

Performance of Academic Institutes: India's Path to Rise Through the Ranks



Ayushee Thukral, Mudit Narain

December 26, 2022

About the organisation



Foundation for Advancing Science and Technology (FAST) India is a non-profit dedicated to building capacity and advancing policy solutions that foster scientific enquiry and research, and facilitate the creation, dissemination, and translation of new scientific knowledge. The foundation works with a variety of stakeholders to develop and strengthen the science ecosystem in India to advance scientific research and its translation into economic value and social good.

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Establishing the case for institutional ranking

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Understanding the global scenario

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The Indian context

Measuring the giant: Research and Development



Efforts to evaluate R&D have existed for decades; some parameters are now widely accepted as measures of scientific outcomes

Prime Minister's Speeches

The Prime Minister reiterated that the government is working with the thinking on Science-Based Development. "Since 2014, there has been a substantial increase in investment in the field of science and technology.

Due to the efforts of the government, today India is ranked 46th in the Global Innovation Index, whereas in 2015, India was at number 81", the Prime Minister added. He acknowledged the **record number of patents** being registered in the country.

He highlighted that in order to make India a global centre of research and innovation in this Amrit Kaal, one will have to work on many fronts simultaneously. Source: The New Indian Express, pib.gov.in

Government Policies

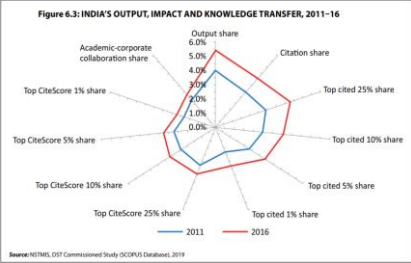
The Science, Technology and Innovation Policy will be guided by the following broad vision;

- (i) To achieve technological self-reliance and position India among the top three scientific superpowers in the decade to come.
- (ii) To attract, nurture, strengthen and retain critical human capital through a 'people centric' science, technology and innovation (STI) ecosystem.
- (iii) To double the number of Full-Time Equivalent (FTE) researchers, Gross Domestic Expenditure on R&D (GERD) and private sector contribution to the GERD every 5 years.
- (iv) To build individual and institutional excellence in STI with the aspiration to achieve the highest level of global recognitions and awards in the coming decade.

India is rapidly evolving with changing national and international dynamics. In the past decade, the scope of policy instruments and regulatory environment has changed significantly, resulting in a rise in the country's performance in terms of **per capita R&D expenditure, publications, patents, and quality of research publications, etc.** Private sector investment is also consistently rising in STI activities. There has been a notable rise in the participation of women in R&D. A plethora of schemes have been implemented by the government to support and stimulate R&D culture among students and young researchers.

Source: STIP 2020

Government Annual Reports



Source: Research and Development Statistics, 2019-20

Table 6.7: PUBLICATION AND CITATION RANKING FOR INDIA IN SELECT GROUPS OF NATIONS, 2016

Rank	SAARC	BRICS	G20	TOP 20
Publication	1	2	5	5
Citation	1	2	10	11

Table 6.6: SCHOLARLY CITATIONS FOR INDIA AND OTHER GROUPS OF NATIONS DURING 2011 AND 2016 (Number)

Year	India	SAARC	BRICS	EU28	G8	G20	World
2011	880733 (3.0%)	987478 (3.4%)	5229291 (17.8%)	11321919 (38.5%)	19279279 (65.5%)	24513632 (83.3%)	29422393 (100%)
2016	262677 (4.1%)	307936 (4.9%)	1830409 (28.9%)	2377425 (37.5%)	3717522 (58.7%)	5350193 (84.5%)	6333593 (100%)

Source: NSTMS, DST Commissioned Study (SCOPUS Database), 2019

Reporting by International / Global Agencies

- **Economic growth** will be measured through indicators such as **patents and business start-ups.**
- **Workforce outcomes** will be measured by student mobility into the **workforce and employment markers.**
- **Scientific knowledge** will be measured through **publications and citations.**
- **Social outcomes** will be measured by long-term health and environmental impact of funding.

For more information about STAR METRICS, please visit [here](#).

The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. <http://www.nsf.gov/>.

















Source: NSF STAR Metrics, UNESCO UIS



Parameters measuring R&D come together in ranking methodologies



Rankings provide proxy for measurement of R&D in academia

						
 Publications			✓	✓	✓	✓
 Citations	✓	✓	✓	✓	✓	✓
 Researchers	✓	✓	✓		✓	
 Start-ups						
 Employment outcomes	✓				✓	
 Funding		✓			✓	
 Patents					✓	
 Diversity					✓	✓

Source: Ranking methodologies for QS World University Rankings, THE World University Rankings, Shanghai's ARWU Rankings, US News Rankings, NIRF Research Rankings, CWTS Leiden Rankings

Why do Higher Education Institutions (HEIs) care about rankings?



Whatever gets measured, gets done: Rankings offer a quantitative measure for an intrinsically qualitative evaluation



50%

HEIs used rankings for publicity



70%

HEIs wanted to be in top 10% nationally



71%

HEIs wanted to be in top 25% internationally



50%+

HEIs had formal process of reviewing results



68%

HEIs used rankings as a strategic tool for management and academic improvement

University with a higher position in rankings has **24%** more chances of being chosen by a high performing student

Source:

1. How do rankings impact higher education? Editor of Institutional Management in Higher Education Programme, OECD. IMHE. (2007). <https://www.oecd.org/education/imhe/39802910.pdf>.
2. Estrada-Real, A.C., Cantu-Ortiz, F.J. A data analytics approach for university competitiveness: the QS world university rankings. Int J Interact Des Manuf 16, 871–891 (2022). <https://doi.org/10.1007/s12008-022-00966-2>
3. Vetrova, I.F., Amerslanova, A.N., Yuretskaya, Y.S.: An overview of the main types of university control in the leading countries of the world. Lect. Notes Netw. Syst. 280, 996–1004 (2021). https://doi.org/10.1007/978-3-030-80485-5_111

Annual ranking announcements make headlines



From students to institute directors to policymakers, all stakeholders use rankings as benchmarks

Ministry of Education @EduMinOfIndia

India's 56 Universities were listed in the Times Higher Education University Ranking declared yesterday. This year, 6 Indian universities made it to the #Top500 list, with @IITRopar making its debut.

Abhay Karandikar @karandi65

#QSWUR2023 is out today, and I am delighted to share that our hard work in the last few years is finally reflected in #QSWUR where @IITKanpur is ranked 264 (a jump of 13 places from last year) & 4th in India among IITs.

@worlduniranking @dpradhanbjp

CP Gurnani @C_P_Gurnani · Mar 5, 2020

Dear world.

It's only a matter of time before these institutions reach the single digit league.. Kudos @iitbombay @iitdelhi

IIT Bombay, Delhi rank among Top 50 in QS World University Rankings

NDTV @ndtv Official

NIRF Ranking 2022: Indian Institute of Technology (IIT) Madras ranked best educational institute by the Ministry of Education

Institution	Rank
Indian Institute of Technology Madras	1
Indian Institute of Science, Bengaluru	2
Indian Institute of Technology Bombay	3
Indian Institute of Technology Delhi	4
Indian Institute of Technology Kanpur	5
Indian Institute of Technology Kharagpur	6
Indian Institute of Technology Roorkee	7
Indian Institute of Technology Guwahati	8
Indian Institute of Technology Medical Sciences, New Delhi	9
Indian Institute of Technology Lehru University, New Delhi	10

12:03 PM · Jul 15, 2022 · Twitter Web App

FIITJEE NOIDA @Fiitjee_Noida · Nov 9

- QS World University Rankings 2023 - **IIT Bombay** is the best educational institution in India, as per the 'QS World University Rankings: Sustainability 2023'.

