced economic and human development

In addition to these, there are several sector-level imperatives that need to be considered because India's performance across key measurable parameters has been below other emerging markets like Brazil and China. There is also a significantly wide gap between India and developed markets like the US or Korea. Each of these sectors will have to improve in a resource-constrained manner to achieve a balanced growth in India.



India's HDI is closer to Sub-Saharan Africa than to countries such as China, Brazil and USA

India lagged global HDI on all index parameters –health, education and income, in 2013

Source: Oxford Economics; World Bank

There is also a need for a breakout growth strategy across the enterprise ecosystem. A major factor behind the lag in India's country-level performance over global counterparts has been the lacklustre performance of its enterprises, be it government bodies, the corporate sector, SMEs or educational institutes. For instance, India has only five companies among the leading 500 brands globally, while China has 32. In terms of creating global businesses, only three Indian firms were listed on the NYSE International 100 Index as of 2013, compared to 22 Canadian firms and 16 from the UK. Although SMEs employ 40% of India's overall workforce, they contribute only 17% to the nation's GDP. This is mainly due to an unfavourable regulatory environment, marked by the need for multiple procedures and high paid-in capital to start a new business. When propelled by adequate policy support, these companies can achieve adequate success through investments in innovation and product specialisation in niche areas.



3

ADVANTAGE KARNATAKA



3. Advantage Karnataka



The 4th largest technology cluster, which is expected to become the largest by 2020, Karnataka possesses all the skills, knowledge and capabilities required to realize India's goals. 400 out of Fortune 500 companies (80%) have outsourced operations in Karnataka. It is the largest software exporter in the country, contributing to one-third of the total exports. It has also been ranked among the world's top 15 startup ecosystems and is also the second fastest growing start-up ecosystem. The state was also the first to announce multi-sector startup policy and presently accounts for more than 4000 startups. With an abundance of skilled engineers and PhD students graduating annually, the state already boasts of around 400 R&D centres.

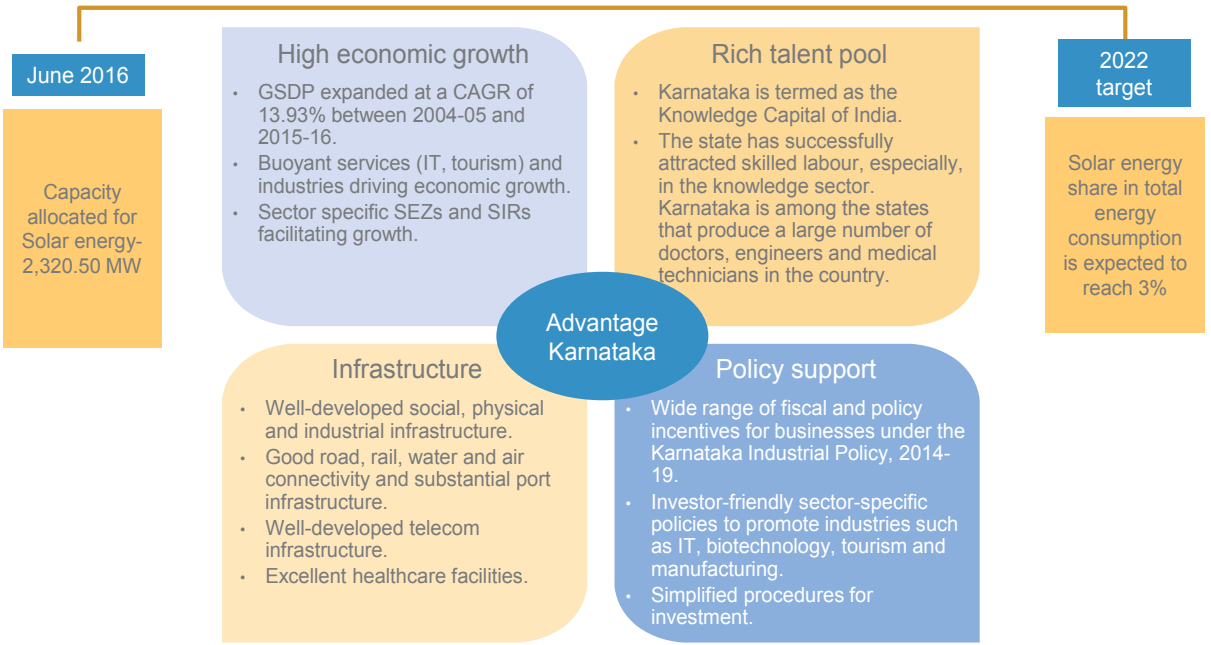
The Government of Karnataka has been a pioneer in initiating measures to support innovation, and intends to accelerate growth through sustained action. The government envisages a world-class startup ecosystem through strategic investment and policy interventions, leveraging the robust innovation climate in the State.

In 2015-16, the gross state domestic product (GSDP) of Karnataka was about US$ 156.23 billion. The per capita GSDP increased to US$ 2,557, growing at a CAGR of 12.91% between 2004-05 and 2015-16. Sectors like biotechnology, computer software and electronics are major contributors in the overall exports from the state. Exports of IT and electronic products from the state reached US$ 10.38 billion by the end of December 2015 and accounted for around 38% share in



India's IT and electronic products exports and 52.89% share in Karnataka's overall exports by the end of December 2015. The state's total food grain production is estimated to be 11 million tonnes in 2015-16. Karnataka is also the third largest producer of plantation crops in the country. Furthermore, the cumulative FDI inflows in the state from April 2000 to March 2016 were recorded at US$ 20.24 billion, the fourth highest in India after Maharashtra, Delhi and Chennai, and accounted for a share of 7% in India's cumulative FDI inflows.

