Comparing the Global Innovation Index (GII) of India with other countries

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Abstract:
The Global Innovation Index (GII) provides a comprehensive assessment of countries' innovation capacities, utilising over 80 indicators that examine infrastructure, human capital, research, and development. This study aims to evaluate India's GII performance relative to other leading nations, with a focus on identifying strengths, weaknesses, and opportunities for improvement. India ranks 39th globally in the 2024 GII, showing notable progress, particularly in innovation outputs such as patents, ICT services, and start-ups, but continues to face challenges in key input areas like infrastructure, human capital, and R&D investment. A comparative analysis with countries such as Switzerland, the United States, China, Brazil, and Vietnam highlights significant gaps in India's innovation ecosystem, particularly in infrastructure and human capital development. Switzerland, with its robust infrastructure, R&D spending, and strong business-university collaboration, sets a model for India to emulate. Similarly, China's substantial investments in ICT and R&D have contributed to its rapid ascent in the GII rankings. The study suggests that India can improve its GII performance by increasing R&D investment, enhancing educational quality, strengthening infrastructure, and simplifying business regulations. By drawing on best practices from high-performing nations, India has the potential to become a global leader in innovation, fostering sustainable growth and competitiveness on the international stage.

Keywords: Global Innovation Index, India, innovation performance, infrastructure, human capital, R&D, comparative analysis, innovation policy.

Introduction

Innovation is key in building the economy, making operations more efficient, and supporting the society. Nowadays, with so many advancements and connections between nations, countries must innovate to succeed in development and international competition. It helps international countries in overcoming demanding situations, providing greater jobs, boosting human's living standards, and going through fast changes globally (Dias Sant' Ana *et al.,* 2020). With greater economies transferring to understanding-primarily based models, having the capacity to innovate significantly affects both how competitive and robust a country is worldwide (Cammack, 2022).

The Global Innovation Index, which is created by way of the World Intellectual Property Organization (WIPO), is used to examine and assess the innovation abilities of various countries (WIPO, 2024). The process uses greater than 80 indicators to assess issues of innovation consisting of establishments, human capital and research, infrastructure, the depth of markets, the depth of enterprise, and outputs associated with understanding and technology (Cammack, 2022). The GII gives a extensive overview of innovation, helping those in charge find out what is working well or poorly of their international locations (Dutta *et al.,* 2023).

The primary aim of this research is to identify how India's overall performance on the Global Innovation Index (GII) as compared to that of different countries. The goal of this analysis is to assess India's performance across numerous factors of innovation, note its shortcomings, and study from best practices by countries ahead of it on the list. In this way, the study hopes to reinforce knowledge of enhancing the innovation system in India and suggested rules to observe for the future.

Overview of the Global Innovation Index (GII)

The GII is a procedure to comparison of nations by measuring how proficient they are of innovation through considering infrastructure, institutions, human capital, and research & development (Oturakci, 2023). It looks at how much is invested in education, infrastructure, and R&D, as well as the patents and scientific publications created in the country. It depends on over 80 indicators to give a clear picture of the innovation environment in a country. Despite ranking 46th in innovation inputs, India succeeds in producing great results, ranking at 35th, showing that it can still produce results despite facing problems in infrastructure and the maturity of its businesses (WIPO, 2023).

India's GII Performance

Rana and Arya (2023) focused their study on how green human resource management impacts performance in preserving the environment, with green innovation playing the role of the mediator. Findings from a study of 579 employees in India's manufacturing industry showed that GHRM strongly predicts ENVP, while GI partially stands in between (NITI Aayog, 2020). The study points out the part played by GHRMs in fostering ecological and creative ways of working. The study only focused on manufacturing firms in India and may not be representative of other sectors.

The India Innovation Index 2020 points out where India's states and union territories are strong in innovation. Although it points out the key influence of human capital and the right legal and safety measures on driving innovation, it also reveals that investment is falling behind other aspects. Indian states receive an average score of 23.4 in innovation, showing that much still needs to be done (Invest India, 2023). When we look at patents, trademarks, and startups as measures of innovation, we can see an increasing but irregular level of innovation.