#IITBombay was featured in the 281-300 rank range, followed by **#IITDelhi** in the 321-340 rank.

V. Ramgopal Rao, Ph.D. @ramgopal_rao

Want to get a perspective on QS World rankings released yesterday with respect to the Indian institutions? Please read on. @worlduniranking #iits #QSRankings #rankings #highereducation

Prof. V Ramgopal Rao • Following
Professor of Nanoelectronics & Immediate Past Director, IIT Delhi. Deep-tech...
7m •

In the QS World University Rankings 2023 (being discussed in media and TV channels today), IIT Delhi has improved on its last year performance by 11 places. IIT Delhi has moved up by 48 places in the QS World University Rankings in the recent past.

The rightful place for an institution such as IIT Delhi is however among the top 50. We will reach there soon, provided we do a few things right.

Please read on to get the right perspective about the international rankings.

QS Quacquarelli Symonds ranks institutions on the following 6 parameters.

1. Academic Reputation from Global Survey (40%)
2. Employer Reputation from Global Survey (10%)
3. Faculty –Student Ratio (20%)
4. Proportion of Intl Students (5%)
5. Proportion of International Faculty (5%)
6. Citation per Faculty Scopus (20%)

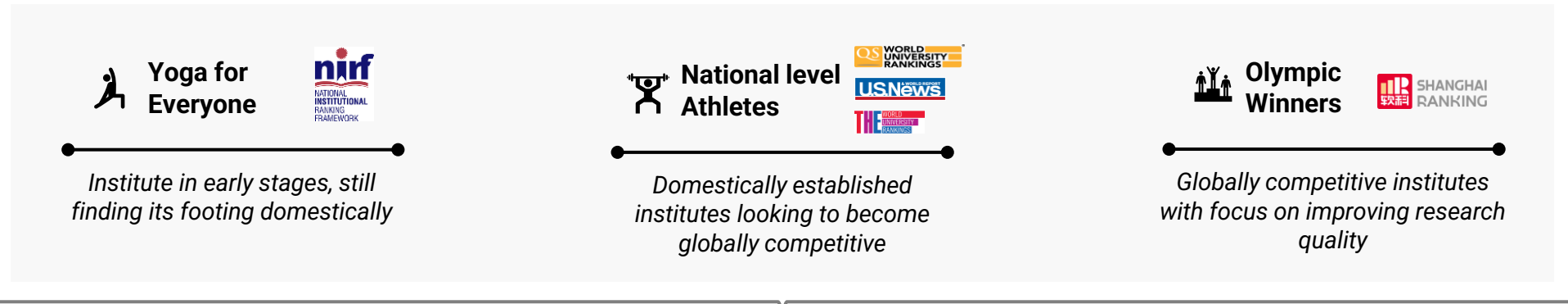
As you can see, 50% of weightage (1&2) in these rankings is for perception, which is a totally subjective metric. Who you ask decides where you are ranked. We need to improve our perception. Indian institutions are scoring very poorly here.

Source: Twitter

5 key ranking methodologies come out on top



Different ranking methodologies will become relevant for different stages of institute lifecycles



Source: Vernon MM, Balas EA, Momani S (2018) Are university rankings useful to improve research? A systematic review. PLoS ONE 13(3): e0193762. <https://doi.org/10.1371/journal.pone.0193762>






Notes:

- 24 ranking systems identified by source paper + NIRF
- Rankings categories as ineligible due to : (a) discontinued publication, (b) lack of specified methodology, (c) less than 100 institutions ranked, (d) no global focus, (e) lack of research indicators
- FAST India analysis based on rankings publicized by Indian institutes and Google Trends in India

Each methodology fulfills a somewhat different purpose



QS is the most widely used ranking, and hence, the basis for our analysis presented in the next sections

					
Stated purpose and use	<ul style="list-style-type: none"> • University comparison • Assist students 	<ul style="list-style-type: none"> • University comparison • University marketing • Assist students 	<ul style="list-style-type: none"> • Research performance • Research quality • University comparison • Assist students • Government assessment 	<ul style="list-style-type: none"> • University comparison • University marketing • Assist students 	<ul style="list-style-type: none"> • Research performance • University comparison • University marketing • Government assessment
Acceptance	<ul style="list-style-type: none"> • Accepted in India 	<ul style="list-style-type: none"> • Wide international acceptance 	<ul style="list-style-type: none"> • Wide international acceptance 	<ul style="list-style-type: none"> • International acceptance 	<ul style="list-style-type: none"> • International acceptance but prominent in China
Pros	<ul style="list-style-type: none"> ✓ Multiple Parameters - well rounded ✓ Reflects India's diversity concerns ✓ Focus on both quality and quantity ✓ Less focus on perception 	<ul style="list-style-type: none"> ✓ Most widely used around the world ✓ Focused on both research and education 	<ul style="list-style-type: none"> ✓ Well rounded, focused on research quality ✓ Includes funding from industry 	<ul style="list-style-type: none"> ✓ Focus on top level research ✓ Many aspects (books, conferences) measured ✓ Measures depth of international collaborations 	<ul style="list-style-type: none"> ✓ Measures only very high-quality parameters (Nobel Prizes, articles in <i>Nature</i> and <i>Science</i>, etc)
Cons	<ul style="list-style-type: none"> ✗ Not globally comparable ✗ Inward focused ✗ No measure on international diversity 	<ul style="list-style-type: none"> ✗ Excessive focus on reputation 	<ul style="list-style-type: none"> ✗ Doesn't include metric on high quality research ✗ Lack of transparency has led to institute dropouts 	<ul style="list-style-type: none"> ✗ No measure of faculty strength or patents ✗ Not widely followed, mostly used for university selection 	<ul style="list-style-type: none"> ✗ Not applicable to most institutions ✗ Very niche metrics
Relevance	<ul style="list-style-type: none"> • Domestic comparison for new and upcoming institutes 	<ul style="list-style-type: none"> • Establish global competitiveness for institutes 	<ul style="list-style-type: none"> • Establish global competitiveness for institutes 	<ul style="list-style-type: none"> • Establish global competitiveness for institutes 	<ul style="list-style-type: none"> • Well reputed universities focusing on further improving research

Source: Vernon MM, Balas EA, Momani S (2018) Are university rankings useful to improve research? A systematic review. PLoS ONE 13(3): e0193762. <https://doi.org/10.1371/journal.pone.0193762>. FAST India Analysis

Rankings are an imperfect measure that need to keep evolving



Not everything can be measured: Rankings, albeit a proxy, do not provide a complete picture

Why our obsession with ranking universities does more harm than good

University rankings harbour a dubious notion about education — everything has to be measured, whatever is immeasurable is insignificant



A good university need not necessarily be the one that occupies a higher position in the scale of ranking. (Express Photo/File)