Karnataka has vibrant automobile, agriculture, aerospace, textile & garment, biotech and heavy engineering industries. The state has sector-specific SEZs for key industries such as IT, biotechnology, engineering, food processing and aerospace. Apart from being the IT hub in India, Karnataka has 47 IT/ ITeS SEZs, three software technology parks and dedicated IT investment regions. The state also houses 44 universities, 4,519 pre-university colleges, 206 engineering colleges and 293 polytechnics, 47 medical colleges and 38 dental colleges.



Sources: Karnataka Udyog Mitra, D&B Cluster State Overview, Karnataka Vision 2020, Department of Industrial Policy and Promotion, Visvesvaraya Trade promotion Centre

3.1 Sectoral Opportunities in Karnataka

Pharmaceuticals

The Indian pharmaceuticals industry is one of the highest R&D spenders in the manufacturing domain with companies spending between 10 and 20 per cent of their annual sales on R&D. The outcome of this rising R&D investment has been largely positive and Karnataka has played a key role in India's emergence as a significant player in the global biotechnology industry. Karnataka is home to nearly 60.0 per cent of the country's biotech units. More than 60 per cent of the biotechnology companies in India have a base in Bangalore and the state drives 50 per cent of the total revenues in India's biotechnology sector. Patents granted to India-based pharmaceutical companies have been increasing significantly with Indian firms having a comparative advantage in patent filings due to their high intellectual base and low-cost R&D. India also has the highest number of FDA-approved production facilities in the world.

In the coming years, many blockbuster drugs would go off-patent. This would exert pressure on the top pharmaceutical companies worldwide, thereby increasing demand for contract research. As per state budget 2016-17, the state government established Bengaluru Bio-innovation Centre with an investment of US$ 8.55 million for enabling MSMEs to access high-end laboratory and instrumentation facilities. This is where a huge opportunity lies in Karnataka. Considering the long duration of drug discovery and development amid increased competition, these companies are trying to outsourcing research. With a well-established industry, lower R&D costs and availability of highly qualified workforce, Kanataka is a suitable option for outsourcing research.

Aerospace

India has crossed several major milestones in space history, namely, Indian Space Research Organisation's Mars Orbiter mission, etc. This has helped in firmly establishing India's aerospace expertise globally – India is now part of the elite club of interplanetary travellers, which includes the United States, Europe, and Russia.

The current existence of a large density of aerospace institutions and new companies establishing operations in the city's outskirts, in key industrial belts surrounding Bangalore and in north Karnataka, combine to make Karnataka a very attractive destination for the Aerospace and Defence industry. Realising the potential Karnataka has been proactive in making investments and policies for the Aerospace sector. Karnataka is the first state which announced the aerospace policy in the country. Karnataka Aerospace Policy has identified an investment potential of US$ 12.5 billion in this sector during 2013–23 and plans to develop aerospace clusters in different regions of the state. The state government plans to develop an aerospace park spread over 1,000 acres near the Bengaluru International Airport (BIAL) with an investment of US$ 1.7 billion, with the intention of attracting global and domestic players in the Indian aerospace industry. The park is expected to be operational by 2017.

Information and Communications Technology (ICT)

India is the world's largest sourcing destination for the information technology (IT) industry, accounting for approximately 67 per cent of the US$ 124-130 billion market. The industry employs about 10 million workforces. More importantly, IT has led the economic transformation of the



country and altered the perception of India in the global economy. India's cost competitiveness in providing IT services, which is approximately 3-4 times cheaper than the US, continues to be the mainstay of its Unique Selling Proposition (USP) in the global sourcing market. Bengaluru is a major hub of the telecommunications industries. In 2015, the state government of Karnataka has announced plans to set up an Information Technology Investment Region (ITIR) near the Kempegowda International Airport and proposed an investment of US$ 2.35 billion.

Having proven its capabilities in delivering both on-shore and off-shore services to global clients, emerging technologies now offer an entire new gamut of opportunities for top IT firms in Karnataka. Social, Mobility, Analytics and Cloud (SMAC) are collectively expected to offer an opportunity of US$ 1 trillion. Cloud represents the largest opportunity under SMAC, increasing at a CAGR of approximately 30 per cent to nearly US$ 650-700 billion by 2020. The social media is the second most lucrative segment for IT firms, offering a US$ 250 billion market opportunity by 2020. The Indian e-commerce segment is US$ 12 billion in size, witnessing strong growth, and thereby offers another attractive avenue for IT companies to develop products and services to cater to the high growth consumer segment.

Energy Efficiency

In December 2015, the debate on climate action had a defining moment when world leaders signed an agreement to build a clean global economy at the Climate Change Summit in Paris. On the same platform, the world also saw India emerge as a leader at the forefront of that change, as it accepted the need to curb carbon emissions and reinforced its development imperative.

Karnataka is endowed with high renewable energy potential such as wind, hydro, solar, tidal and geothermal energy resources. The renewable energy potential for the state is estimated at 30.2 GW, primarily from wind, solar, small hydro, co-generation and biomass sectors. Karnataka's emphasis on green energy has opened the gates for several private companies investing in the field of energy conservation. For instance, in January 2015, renewable energy developer and technology provider, SunEdison has signed an MOU with Karnataka Government to develop 5 GW of renewable energy projects within the state over the next five years.

Electronics System Design Manufacturing

Electronics System Design Manufacturing industry (ESDM) is growing at a fast pace in the state. This sector will see a growth in the coming years as many start-ups are looking at manufacturing activities. A vibrant ecosystem for design-led manufacturing is present in the state, which include the Electronics System Design and Manufacturing (ESDM) policy which now includes venture capital support as well, through the Karnataka Semiconductor Venture Fund (KarSemVen), which has supported six start-ups already to the tune of Rs 30 crore. The objective of the K-ESDM policy is to make Karnataka the preferred investment destination for sectors like telecommunications, defence, automotive, and consumer products among others. There is a steady increase in registration of K-ESDM companies which are now availing the benefits of the scheme.