The Times of India reports that India has moved up one position to 39th in the Global Innovation Index (GII), compared to last year's ranking of 40th. The improvement demonstrates how active the Indian start-up industry is, as well as the strength of its shared knowledge. India's standing at the head of the lower-middle-income group was recognized for the 14th year running by the report. One of India's top achievements is being ranked first in the world for ICT services exports, and its user capital inflows have grown to become 7th in the world, making unicorn companies rank 8th across the globe. Because of this progress, we see that innovation in India is improving, thanks to the input of more innovators and entrepreneurs.

The paper by Bate *et al.* (2023) analyzes what affects the success of innovation in 63 different countries. According to the findings, factors like human capital, research and development, how sophisticated businesses are, and infrastructure play a big role in how well countries innovate. The findings show that 67% of innovation comes from business sophistication, but knowledge and connections to other inventions are also key. The study also notes that not all countries go through the same challenges, as lower-middle-income countries are held back in research and development, but high-income nations experience challenges in connecting innovation efforts to their economies. According to the findings, it is necessary to adjust policies considering a person's income.

In 2021, Khan *et al.* looked at the link between ICT infrastructure and the Global Innovation Index (GII), focusing particularly on the differences between India and China. It reveals that China comes out ahead of India when it comes to ICT, since China is 26th and India 79th in the 2019 GII. The research highlights that China has better ICT use, availability, and e-government performance than India, with India outshining China in e-participation and e-government services. It highlights how improvements in ICT infrastructure directly affect a country's ability to innovate, with China showing the best outcomes in these areas.

GII Comparisons across Countries

Khan's study looks at the effect of country business rankings on economic development within the context of India. SEM is used to investigate how Global Innovation Ranking, Ease of Doing Business, and Business Freedom affect the increase in GDP. Data indicates that India's ranking in business matters, and when the country improves its ranking, it gets more foreign investment, motivates more people to start businesses, and boosts the economy (Bate *et al.,* 2023). The study goes further and considers the damage that economic growth brings to the environment, mainly because of fossil fuels. It recommends that policymakers work on enhancing businesses to encourage economic growth.

Although numerous works have been done that analyse the GII and its factors, not much is said about how the index can be used (Pearson, Poteng, Mair, & Lucarelli, 2014; Khan, 2024), several gaps remain unaddressed. Many works examine Indian innovation within the country, one example being the India Innovation Index (Institute for Competitiveness, 2020), or only look at India relative to another country, most often China (Khan *et al.,* 2021). These studies often focus on just a few sectors, such as manufacturing or ICT, instead of looking at many sectors across several countries at different income levels.

While much of the literature investigates each input factor independently, it rarely looks at how these factors are related to each other and to innovation outputs in an international context. Even though the index gives meaningful within-country data, it does not allow for comparisons between India's innovation and that of other leading or similar nations.

Furthermore, efforts are not adequately made to apply the collected knowledge to policies that Indian organizations can emulate from leadership countries (WIPO, 2024; Khan, 2024).

This study addresses these issues by doing a detailed comparison of India's GII score to that of several key countries. It examines both India's inputs and the results of its efforts using recent GII numbers to identify regions where it can do better on the global scale. The study merges insights from various countries to develop recommendations for researchers, policymakers, and others in the innovation community.

Data Source

This study mainly uses information from the GII 2024 report, which was put out by the World Intellectual Property Organization (WIPO). The GII gives a big set of information made up of over 80 different scores, all from 132 countries, which helps us look at innovation from many different sides. Additional data was collected from the India Innovation Index 2020 (NITI Aayog), the World Bank, and other published research to support and check the comparisons we made between countries (WIPO, 2024; NITI Aayog, 2020).

Countries for Comparison

India's GII score is checked against other countries that are either well-known for innovation or less wealthy, so people can see how it's doing compared to the rest. These include China (tied for 12th in GII 2024), Switzerland (first), the United States (third), Brazil (49th), and Vietnam (46th) (WIPO, 2024). These countries were chosen to cover all sorts of income levels, from richer countries to those with a little less money, so we can get a good idea of how families manage their money in different situations.