As a teacher deeply engaged with the ethos and practice of higher education, I feel somewhat disturbed and annoyed by our almost neurotic obsession with the phenomenon of “ranking” and “branding” universities. And, there is no dearth of agencies — from the international agencies like Quacquarelli Symonds (QS) and Times Higher Education World University Rankings to even our own National Institutional Ranking Framework (NIRF) — that are continually declaring the list of “top” universities. No wonder, while these “top” universities celebrate their victories, market their “brand” value, attract young students as consumers, and enhance the “egos” of their celebrity professors, the universities that occupy no significant place in the list suffer from chronic anxiety, and are compelled to feel a sense of “samane bhavad”

Several IITs boycott Times Higher Education World University Rankings, IISc only entry in top 300

Seventy-five Indian institutes were part of the rankings in 2023 as compared to 56 in 2020 and just 31 in 2017

October 12, 2022 10:17 am | Updated 12:36 pm IST - New Delhi

Source: News articles, Twitter

CHINA Three major universities quit international rankings

Yojana Sharma 11 May 2022



Here are the 6 pointers for #NIRF (National Institutional Ranking Framework), @EduMinOfIndia to further improve on the ranking framework. @dpradhanbjp. @PMOIndia @narendramodi

Create a parallel NIRF Plus or NIRF international and rank our top 50 NIRF institutions with the best 50 institutions in the world. Time has come to create new goal posts now. Otherwise, it will be a sort of musical chairs at the top and will be a zero-sum game for the country. The parameters for the international benchmarking can be taken from publicly available data for these international institutions (viz., Faculty-student ratio, Research budgets normalized to PPP, Cost of Education etc.) and data that can be independently sourced (Research publications, Research impact from citations, patents granted etc.).

Ranking institutions every year is a bit of an overkill. Rankings can be done once every 2 years. Nothing much changes in any Institute every year. In this two-year cycle, even the data verification can be completed following the peer review process.

Institutions which receive similar scores within an error bar (say, +/- 5%) must be assigned the same rank. Institutions are multidimensional and ranking them differently based on minute differences in scores is demotivating to the institutions, to say the least. The purpose of any ranking is to motivate the institutions and applaud their achievements and not to demotivate them.

Columbia University admits to reporting inaccurate data for US News college rankings

Jordan Mendoza
USA TODAY

Published 3:34 p.m. ET Sept. 12, 2022

The Dilemmas of Ranking

Popularity contests

Survey approach rewards the most popular - academic community vote on peer institutes

Substitute for quality

Quantitative factors (funding, papers, books) serve as a proxy for quality. However, high numbers do **not necessarily indicate high impact**

Missing factors

Generally, rankings **do not include teaching quality**. Undergraduate teaching, access to underserved, focus on specific programs **are not rewarded**

One size fits all

Methods **ignore missions, goals and focus areas** of institutes with emphasis on norms of only a few top research institutes

Increasing inequality

Beyond the first 10-15 institutions across countries, scores on rankings parameters witness **sharp declines**

Language of science

Citation count as a measure emphasizes material in English and journals readily available in larger academic systems which **artificially boosts English speaking regions** (US, UK)

Source: Altbach, P. (2006). The Dilemmas of Ranking. International Higher Education, (42). <https://doi.org/10.6017/ihe.2006.42.7878>, FAST India Analysis

1

Establishing the case for institutional ranking

2

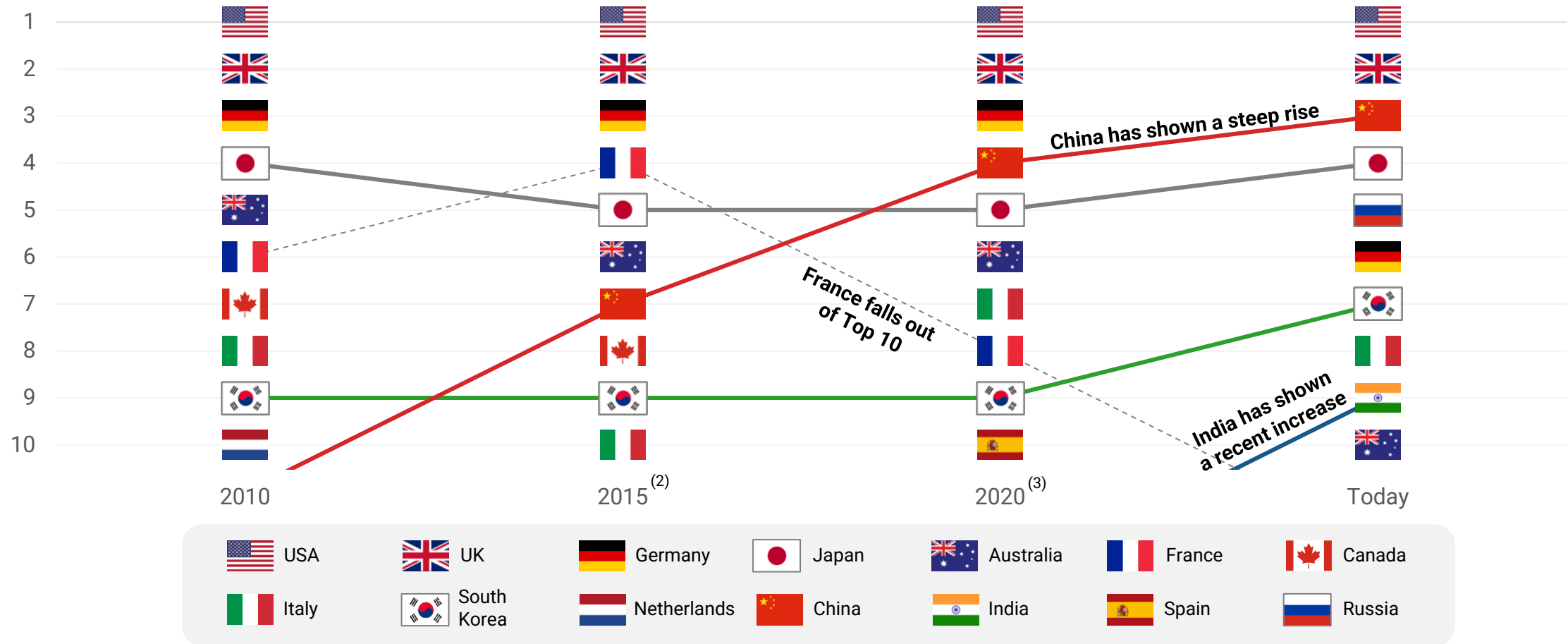
Understanding the global scenario

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The Indian context

Shifting dynamics: Reducing Western presence, growing prominence of Asia

QS Top 10⁽¹⁾: Countries with highest number of institutes in QS total list of institutes



Source: QS 2023

Notes:

1. Top 10 countries have been identified based on total number of institutes in QS year on year. QS total number of institutes included 1,422 institutes in 2023 (Today), 1,000 institutes in 2020, 699 institutes in 2015, and 500 institutes in 2010
2. Japan and France, both, had 29 institutes in 2015 and were hence tied for rank #4. Canada and South Korea, both, had 24 institutes in 2015 and were hence tied for rank #8. In case of ties, countries have been mentioned in alphabetical order.
3. China and Japan, both, had 41 institutes in 2020 and were hence tied for rank #4. In case of ties, countries have been mentioned in alphabetical order.

