

## Chapter 8 - Innovation: Trending Up but needs thrust, especially from the Private Sector

---

### INTRODUCTION

- India entered the top 50 innovating countries for the first time in 2020 since the inception of the Global Innovation Index (GII) in 2007, by improving its rank from 81 in 2015 to 48 in 2020.
- India ranks first in Central and South Asia, and third amongst lower-middle-income group economies.
- The business sector in India contributes much less to gross expenditure on R&D (about 37 percent) when compared to businesses in each of the top ten economies (68 percent on average).
- India's gross expenditure on R&D at 0.65 percent of GDP is much lower than that of the top 10 economies (1.5-3 percent of GDP) primarily because of the disproportionately lower contribution from the business sector. Also, the government sector contributes the highest share of total R&D personnel (36%) and researchers (23%) amongst the top ten economies (9% on average).
- Indian resident's share in total patents filed 36%. (Top ten economies average is 62%)

### WHY INNOVATION MATTERS?

- Solow model says output per worker mainly depends on savings, population growth, and technological progress.
- While the Solow model treats technological progress as exogenous; the new growth theory endogenizes technological progress and suggests several determinants of the same.
  1. human capital
  2. Search for new ideas by profit-oriented researchers.
  3. infrastructure
  4. improving quality of existing products
- Endogenous growth has also been explained using the Schumpeterian model of creative destruction (replacement of the old one through innovation)
- An increase of 10 percent in R&D investment has been associated with productivity gains ranging from 1.1 percent to 1.4 percent.
- The relation between innovation and the research sector received attention with endogenous growth models. Research showed that small enterprise R&D activities brought large returns to the national economy through new technologies.
- India must focus on improving its performance on institutions and business sophistication innovation inputs. These are expected to result in higher improvement in innovation output.
- As per Global Innovation Index data, there is a positive correlation between past innovation performance and current GDP per capita (India has performed below).

### HOW DOES INDIA PERFORM ON INNOVATION?

- The GI Index is co-published by Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO), a specialized agency of the United Nations
- India ranks 48th amongst 131 countries in terms of its innovation performance as measured using the Global Innovation Index.
- India entered the top 50 innovating countries for the first time since the inception of the index in 2007.

- GII has two sub-indices:
  1. The Innovation Input sub-index has five pillars:
    - Institutions
    - Human Capital and Research
    - Infrastructure
    - Market Sophistication
    - Business Sophistication
  2. The Innovation Output Sub-Index has two pillars:
    - Knowledge and Technological outputs
    - Creative outputs

### **Is India a positive outlier only because of its population?**

- India is an innovation outlier in terms of its level of development (per capita GDP in PPP terms). India is the third-largest economy globally in PPP terms and the second largest in terms of population.
- It may be seen that population does not seem to be correlated to GII, Innovation Outputs, and Innovation Inputs. However, GDP seems to be positively correlated with innovation performance.
- This divergent performance for India in terms of the size of its economy and its level of development is a significant finding and warns against being complacent.

### **TRENDS IN INDIA'S INNOVATION PERFORMANCE**

- India has consistently improved on GII from rank 81 in 2015 to rank 48 in 2020 where China has improved its rank from 29 to 14 during the same period.
- India needs a goal-oriented approach to reach up to its potential. For example, Medium-term and Long-term Plan by China to become an "innovation-oriented society" by the year 2020, and a world leader in science and technology (S&T) by 2050.

### **R&D expenditure in India**

- Gross domestic expenditure on R&D (GERD) as a percent of GDP has a positive relationship with the level of development measured by GDP per capita on a PPP basis.
- When comparing India with top ten economies such as the USA, China, Japan, Germany, and France have higher than expected GERD for their level of development.
- Business sectors' participation in total GERD has a positive correlation between the level of development and GERD, while the government sector's participation in GERD is negatively correlated with development.
- In India, the Government contributes 56 percent of GERD while this proportion is less than 20 percent in each of the top ten economies. "Yet, India's GERD is much lower than that of the top ten economies because India's business sector contributes a much smaller percent to total GERD (about 37 percent).

### **India's performance on patents and trademarks**

- The total number of patents filed in India has risen steeply since 1999, mainly on account of the increase in patent applications filed by non-residents.
- While patent applications filed by residents have increased steadily since 1999, they have risen at a much lower rate than patent applications by non-residents.

**Non-Resident Indians and Innovation**

- Around six percent of US-resident inventors listed at the European Patent Office in 2009 had an Indian name and surname.
- Large-scale out-migration of skilled workforce and students from India is not necessarily bad news for India's innovation aspirations. This could potentially result in the return of a higher-skilled workforce in the future. However, this would require an enabling environment that facilitates re-entry into the Indian job-market and high-tech research opportunities.

**Is Indian innovation affected by access to finance?**

- Industries that are more dependent on external finance, and are more high-tech intensive, exhibit disproportionately higher innovation in countries with well-developed equity markets.

**REASONS:**

1. No collateral requirements for equity financing and minimizes the risk of financial distress.
  2. Rational expectations enable investors to extract relevant information about equilibrium prices.
  3. Equity markets can facilitate this evaluation through information embedded in stock market prices.
  4. Equity financing can be particularly well suited for innovative projects that are riskier.
- It also observed that developed credit markets appear to discourage innovation in industries that are more dependent on external finance and are more high tech-intensive.

**Reasons:**

1. Innovative firms may have limited collateral to deploy for debt financing by way of tangible assets, restricting their use of debt.
  2. Risk-averse banks under-invest in high-uncertainty innovative projects.
- Given that most of these large economies are more innovative than India and equity market development facilitates greater high-technology innovation, this potentially indicates that innovation in India needs to become more high-tech intensive.

**IS INDIA EFFECTIVELY TRANSLATING INNOVATION INPUTS INTO INNOVATION OUTPUTS?**

- It may be seen that India can effectively translate investments in innovation inputs to produce a higher level of innovation outputs. This implies that India stands to gain more from its investments into innovation than many other countries. With higher investments, it may be possible that this relationship between innovation inputs and innovation outputs becomes even more favourable for India.
- The improvements in institutions and business sophistication could lead to higher creative output performance. Higher income is also expected to lead to better performance in creative outputs and hence ranks closer to one in Innovation Output rank and Creative Output rank (thereby reflecting a negative correlation).

**POLICY IMPLICATIONS**

- India to become the third-largest economy in GDP current US\$ in the near future. This requires boosting gross expenditure on R&D from 0.7 percent of GDP currently, to at least the average level of GERD in other top ten economies (GDP current US\$) of over two percent.

- India's business sector needs to rise to the occasion and significantly ramp up its gross expenditure on R&D to a level commensurate to India's status as the fifth-largest economy in GDP current US\$.
- Literacy, education, physical infrastructure, and policies enabling ease of doing business, as drivers of new firm creation and entrepreneurship, remain relevant in innovation in India.

#### CONCLUSION

- For India to become an innovation leader, it needs greater thrust on innovation.
- The business sector's contribution to total R&D personnel and researchers also lags behind that in other large economies. This situation has prevailed despite the tax incentives for innovation has been more liberal than other economies.
- India's innovation ranking is much lower than expected for its level of access to equity capital. This points towards the need for India's business sector to significantly ramp up R&D investments.
- Indian residents' share in total patents filed in the country stands at 36 percent. This lags behind the average of 62 percent in other largest economies. Resident share in patent applications must rise for India to become an innovative nation.
- India must focus on improving its performance on institutions and business sophistication innovation inputs. These are expected to result in higher improvement in innovation output.