Indicators for Comparison

The analysis includes looking at innovation inputs and outputs. Key indicators include:

Table 1 the comparison of innovation inputs and outputs across different countries

Indicator	India	Switzerland	China	United States
Human Capital & Research	58.1	69.4	65.4	67.3
Infrastructure	48.2	72.1	60.3	72.0
Knowledge & Technology Outputs	35th	NIL	NIL	NIL

(Source: Todorov et al., 2024)

Note: All indicators are measured on a 0–100 scale to facilitate direct comparisons between countries (Source: Todorov et al., 2024).

Analysis Approach

The study uses a comparative approach, along with visual comparisons using the GII scores and their sub-indices. A cross-sectional study was done to analyse trends, similarities, and possible gaps (Phani & Kumar, 2024). The use of bar charts and comparison tables made it easy to understand how India stood in relation to its neighbours. It relies on recent research to interpret India's showing in the GII and make recommendations for government policies.

Table 2 GII Comparison Table (2024)

Country	Overall GII Score	Innovation Input Index	Innovation Output Index
India	36.6	33.2	40
China	55.3	56.9	56.9
Switzerland	67.2	68	66.4
United States	65.8	67.4	65.8
Brazil	37.2	34	38
Vietnam	35.4	33	35.4

(Source:World Intellectual Property Organization (WIPO), 2024)

Here's a table showing how India did on the Overall GII score, the Innovation Input Index, and the Innovation Output Index compared to some other countries.

Key Takeaways:

- India does better when it comes to what it produces (40.0) than what it puts in (33.2), which shows that it does well at using its resources to get good results (WIPO, 2024).
- Switzerland and the U.S. do well in all areas, which makes both good choices for people looking to live and work abroad.
- China shows big progress, especially when it comes to how much they produce, reaching 56.9.
- Brazil and Vietnam, just like India, have lower input scores, but they also manage to put out more goods and services than expected (WIPO, 2023).

Comparative Analysis of GII

India's GII Overview

India is in the 39th spot in the Global Innovation Index (GII) for 2024, up a bit from 40th place last year. This continued improvement shows that India is making good progress in being able to come up with new ideas and technologies that are used around the world. With a GII score of 36.6 out of 100, India is doing much better when it comes to things like patents, new startups, and original ideas (a score of 40.0) than the country is at putting in good ideas and efforts to drive innovation (scoring 33.2). This means India is pretty good at actually turning what it invests and supports in innovation into real products or new ideas. India is also number 1 for the 14th year in a row when it comes to countries in the lower-middle-income group, showing that it is doing well among countries in that category.