4

OUR RECOMMENDATIONS



4. Our Recommendations



With the conducive business milieu present in Karnataka, as well as the favourable regulatory environment steered by the Government of Karnataka, Bengaluru emerges as the natural R&D capital in India. However, even with existing knowledge, skills and capability, there is a need for consolidation. In this regard, a research umbrella organization should be established, which will bridge all the research and development labs in the city. Furthermore, to promote synergy between research and industry, it is imperative that this umbrella organization lays down an interconnected framework for all.

4.1 Hub & Spoke Model

Consolidation and collaboration for research and industry would happen under a hub and spoke model. A Centre of Excellence is proposed to be established in Bengaluru, which would essentially be an academia led initiative designed to lead the research and increase the impact of innovation across sectors. It will be aimed at promoting advancement, leadership and excellence in the pursuit of all areas of research.



Private sector companies, global research institutes, open labs and incubators and government programmes would form spokes of this Centre. In the long run, India can also look to developing world class global infrastructure in certain fields of international consortia.

Hub: Centre of Excellence (CoE), Bengaluru

The prime role of the CoE would be to lead and engage in applied research and technical services to help industries stay competitive and sustainable.

To achieve the above, the CoE would collaborate with local corporations to improve the future with innovative technologies. By examining worldwide trends, the CoE would create and share a suitable roadmap for companies and would also provide multiple collaboration models to adapt to the varied needs of the industry. Some of these are:

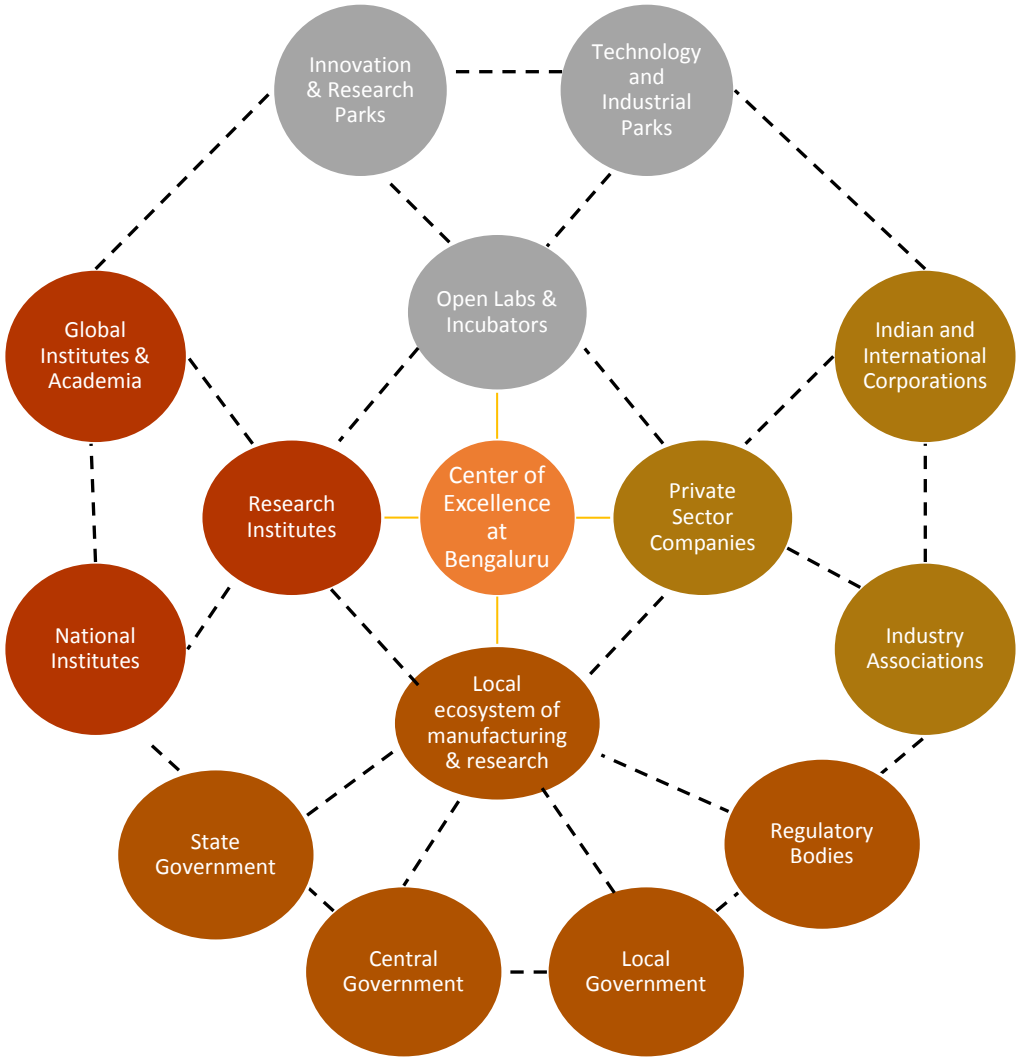
i. **Contract Research**: CoE may consolidate requests for contract research including, for example, in areas of material testing and evaluation, prototyping or research services for international organizations on a contract basis. Conversely, CoE will also contract projects to international institutes, mainly for advanced research.

ii. **Joint Research**: This type of research will encompass majority of CoE's international collaboration projects, with each party carrying its own funding. The project goals will be set collaboratively by participating parties.

iii. **Foreign companies and Academic Institutes to establish R&D centers in India:** CoEs can also help foreign companies and academic institutes build R&D centers in India, with the intent to develop technology links with local industries. Some companies might choose to set up their small research units and facilities in the CoE Open Labs, while others might establish R&D centers in science parks.