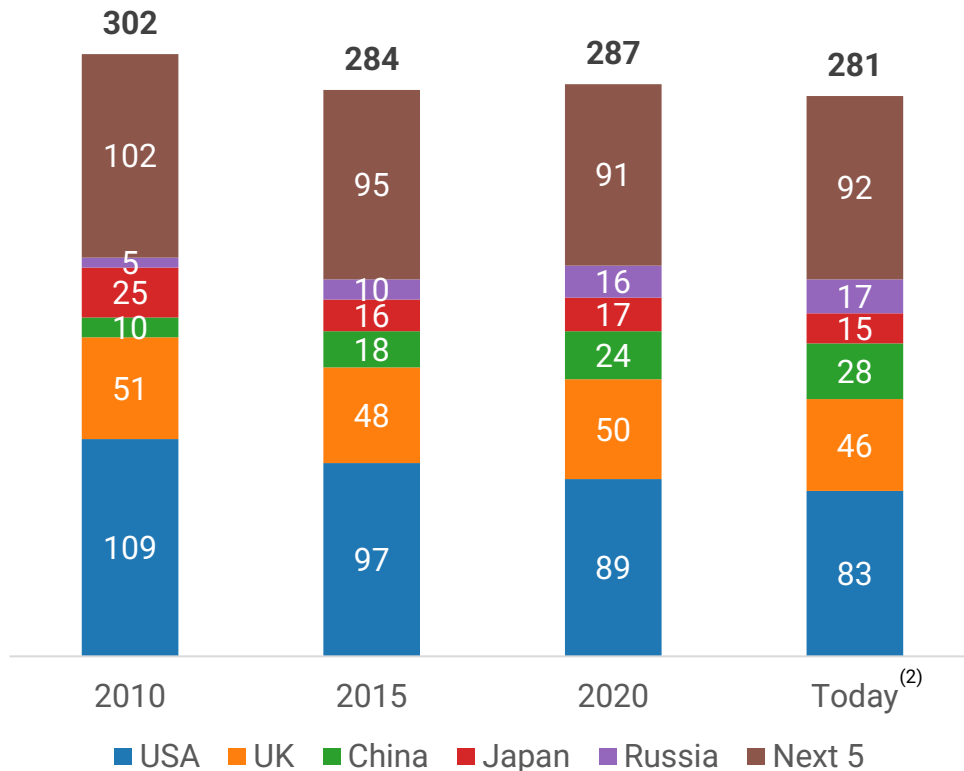
However, US still occupies the tip of the peak



US, UK, and China are in a league of their own

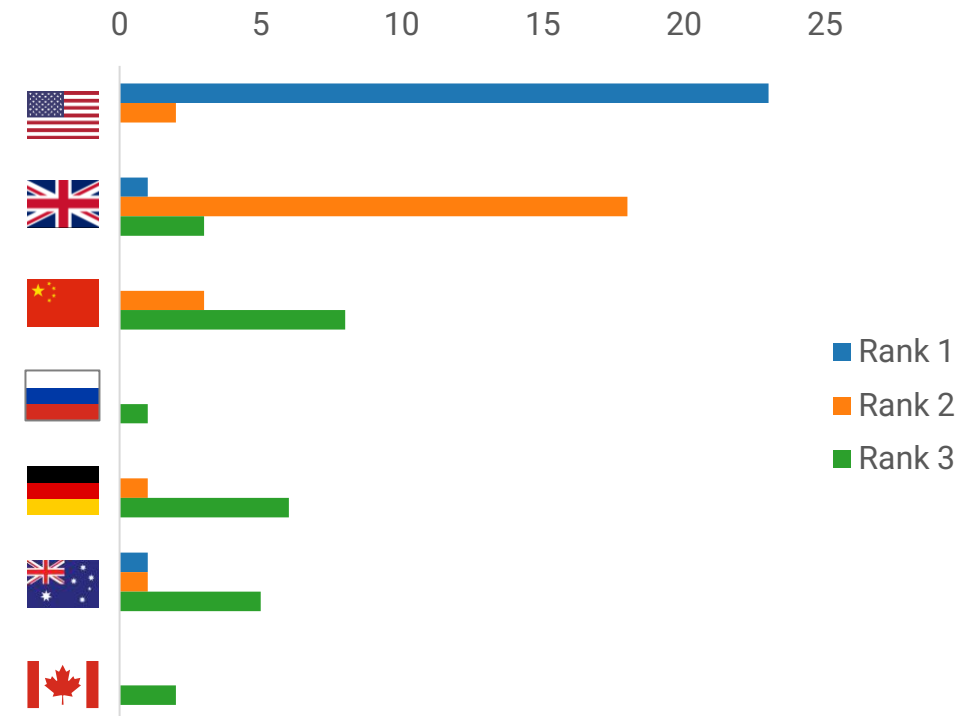
Top 10 countries⁽¹⁾ total ~60% institutes in Top 500

Number of institutes by country in QS top 500



World Top 3 countries sweep the leader boards

For 25 S&T subjects in QS, top 3 rank holders by country⁽³⁾



Source: QS 2023

Notes:

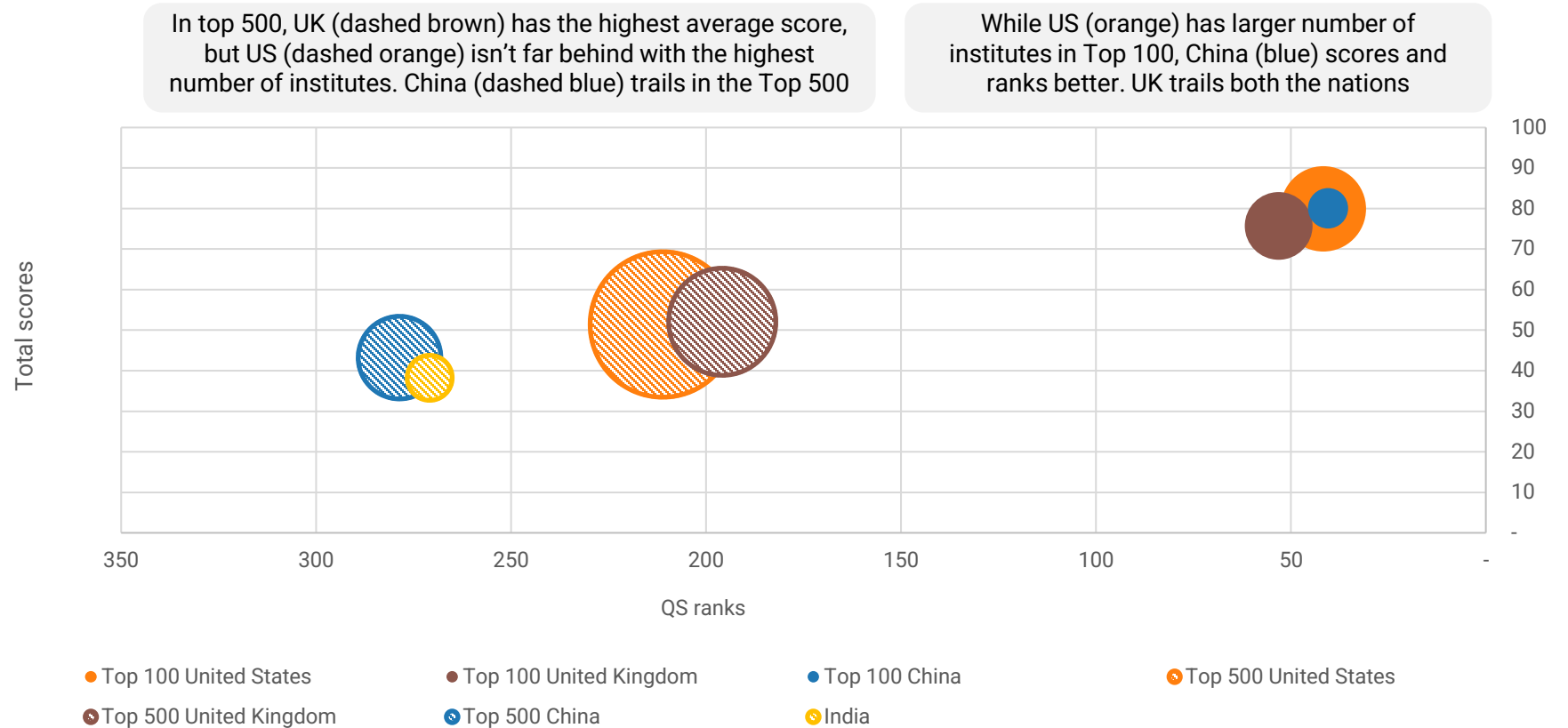
- Top 10 countries have been identified based on total number of institutes in QS year on year. QS total number of institutes included 1,422 institutes in 2023 (Today), 1,000 institutes in 2020, 699 institutes in 2015, and 500 institutes in 2010
- Next 5 countries in the Top 10 include Germany, South Korea, Italy, India and Australia
- Out of 51 subjects ranked by QS, analysis has been undertaken for 25 subjects in the Engineering and Technology, Life Sciences and Medicine, and Natural Sciences categories. For each subject, countries have been ranked based on number of institutes in the subject wise lists