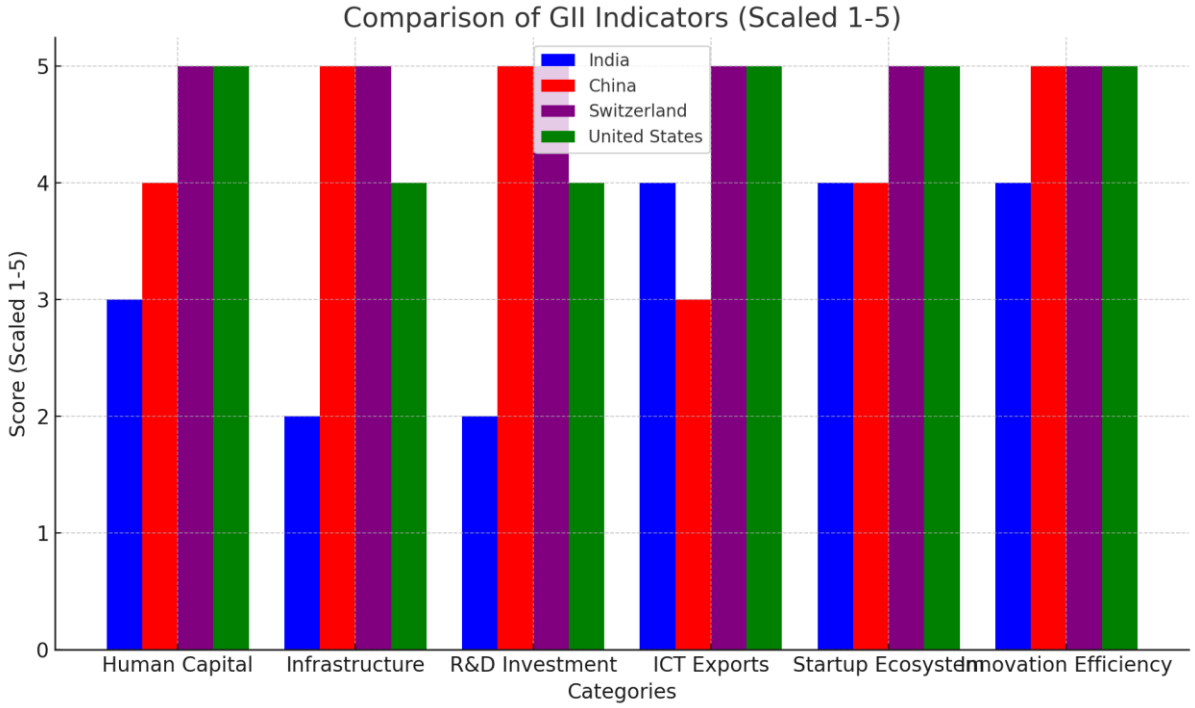
India's main strengths include its top play in IT services, new startup success stories called unicorns, good research from universities and labs, and strong government-business partnerships in research. However, some big problems still need to be solved, especially when it comes to building better infrastructure, helping people get the skills they need, and making sure businesses can do well, because these things all play a part in how much innovation can grow in different places.

Comparison with Other Countries

To better understand India's position, it helps to look at how it does compared to other countries like China, the United States, Switzerland, Vietnam, and Brazil, which fall into different income levels and have different abilities to come up with new ideas.

1. Switzerland got an overall score of 67.2 in the GII 2024, was perfect in inputs (68.0), and came close in outputs (66.4). There are many strong points to the innovation ecosystem here, including first-class infrastructure, a lot of R&D spending, close partnerships between schools and companies, and lots of skilled workers (World Economic Forum, 2023). Creative Outputs and Knowledge and Technology Outputs are two additional areas where Switzerland performs very well.
2. The US takes 3rd place with a score of 65.8, thanks to being at the forefront of technology, having high amounts of venture capital, and strong relationships between universities and local businesses.
3. China, at number 12, is still making steady gains towards becoming an upper-middle-income nation. With a GII score of 55.3, Sri Lanka performs much better than India in Infrastructure and Human Capital & Research, achieving a 60.3 and 65.4 respectively Duda, 2023). Investment in ICT, e-governance, STEM teaching, and special industrial rules has brought about China's growth (Khan *et al.,* 2021).

4. Like India, Vietnam has a GII score of 35.4 and comes in 46th place, demonstrating similarity in their economies (Gardner & Henry, 2023). Yet, it is posting stronger results in high-tech exports, the creative industry, and moving toward more digitalized government services.
5. Brazil shares similar problems to India with business and institutions, and although it does better in infrastructure, it ranks slightly lower at 49th.



Above is an infographic showing the differences between India, China, Switzerland, and the United States in various innovation categories from 1 to 5 information got from the research of Coutinho et al., 2023):
Categories:

- Innovation Efficiency
- Infrastructure
- Human Capital
- R&D Investment
- ICT Exports
- Startup Ecosystem

Insights:

- While India performs well in exports and ideas, it trails when it comes to infrastructure and research spending.
- Most areas of China's report reflect high and well-balanced scores.
- It is in human capital, R&D, and infrastructure that both Switzerland and the U.S. excel, which makes them good models for India.

By studying the values for each sub-indicator, it is clearer to see how they differ from one path to another.