Other activities such as feasibility studies, integration, new product development, prototyping, improvement of manufacturing process, safety compliance, etc. can also be carried out in CoE.

Proposed Hub & Spoke Model





Spokes to the Centre of Excellence

Private Sector: To ensure and expedite product commercialization, it is important that CoE collaborates and partners with various companies across various sectors. This will help in driving the development of emerging technologies and promoting service industry innovation, thereby increasing industrial impact and economic value.

Global Research Institutes: It is important to integrate all available resources for the success of this model. Promoting high quality research will enable businesses to unlock their innovation potential. This can be achieved by partnering with global research institutes.

Open Labs and Incubators: Collaborating with labs and incubators across the country will encourage and foster the development of more startups. With abundant R&D assets and strengths as well as venture capital resources, these labs and incubators would be able to support technological advancements across various sectors, including, telecommunications, electro-optical technology, precision machinery, IC design, chemical materials, medical instrumentation, green energy, biotechnology, etc.

Local ecosystem of manufacturing & research: The role of local ecosystem players shall be crucial in the success of the proposed model. The model shall enable local private sector SMEs, MSMEs, and startups to contribute in equal measures.

With strong industry-oriented research support, CoE will aim to provide domestic businesses with professional information and consultancy services. Additionally, it will create value-added integration and enhance industrial efficiency. Its research capacities will include various areas of interest, along with observations of economic, industrial, and technical trends to provide policy recommendations and serve the industry.

Pilot Model: Precision Medicine

India has a heavy burden of inherited diseases driven by the unique genetic characteristics in the population. With 1.4 billion people, the absolute number of patients suffering from diseases in which genetics play a role is significantly large.

Precision Medicine in the country is considered to be at an early adoption stage. The need and its potential in the Indian healthcare scenario is high, considering that the system is under great pressure due to sheer numbers. It is an emerging approach of medicine which looks at the root cause of an illness, rather than addressing the symptoms alone.

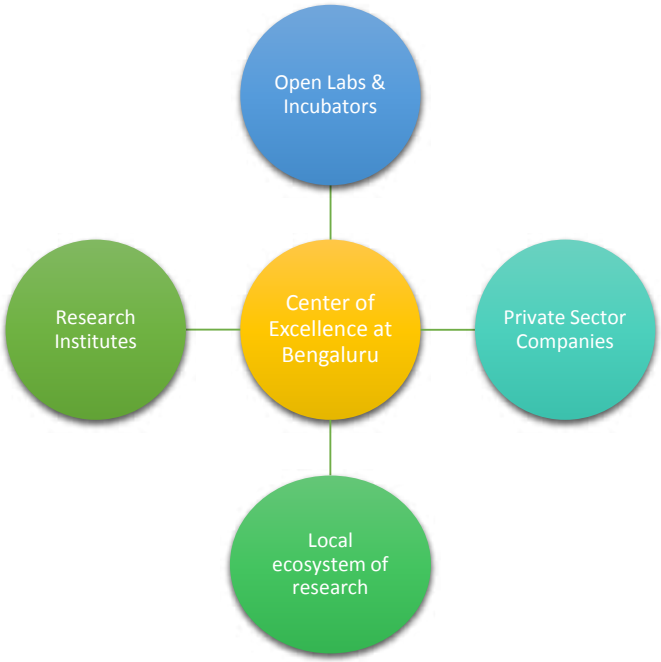
In India, Precision Medicine is being practiced in several specialties like oncology, cardiology, psychiatry and diabetology. It is already being embraced to a reasonable extent, especially in cancer.

Bengaluru, with its reputation of being the biotechnology capital of India and presence of a robust life sciences R&D ecosystem is most suited to take a lead in the Precision Medicine research. The proposed Hub-and-Spoke model for Precision Medicine shall have the following essential components:

Pilot Hub & Spoke Model for R&D in Precision Medicine

- Medgenome Labs Pvt. Ltd.
- Swagene
- Ganit Labs

- National Institute of Biomedical Genomics (NIBMG)
- Centre for Genome Research
- Bioaxis DNA Research Centre
- Genotypic Technology
- Madras Diabetes Research Foundation (MDRF)
- Indian Council of Medical Research (ICMR)
- Institute of Bioinformatics



- Xcode Life Sciences
- Avesthagen
- Strand Life Sciences
- Positive Bioscience
- Mapmygenome
- Mitra Biotech

Local startups and SMEs providing customized products and services to enable research



4.2 Special Innovation Zones

The introduction of Special Economic Zones (SEZs), Software Technology Parks of India (STPIs) and Science & Technology Entrepreneurship Parks (STEPs) in India was nothing less than a revolution. It provided a level playing field to the domestic enterprises and manufacturers, so that they could compete with the global players.

While each of these initiatives have helped in creating an atmosphere for innovation and entrepreneurship, they do not necessarily have adequate provisions for bridging innovation and research with manufacturing on-site. Therefore, this calls for development of Special Innovation Zones (SIZs), the features of which may be derived from the three initiatives that are already in place.