Excellence vs critical mass: China and US dominate discussions



Chinese universities are higher ranked than US in QS Top 100 institutes; US leads the way in QS Top 500

- The x-axis represents average ranking of the region's institutes that feature in the top 100 / 500
- The y-axis represents average total score of the region's institutes that feature in the top 100 / 500
- The size of the bubble represents the number of institutes that feature in the top 100 / 500



Source: QS 2023

Notes:

1. Top 100 United States, United Kingdom, China indicate average scores of institutes in the Top 100 for the mentioned countries
2. Top 500 United States, United Kingdom, China indicate average scores of institutes in the Top 500 for the mentioned countries
3. India indicates the average score of Indian institutes in Top 500

Traits of a world class university



Key characteristics of top 300 universities (QS 2018)

Nature of funding: Public funded universities tend to do better



84%
of top 300
universities are
public funded

Faculty – student key statistics: Large universities have an edge

25,000+

Average
number of
students

2,600+

Average
number of
teaching staff

9.4

Mean faculty
student ratio

19%

Average % of
int'l students

Average budgets: Direct correlation between funding and performance



\$0.7Bn
Ranks 201-300



\$1.0Bn
Ranks 101-200



\$1.9Bn
Ranks 1-100

Top 100 universities have average funds **double** those of the universities in the positions 101–200 and **triple** those of the universities in the positions 201–300

Research excellence initiatives: Key insights

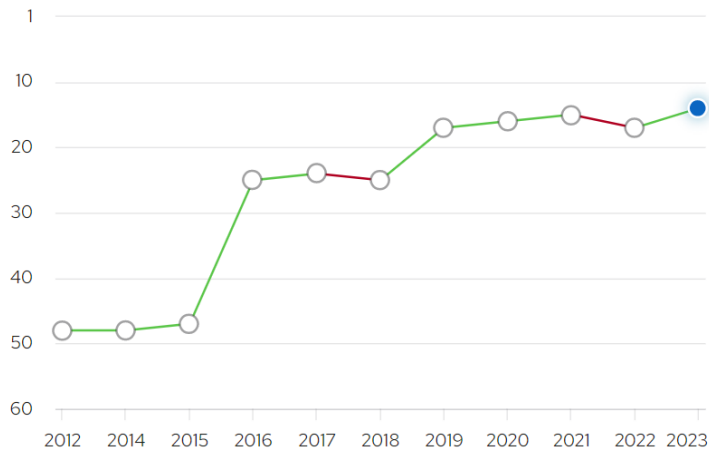
- **Funding is an influential factor:** Countries like China, Saudi Arabia, Australia have made considerable progress on back increased and sustained investment in universities
- **Continuous modernization:** Denmark, Finland, have seen ranking improvements with changes in management and governance systems
- Most promote **internationalization** as a strategy to attract top talent
- **University central leadership** is a key actor in all processes

The Chinese Story: Major spikes in QS Rankings in recent years

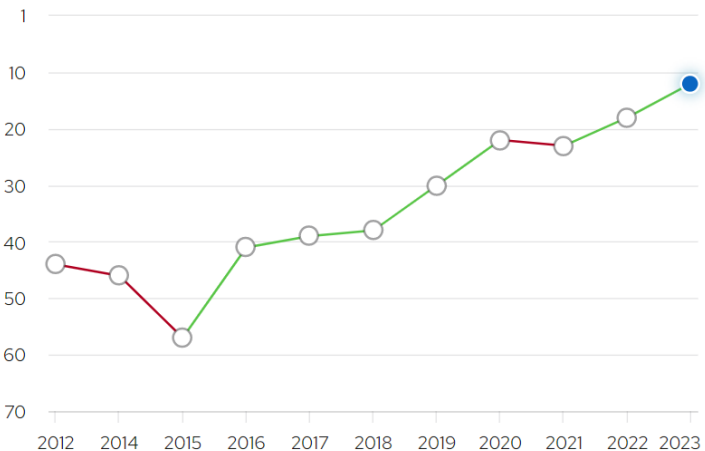


Impact of multiple interventions since 1990s

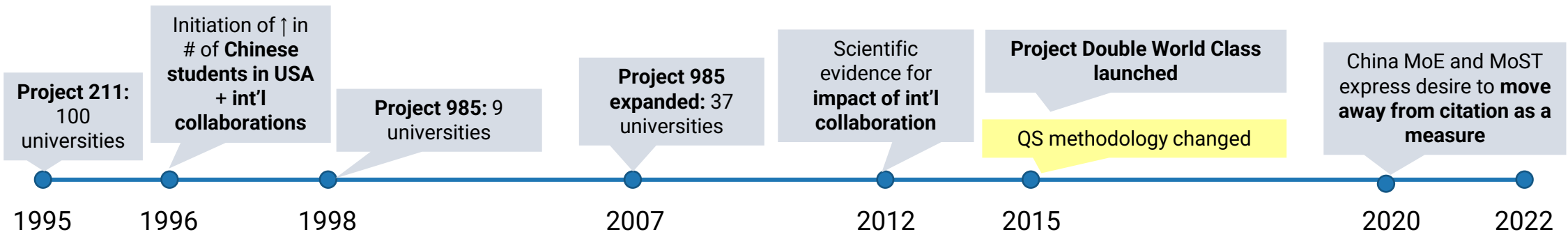
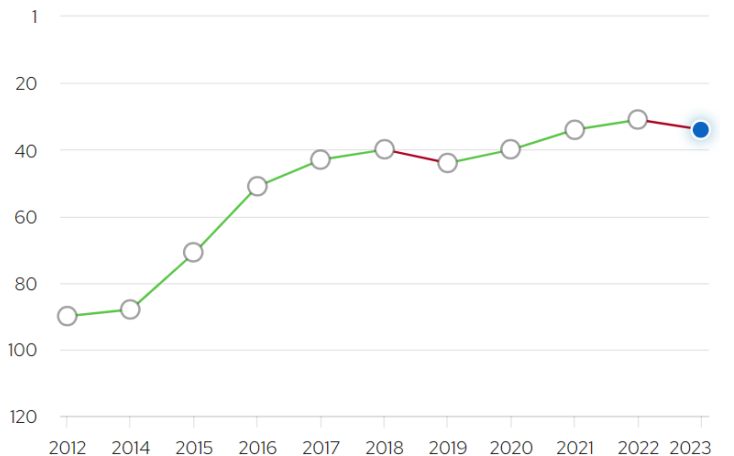
Tsinghua University