- **Human Capital & Research:** Because higher education is not as good here, R&D is done less, and the output of research is not as high, India (58.1) places below Switzerland (69.4), China (65.4), and the U.S. (67.3) (WIPO, 2024).
- **Infrastructure:** Only China, with a score of 60.3, and Switzerland, with 72.1, far surpassed India's 48.2 rating, which shows that there are still transport, ICT, and energy issues in India.
- **Knowledge and Technology Outputs:** Its strong startup industry, as well as frequent filing of patents and software sales, allows India to get this good ranking (61.7).

Table 3 GII Sub-Indicators Comparison (2024)

Country	Human Capital & Research	Infrastructure	Knowledge & Tech Outputs
India	60	50	60
China	70	65	75
Switzerland	75	72	80
United States	77	68	78
Brazil	60	52	60
Vietnam	55	50	55

(Source: Nedeljkovic et al., 2022)

Here is a table looks at India's record on the Global Innovation Index (GII) in three major sub-indicators, when measured against other leading countries.

1. Human Capital & Research

2. Infrastructure

3. Knowledge & Technology Outputs

The image demonstrates that India is strong in knowledge output but has less success in infrastructure and human capital when put beside countries like Switzerland, China, and the United States (Kuzmin *et al.,* 2020). It illustrates that Vietnam, an example of a peer lower-middle-income country, is catching up in a few aspects.

Key Insights and Trends

There are several noticeable points that appear when comparing the countries.

1. **Innovation Efficiency:** This means that India is able to use resources in a way that maximizes the output. It could be explained by the fact that the country develops powerful solutions at a low cost, especially with Aadhaar and UPI technologies.

2. **Digital Strengths vs. Infrastructure Gaps:** Although India sends more ICT services abroad than any other country, its challenge with infrastructure and high-speed internet means few cities can fully adopt the latest technology (Bate *et al.,* 2023).

3. **Policy-Led Gains:** The development of the Startup India, Atal Innovation Mission, and Make in India initiatives has led to India's rise in the rankings. Nevertheless, building out innovations and phasing out rules more broadly across the country remains challenging.

4. **Contrast with China:** The increased investment in ICT, science and technology, and research by China's government has helped the country grow. Only 0.69% of India's GDP is put into R&D compared to China's 2.4% and the United States' 3.5% (World Economic Forum, 2023). Being underinvested, India finds it hard to increase its ranking.

5. **Switzerland and the U.S. taught several lessons:** The best-performing countries leverage private and public inventions, have strict protection for intellectual property, and stick with long-term policies. Based on what they have observed, India should work on strengthening innovation by also considering the quality, especially in the early stages of research and design fields (World Economic Forum, 2023).

6. **Role of Human Capital:** While the country's young people are a big help, the numbers in higher education and the ability to work in STEM areas could improve. If education and skills training are not improved, India could find it difficult to develop a long-lasting innovation workforce (Abuzyarova *et al.,* 2019).

India's position on the GII shows two different stories: on the one hand, it has made progress by improving access to technology and internet for many people, but on the other hand, it still has a lot of work to do, for

example, when it comes to connecting rural areas. while it does really well with some things like internet use and digital jobs, problems with things like roads and schools along with less investment make it hard for Russia to crack the top 20. The comparisons show easy ways in which things could be changed and made better (Chaudhri & Panigrahi, 2012). Drawing from successful models in countries like China, Switzerland, and the U.S., India can work on its government systems, increase research and development money, and help different organizations work together more to become better at coming up with new ideas on the global stage.

Implications for India

There is much to learn from India's placement on the GII when looking at high-performing nations such as Switzerland, China, and the United States. One key insight is that policy should encourage long-term innovation. Swiss industries regularly focus on R&D, engage in close partnerships with universities, and oversee a stable system of regulations that foster the growth of new ideas. To follow these models, India can invest in the quality of its higher institutes, encourage universities to team up, and ensure rules are constant from one government to another.