SEZs	STPIs	STEPs	SIZs
An area in which business and trade laws are different from rest of the country Aim is to promote Foreign Direct Investments (FDIs), to encourage businesses to set up in the zone, to increase trade and investment and stimulate job creation Incentives and facilities offered includes single window clearance, simplified compliance procedures, tax holidays, etc.	A society established in 1991 by the Indian Ministry of Communications and Information Technology Objective is to encourage, develop, promote and boost export of software from India, provide data communication services including value added services to IT enabled Services (I.T.E.S) related industries, etc. Incentives and facilities allow setting up of an STP anywhere in India, approvals are given under single window clearance system, 100% Foreign Equity, etc.	An area designated for innovation and entrepreneurship and to promote active interaction between academic institutions and industries To provide a re-orientation in the approach to innovation and entrepreneurship involving education, training, research, finance, management and the government The Government of India has set up 17 STEPs which are now undertaking business incubation activities in different sectors of science and technology. Each STEP also follows its own model depending on the local needs and the environment	Connect on-site research and innovation with on-site manufacturing Forge a close linkage between universities, academic and R&D institutions with the industry Promote entrepreneurship among young graduates by providing Incubation Support to start-ups Offer fiscal incentives to both research and manufacturing set ups

While the existing initiatives create conditions for research and manufacturing, there is a need to bridge the gap between these two elements on the same site. This is where Special Innovation Zones (SIZs) come into play. These SIZs would create conditions and an environment for research and manufacturing on the same site.

These SIZs could be separate, demarcated regions which are governed by economic laws that are more liberal than the typical economic laws. An SIZ unit should also promote Foreign Direct Investment ("FDI") and technology into the country. The SIZs could cater to multiple industries, which can be sector specific or multi-product.

The entire manufacturing exercise has got a lot of impetus recently, courtesy, recent government announcements. However, manufacturing cannot be done in isolation. The rise of China is also a combined outcome of conducive policy framework and integrated infrastructure support. Thus, there is a need for a world-class research and manufacturing hub like the SIZ.

In order to achieve synergetic benefits and to harness the knowledge and expertise available in academic and R&D institutions, every SIZ will need to be promoted around a host institution. The role of these host institutions would be to launch, sustain and help these SIZs grow. Therefore, the host institution has to play an important and crucial role in promotion and growth of a SIZ.

Each project envisages active involvement and participation of agencies such as the host institution, ultimate user of the facilities, financial institutions, government agencies and the SIZ management.

Furthermore, similar to the SEZ model, the government should consider providing incentives and facilities to these SIZs. These incentives and facilities could include the following:

- 100% Income Tax exemption on export income
- Exemption from minimum alternate tax under section 115JB of the Income Tax Act
- Exemption from Central Sales Tax
- Exemption from Service Tax
- Single window clearance for Central and State level approvals
- Exemption from dividend distribution tax under Section 115B of the Income Tax Act

Pilot Model: Exclusive Pharma and Med Tech Innovation Zone

Karnataka's pharmaceutical industry constitutes 264 manufacturing units that include small-medium, large, public sector and multinational companies. The state also stands fifth in pharmaceutical exports with 40 percent of its pharma produce being exported overseas. Establishment of an SIZ in this area will reduce the manufacturing cost of drugs and medical devices significantly, as compared to global prices.

In this regard, the Government of Karnataka has also recently announced that an exclusive zone for pharmaceuticals and medical technology (Med Tech) will be established in Bengaluru. This zone will help in giving a boost to domestic production of medical products under the Make in India initiative.

Considering the government's announcements and the need in the sector, it is proposed that a pilot of the SIZ model be initiated in the Medtech sector.

5

GOVERNMENT OF KARNATAKA'S ROLE IN NURTURING R&D ECOSYSTEM



5. Government of Karnataka's role in nurturing R&D ecosystem



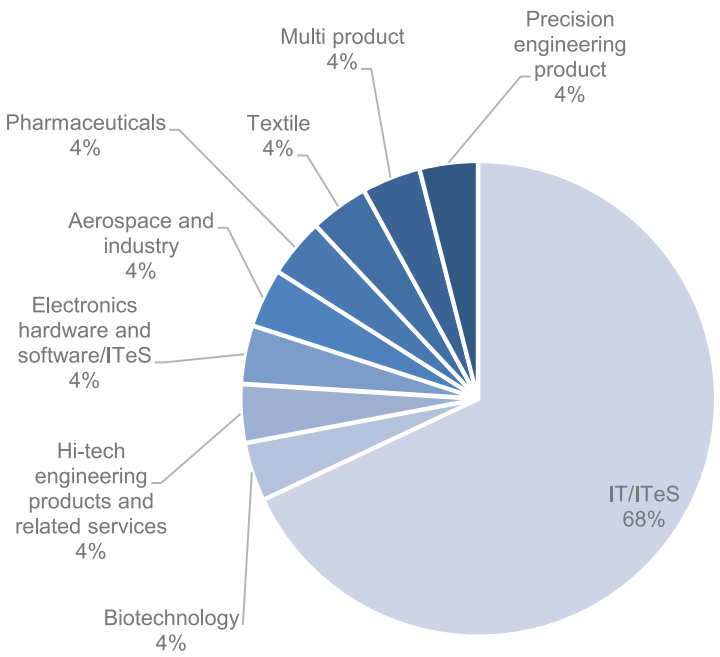
Karnataka is one of the most progressive and industrialized states in the country, driving India's economic growth. The state has an illustrious history of successfully introducing several industrial and technological initiatives. The state's pre-eminent position on the business map of India is based on several factors, some of which are mentioned below.

Karnataka has a stable political environment, where successive governments have recognised the importance of industries present and have provided a conducive business environment to attract domestic and foreign entities.

As a result of this, the state already has 25 operational, 40 notified SEZs, one valid in-principle approval and 61 formal approval SEZs, as of July, 2016. The Karnataka Industrial Areas Development Board has developed 141 industrial areas spread across the state and plans to further develop and upgrade eight clusters around Bengaluru, with an investment of US$ 348.4 million in coming years.