Peking University



Fudan University



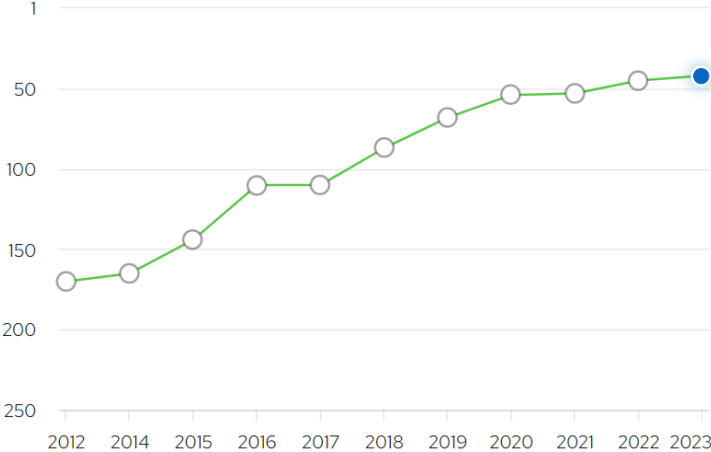
Source: FAST India study on [Rise of S&T in Asian Economies](#), QS website

The Chinese Story: Major spikes in QS Rankings in recent years

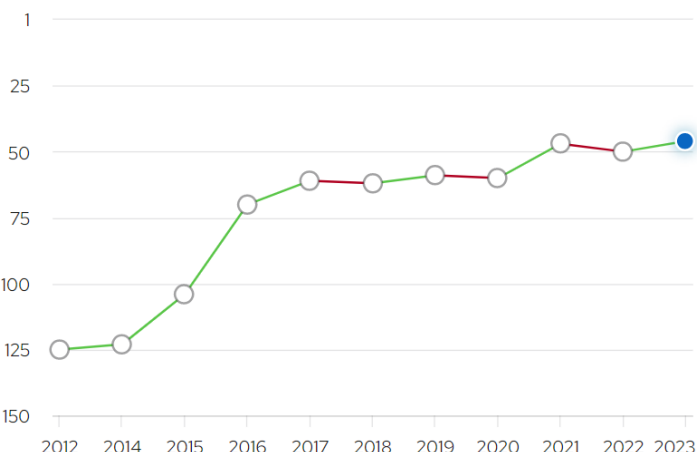


Impact of multiple interventions since 1990s

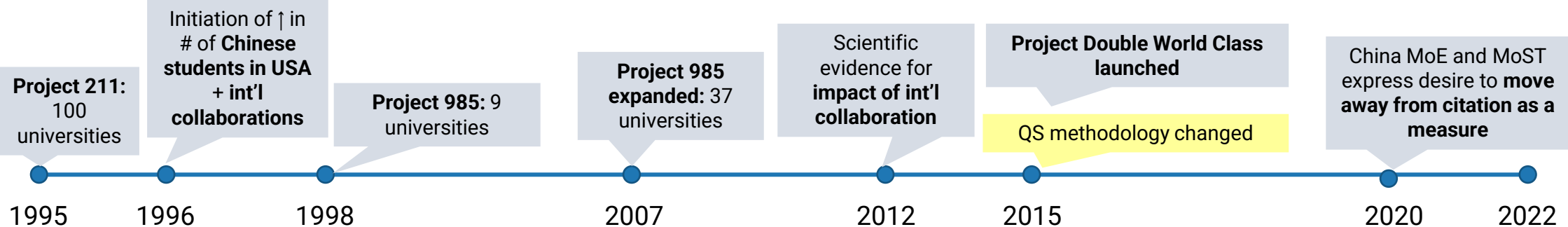
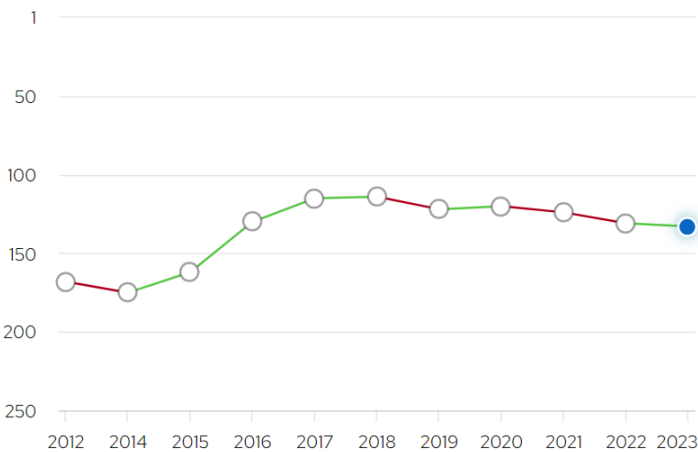
Zhejiang University



Shanghai Jia Tao University



Nanjing University



Source: FAST India study on [Rise of S&T in Asian Economies](#), QS website

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Only nine Indian institutes make the cut globally