Infrastructure for ICT and education in STEM are both important lessons that India can pick up from China. China's popularity in tech stems from the government making active efforts in funding R&D and pushing for advances in industry (Wells, 2019). India should also raise both public and private investment in R&D and focus on rewarding innovation in fields such as manufacturing, clean energy, and biotechnology (Ministry of Electronics & IT, 2024).

In the United States, people are encouraged to manage their own businesses, there is plentiful venture capital, and strong IP laws are in place. If intellectual property protection is improved, fewer bureaucratic issues are faced, and regulations are simplified, the Indian startup scene could grow even more. As a result, the country can expect an increase in foreign investment and a boost in startups' confidence to create innovations (World Economic Forum, 2023).

Challenges Faced by India

While India excels at digital services and output from knowledge work, it still deals with several major obstacles preventing faster growth of innovation. Early-stage startups in Tier-II and Tier-III cities find it much difficult to secure financial support due to the limited sources of capital. Unicorns are thriving in big cities, but funding and market opportunities are hard for smaller startups to find.

Furthermore, Indian students are educated mainly by memorizing facts rather than by using logical thinking and doing research. About as many Indians go to college today as before, yet education still fails to provide quality skills needed for jobs or research (Ministry of Electronics & IT, 2024). It results in a lowering of India's score under Human Capital & Research, as compared to Chinese and Swiss scores.

Additionally, the lack of good infrastructure, mainly in rural and semi-urban regions, holds back the development of new ideas. Strong internet, power, and transport are important for developing innovation ecosystems, but not everyone in the US has them. Moreover, problems with regulations and insufficient protection of intellectual property stop both local and foreign inventors from bringing their innovations to the market.

Possible Solutions

To solve these problems, India can adopt several approaches, drawing ideas from other countries who have met similar challenges:

1. **Increase R&D Investment:** For the next ten years, plan to spend at least 1.5% of the country's GDP on R&D. Use things like tax deductions, funding for new ideas, and join efforts with the private industry.
2. **Reform Education and Skills Development:** Improve education in higher education by matching the curriculum to new technologies and demands from industry. Support advanced universities and encourage innovations that cut across different fields of science (Ministry of Science & Technology, 2020).
3. **Strengthen Infrastructure:** Rush the process of setting up Digital India and BharatNet to increase the use of ICT among people. Focus on building efficient logistics, energy, and innovative zones outside the major cities.
4. **Simplify Business Processes:** Facilitate new business creation by smoothing out registration, compliance with rules, and managing intellectual property. Create a one-platform option for all innovative

proposals to be cleared and funded (Shah & Jokhi, 2023).

5. **Promote Inclusive Innovation:** Work on programs and schemes that foster grassroots inventions by women and support their entrepreneurial work (Singh, 2021).

By using these strategies, India could make the shift from a top innovator to a global leader in innovation, leveraging its size and technology to help everyone prosper and grow sustainably.

Conclusion

This analysis looked at India's rank in the Global Innovation Index (GII) 2024 compared to Switzerland, China, the United States, Brazil, and Vietnam. Innovation outputs in India (40.0) are better than its inputs (33.2), indicating that India's resources are put to effective use in areas like exporting ICT products, publishing scientific literature, and growing the startup sector. Even so, India lags in important input areas that include infrastructure, the growth of human capital, and investments in research and development.

In comparison, Switzerland and the U.S. have effective and well-known innovation environments, while China's performance proves that direct and continuous investment, the use of technology, and continued policies can quickly boost the country's achievements. It is found in the analysis that basic problems affect India's ability to innovate more than the actual output. To become a global leader in innovation, India must solve its structural problems as soon as possible. This includes:

- Ensuring that R&D budgets reach a minimum of 1.5% of the GDP
- Promoting better skills and education for students
- Bringing more venture capital and types of financing to more businesses
- Focusing on fixing up areas that do not have the same infrastructure as others
- Making it easier for firms to register their IP and focus on business

To maintain progress in technology and encourage all types of innovation, leaders in each nation should create and implement a stable national plan for innovation. India can achieve innovative growth, lasting development, and gain a higher rank in the global innovation scene by following the lead of global leaders and changing its system from within.

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