In order to promote focused innovation, entrepreneurship and manufacturing, Karnataka has also established Biotech Park Clusters such as BBC (Bangalore Bioinnovation Center) in Bangalore and in other cities across the state (Mysore, Dharwad, Mangalore and Bidar). The focus areas for such cluster parks are agriculture, health & wellness, medical devices, animal welfare, energy and environment. Other clusters in Karnataka include:

Sector wise Operational SEZs In Karnataka (as on July 2016)



Source: Department of Commerce, Ministry of Commerce and Industry

- Nutri Nutraceutical and Phyto-pharmaceuticals in collaboration with CFTRI, Mysore
- Agricultural Biotechnology in collaboration with UAS-Dharwad
- Marine / Aqua Biotech in collaboration with the College of Fisheries, Mangalore
- Animal Biotechnology area in collaboration with KVAFSU- Bidar

Furthermore, to promote Intellectual Property Rights (IPR) and innovation in the state, the Karnataka Biotechnology Team is also working towards developing a comprehensive database on patents, with on-line processing. It aims to establish an exclusive IP Cell to advise entrepreneurs on how to file patents and protect IPR.

Bengaluru – Start-up Capital of India

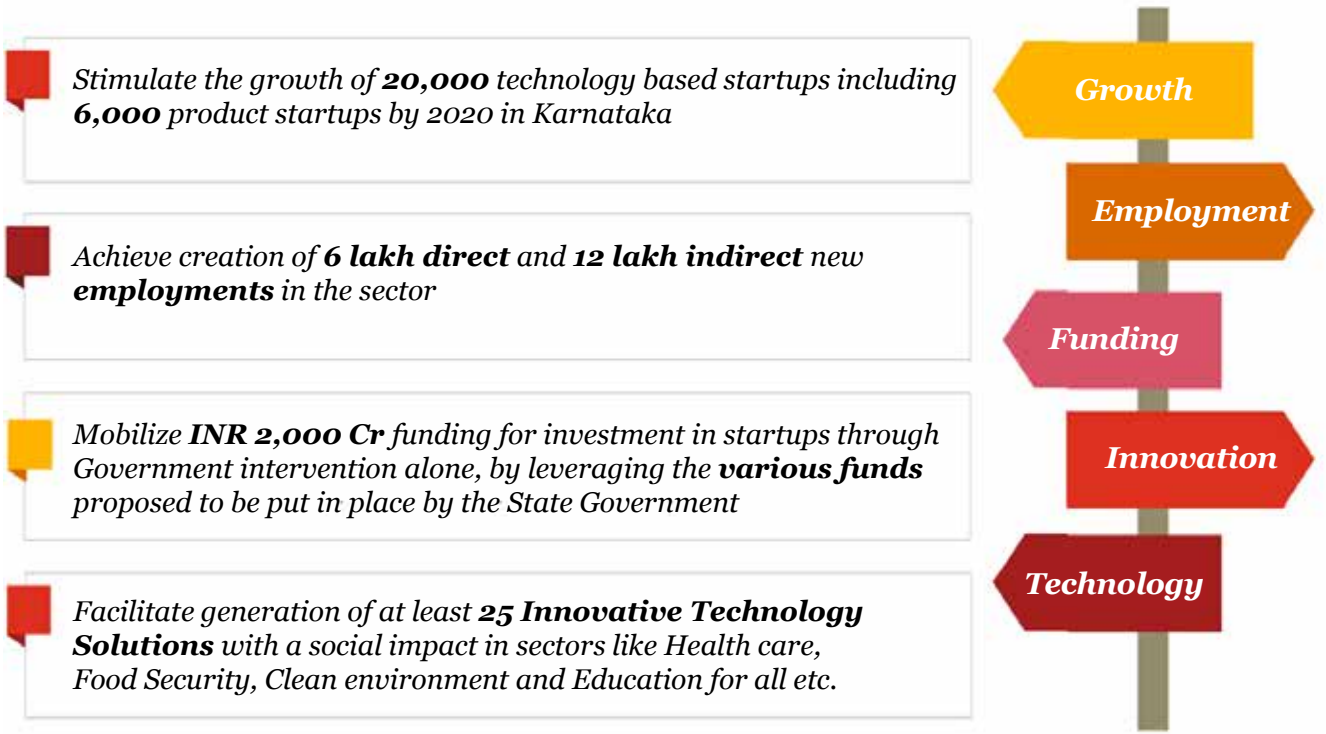
Bengaluru has emerged as IT Start-up Capital of India with over 30% of the national share. Start-ups are being supported with integrated package of subsidised incubation space, fully equipped laboratories, early stage funding and capacity building, partnerships with NASSCOM 10 K Startup Warehouse Program, IAMAI's Mobile 10X Accelerator Initiative and DietY, GOI's IOT COE initiative with NASSCOM. Established Incubation Centers and startups are being supported in Tier-2 cities to develop them as upcoming ICT destinations over 70 Venture Capital Firms. Karnataka was one of the first states to announce a **Startup Policy** which aims to stimulate the growth of 20,000 technology based startups, including 6,000 product startups by 2020 in Karnataka. It also aims to achieve creating 6 lakhs direct and 12 lakh indirect new employments in the sector. Additionally, the State is also setting up a Rs100 crore start-up fund.

Karnataka recognizes that the seeds of entrepreneurship and the innate ability to innovate, must be nurtured in academic institutions. The State is therefore working towards creating such an ecosystem in academic institutions through a **New Age Incubation Network (NAIN)**.

New Age Incubation Network (NAIN)

NAIN will be implemented in engineering colleges and thereafter, will be expanded to all professional and post-graduate institutions in two-tier cities, in a phased manner. At least 50 academic institutions shall be covered under this program during the Policy Period. The selected academic institutions would be assisted to establish an incubator in the given discipline and encourage student projects. All such incubators would be networked and connected to a common portal, to facilitate exchange of thoughts, ideas and collaboration across institutions and disciplines. Each NAIN institution would be assisted in in various ways like capacity building and training for faculty and students, grants for supporting operational expenses in their incubator, etc.