Notably, only autonomous public-funded STEM institutes feature in QS Top 500

QS Top 200



Indian Institute of Science (IISc)
Rank 155



IIT Bombay
Rank 172



IIT Delhi
Rank 174

QS Top 300



IIT Madras
Rank 250



IIT Kanpur
Rank 264



IIT Kharagpur
Rank 270

QS Top 400



IIT Roorkee
Rank 369



IIT Guwahati
Rank 384

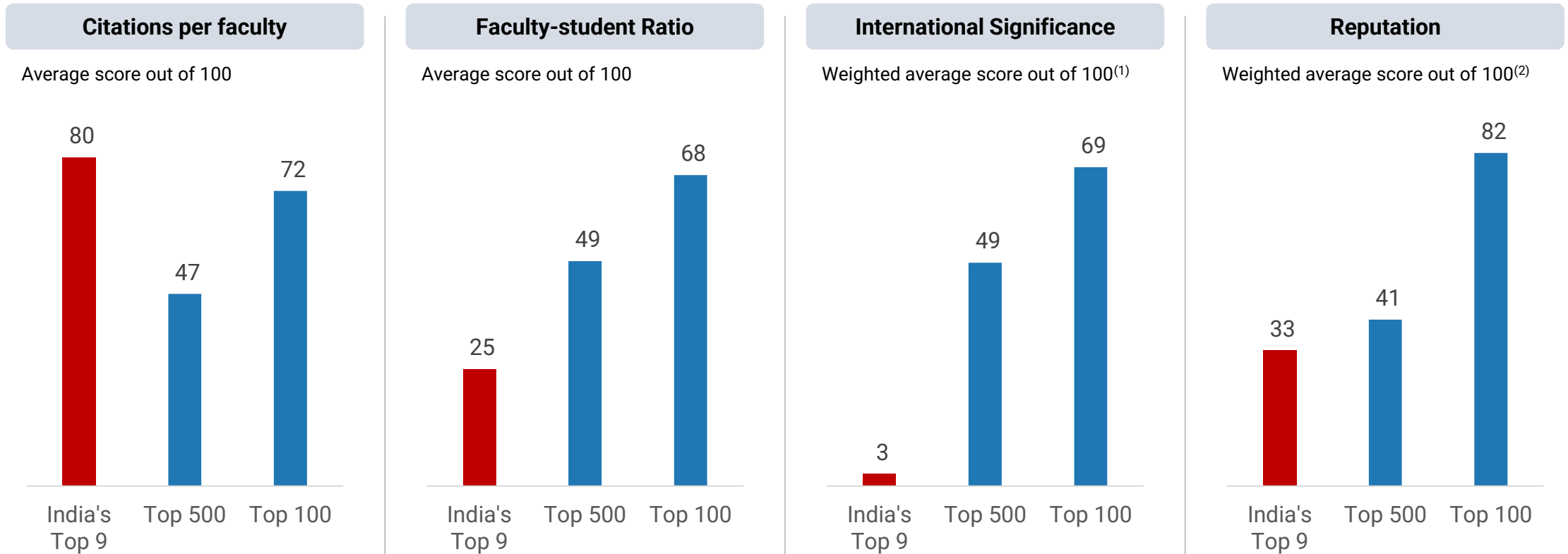


IIT Indore
Rank 396

India vs rest of the world



Weak presence on faculty and student parameters hinder Indian performance

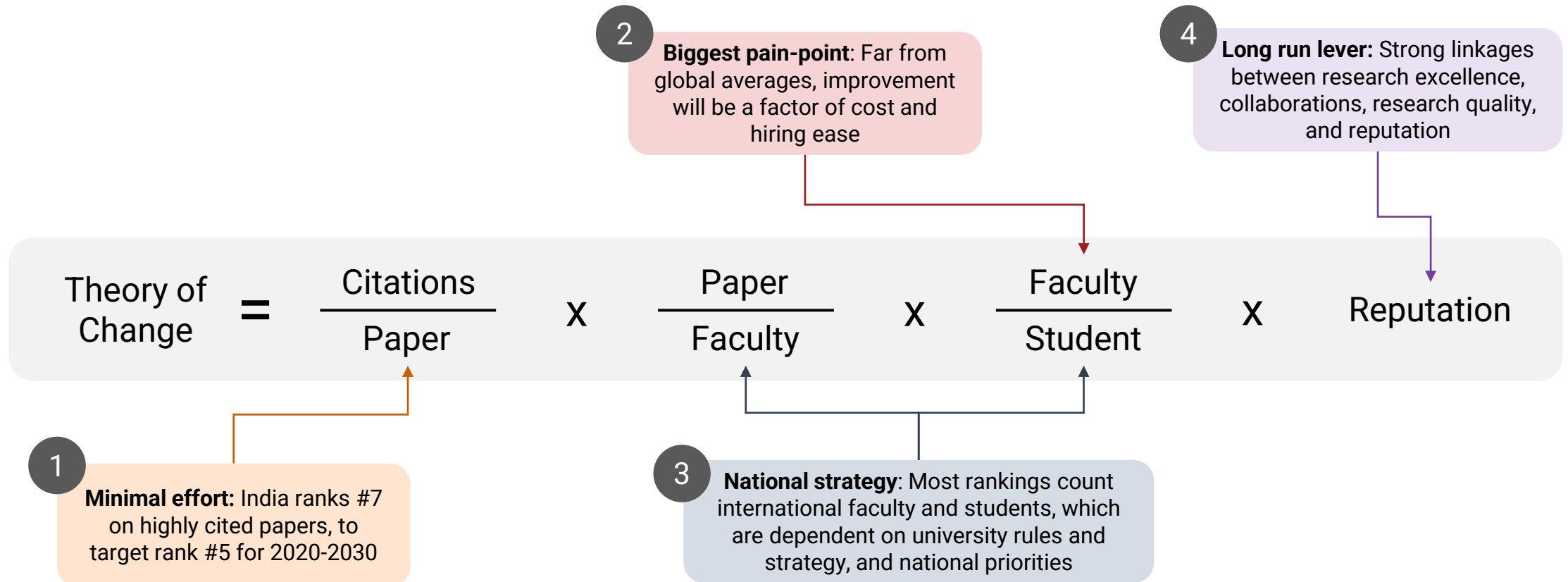


Source: QS 2023, FAST India Analysis

Notes:

1. Weighted average for international faculty and student scores. Corresponding to their contribution to QS ranking calculation, 1:1 weights used
2. Weighted average for academic reputation and employer reputation scores. Corresponding to their contribution to QS ranking calculation, 4:1 weights used

QS Rankings: Levers of change for rise in Indian institutional ranks

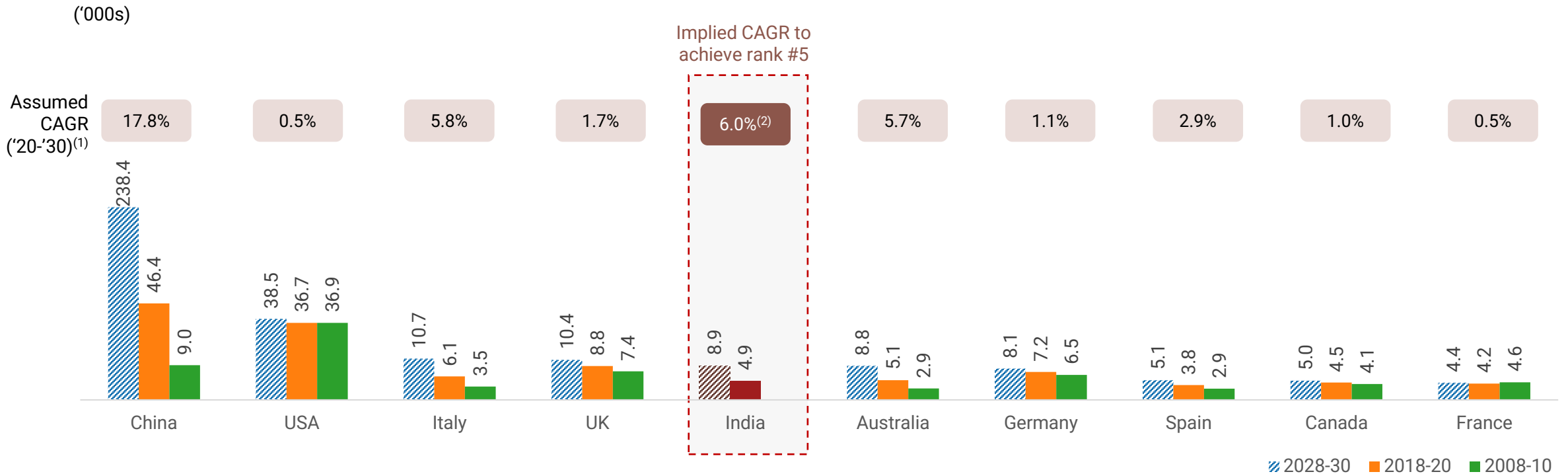


1 India on track to reach Top 5 S&T countries by 2030...



With current efforts, India needs to add incremental 300-500 highly cited papers every year