Goals of Karnataka Start-up Policy 2015-2020



Source: Karnataka Startup Policy, 2015-2020



Technology business incubators (TBIs)

The government is also working towards setting up Technology Business Incubators (TBIs) in institutions of higher learning well-developed R&D facilities, which will foster a strong link between R&D and commercialization of technologies developed. The following thrust areas would be covered under TBIs:

- Information & Communication Technology (ICT)/ Internet of Things (IOT)/Software Products
- Manufacturing including Electronics systems design, Robotics and 3D Printing, manufacturing 4.0
- Healthcare and Bio Pharma
- Agriculture and allied fields
- Clean-Tech
- Energy
- Water Recycling
- Education
- Nanotechnology & Composites

Idea2PoC (Proof of Concept): providing early-stage funding

To encourage innovators, who may need early stage funding to stimulate commercialization of research discoveries and to help in validating proof of concept, the State will set up an Ignition Fund on the lines of BIG fund of BIRAC, GOI. This fund will assist them to cover costs like certification, manufacturing pilot devices etc.

This funding will be in the form of grant-in-aid which will be limited to a one-time grant of up to Rs. 50 lakhs. The state may choose to administer this grant-in-aid fund through TBIs (as defined earlier) or identified incubators of excellence. This may also help incubators to work as accelerators. Furthermore, recognized incubators, which are managing Seed Fund Scheme of Government of India will be given matching seed funds to further increase the amounts available for startups by 200%.

IT Venture Capital Fund

Bengaluru as the 2nd largest technology cluster in the world after Silicon Valley. 3500 IT companies contribute over 38% of the IT exports in the country, with Karnataka being the largest software exporter. More than 85 Chip Design houses and over 370+ R & D houses provide direct employment to over 10 lakhs and indirect employment over to 25 lakhs as on 2014-15.

To meet the growing knowledge based industries and fast changing technology, the Karnataka Information Technology Venture Capital Fund was established in 1999. This was a Rs.15 Crore, SEBI registered IT specific fund, in which investments range per unit was from Rs.50 lakhs to Rs.150 lakhs. The KITVEN fund was successful in assisting a total of 17 units aggregating to Rs.17.56 crore after which the Fund – 2 was launched. This is a Rs.26.25 crore fund under which IT, Bio-Tech, Nano Technology & other knowledge based industries were covered.

More recently, the Karnataka Semiconductor Venture (KARSEMVEN) Fund in 2014-15, which in addition to other incentives also covers setting up venture capital fund exclusively for the Semi-Conductor industry. It aims to

undertake investments in units catering to Semiconductor, Electronics System Design & Manufacturing (ESDM), Embedded Systems and such other allied sectors within the State of Karnataka.

Startup Fund: Fund of Funds

A fund of funds is in the pipeline that will be allocated for investing in venture funds that further take the investment needs in startups across sectors. The fund of funds would be in addition to any sector-specific venture funds, which are already being operated by the State through its entities. This fund could also invest in future venture funds, promoted by the State.

A portion of this fund can also be utilized for angel stage funding. An investment committee with the government, industry and academic experts with sector-specific domain knowledge, financial and legal background etc. with no conflict of interest would be constituted to operate this fund.

Bio-Venture Fund

Karnataka has over 300 Biotech Companies in the state, which contributed to over 30 percent of the Indian biotech revenues of USD 4 billion in 2014-15. The State also set-up a bio-venture fund, with a corpus of Rs. 50 Crores (USD 8 Million), in partnership with professional venture capital firms. The State will give 26 percent of the fund and the remaining 74 percent will be raised from venture capitalists. This fund aims to promote projects in the areas of stem cells, genetics and bio-manufacturing.

Of the 350 biotech firms across the country, more than 52% (182 firms) are located in the state and five out of the top 10 companies are in Bangalore.

AREAS OF INVESTMENTS IN BIOTECHNOLOGY



Source: Biotechnology, Invest Karnataka



Aerospace Hub

Propelled by an increase in defence spending and a growing commercial aviation market, the Indian aerospace industry has become one of the fastest growing aerospace markets in the world. The existing supply chain developed by old-economy aerospace and engineering firms, an investor-friendly government with simplified procedures and fast-track businessapprovals through single-window clearance mechanism, combine to make Karnataka an attractive destination for the industry.

With the headquarters and laboratories of Hindustan Aeronautics Limited in the capital city of Bangalore, Karnataka has emerged as a pioneer in developing new aircrafts and helicopters for the Indian defence and domestic civilians use. To supplement this capability and to exploit its potential in the international market, the state government has also launched an aerospace special economic zone (SEZ) at Devanahalli. Additionally, QuEST Global has established a manufacturing and precision engineering SEZ in Belgaum.

The state permits 100 percent Foreign Direct Investment ('FDI') under the automatic route for MRO, flying training institutes and technical training institutions.

i4 Policy: IT, ITES, Innovation Incentives

This policy has been launched with the aim of converting Bengaluru from one of the top ten IT hubs to the largest IT cluster globally by 2020. The policy offers concessional power tariff, employment-linked incentivisation of land allotment (E-LILA) and treatment of essential service. By 2020, Bengaluru aims to overtake the Silicon Valley, to become the single largest IT cluster on the planet with more than 20 lakhs direct and 60 lakhs indirect jobs.

According to the i4 policy, the state government will exempt IT/ITeS/Start-ups/knowledge based industries from the Karnataka Industrial Employment Rules, 1946, for a period of five years.

Under this policy, plug and play built-up space with Internet is to be provided to start-ups at a concessional rate of Rs. 5 to Rs. 15 per sq.ft., depending on the location. This will mainly benefit start-ups in Tier-2/3 cities of Mysore, Mangalore, Hubli-Dharwad, Belgaum, Gulbarga and other cities and towns.

Big data Initiative

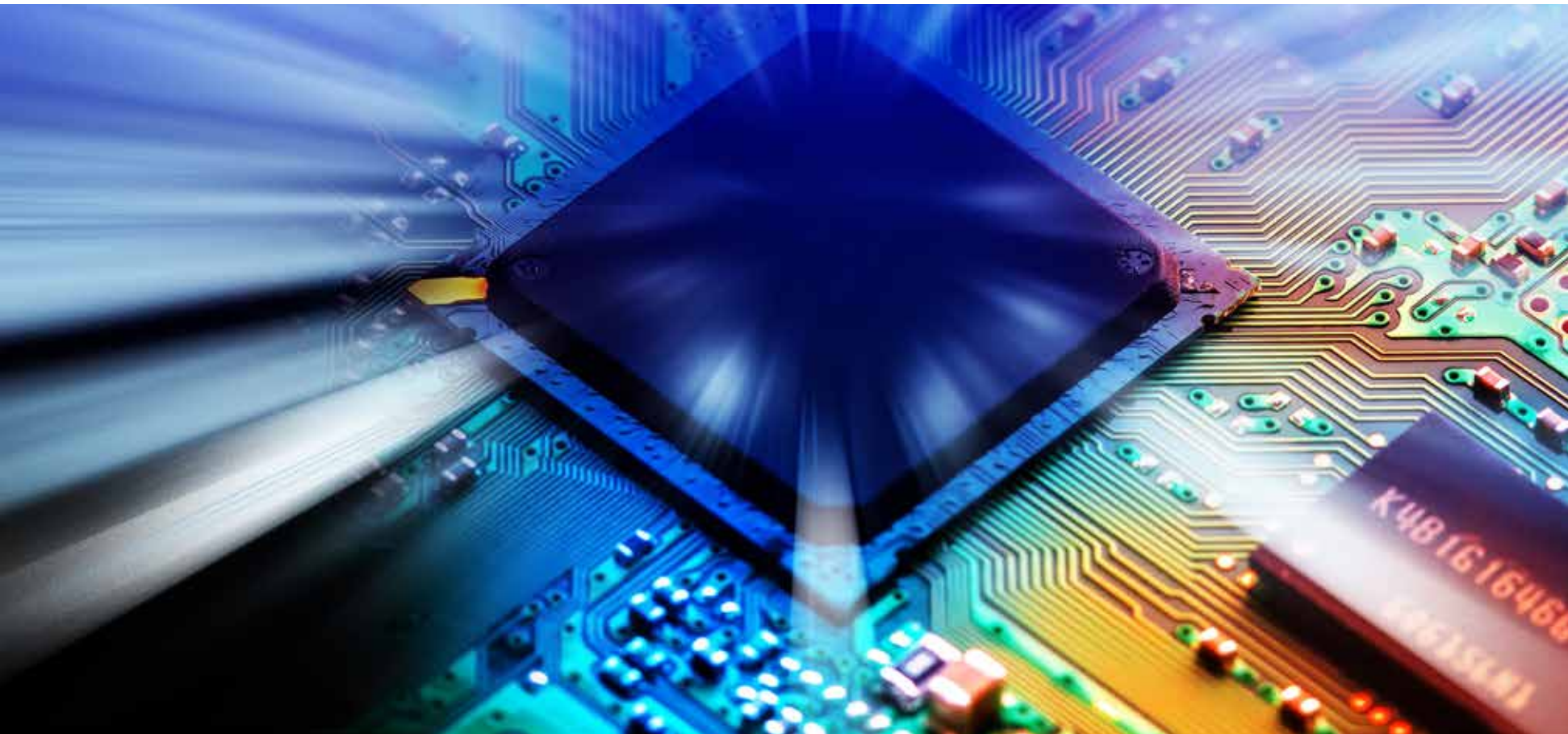
Some of the S&T challenges that researchers face, is related to data overflow pertaining to areas like Astrophysics, Materials Science, Earth & atmospheric observations, Energy, Fundamental Science, Computational Biology, Bioinformatics & Medicine, Engineering & Technology, GIS and Remote Sensing, Cognitive science and Statistical data. These challenges need development of advanced algorithms, visualization techniques, data streaming methodologies and analytics.

Therefore, a new methodology is needed for transforming Big Data stored in heterogeneous and different-in-nature data sources into a structured, well-interpretable format for target data analytics.

The primary objective of the Big Data Initiative is to help build a strong academic and research ecosystem that allows India to address the above-mentioned challenges and take a leadership position in this critical area.

6

CONCLUSION



6. Conclusion



Karnataka offers a very attractive proposition for global players to set up their R&D operations in the state. It gives access to a huge market, and a very talented base of scientists and engineers, who cost much lesser than their western counterparts. This talent pool will still remain young over the next two decades, while others like China would have an ageing working population by 2030. The country sees opportunities, especially R&D, which will strengthen its position as the fastest growing country in the near future.

There are many good models, best practices and enabling regulations strewn over different cities of India. If these practices can be adopted across India, it can improve the business climate by a significant margin. In 2009, World Bank showed that if a hypothetical city called 'Indiana' were to adopt best practices found in several benchmarked cities, it would improve India's rank under the ease and cost of doing business. For example, lowering number of procedures to start businesses to Patna levels, days to start a business to Mumbai levels, procedures around construction permits to Ahmedabad levels, days to enforce a contract to Guwahati levels, and the recovery rate for closing a business to Hyderabad levels, could further ease the players in the market

Such an economy is possible only when there is collaboration and integration. Therefore, an integrated framework will allow for more control and an easy accessibility over the entire value chain, which is the current need of the hour.



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