Number of papers (average) in top 10% of most-cited papers in each research field



To get into Top 3, higher efforts will be required with incremental 400-800 highly cited papers every year (8.1% CAGR)

Source: The Asahi Shimbun, FAST India Analysis

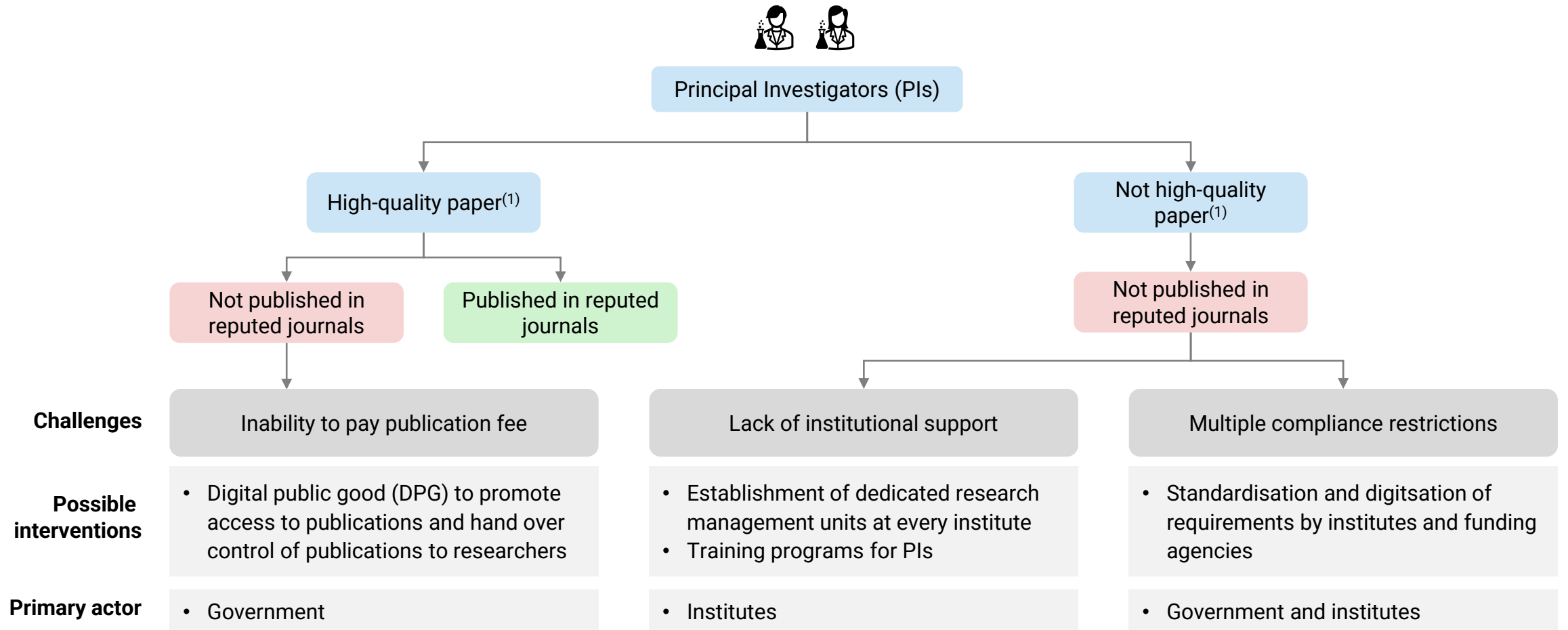
Notes:

1. Based on 2008-10 to 2018-20 CAGR: if positive 2018-20 to 2028-30 CAGR assumed to be the same; if negative, assumed growth of 5% over the 10-year period (implied CAGR of 0.5%).
2. Assumed target of 8,841 papers to be rank #5. To achieve rank #3 (10,691 papers), implied CAGR will be 8.1%

1 ...but increasing the count of papers comes with many challenges



Producing highly-cited papers is a two-layered problem: lack of quality papers, lack of access to publications



Source: FAST India Analysis

Notes:
1. As per journal's peer reviews

2 Faculty shortage is a mammoth crisis for all Indian institutes...



...with arm's length solutions for both, quality and quantity gaps

The challenge	Possible Interventions: The what	Implications: The how	Primary actor: The who
<p>IITs</p> <p>4,500 The approximate number of vacant posts</p> <hr/> <p>11,000 plus Total sanctioned strength</p>	Bridge the gap between academia and labs	<ul style="list-style-type: none"> Linked to Scientific Social Responsibility, create research universities (academic institutions + government labs) with teaching responsibilities for employees of research lab 	<ul style="list-style-type: none"> Government Institutes Government labs
	Bring industry on board	<ul style="list-style-type: none"> Engaging with industry under UGC's 'Professor of Practice' guidelines would improve industry linkages and faculty gaps 	<ul style="list-style-type: none"> Institutes Industry
<p>Central universities</p> <p>6,000 Vacancies in 45 central universities</p> <hr/> <p>19,000 Total posts</p>	Increase funding for faculty hiring	<ul style="list-style-type: none"> As of date, QS top 9 Indian institutes spend ~INR 3,000 cr on faculty; to reach average scores of Top 100-200 institutes (Top 100 institutes), incremental expenditure needed is ~INR 4,000 cr (~INR 8,000 cr)⁽¹⁾ 	<ul style="list-style-type: none"> Government
	Improve ease of hiring	<ul style="list-style-type: none"> Relook at compliance requirements for hiring faculty to improve hiring timelines 	<ul style="list-style-type: none"> Government Institutes

Source: Livemint (<https://www.livemint.com/opinion/online-views/mammoth-crisis-threatens-india-s-iits-and-iims-11671014500207.html>), FAST India Analysis

Notes:

1. Detailed analysis in appendix on slides 42 and 43

3 International collaborations to be step one



Attracting international talent would need fundamental shifts in international policy

Short term: International collaborations by institutes

- QS rankings assigns:
 - 85% weightage to recall of institutes by international respondents in academic reputation survey
 - 50% weightage to recall of institutes by international respondents in employer reputation survey
- International collaboration should be promoted by every institute at three levels



Institute



Researchers

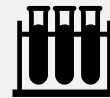
Primary focus



Employers

Long term: Ease of doing science in India by the government

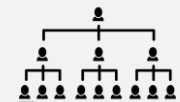
- Macro level challenges (delays in visa clearance, inability to make investments, etc.) and micro level challenges (low salaries as per global standards, poor infrastructure, etc.) make India a less attractive destination for S&T talent
- As of 2018, there were only 40 international professors in 23 IITs
- As seen in private Indian universities that are attracting foreign talent, India needs to provide:



World class research labs



Globally competitive salaries and incentives



Reduction in bureaucratic processes (hiring + research)

4 Building reputation is a virtuous cycle



Continuous efforts at all levels of the institute will build and sustain reputation over years



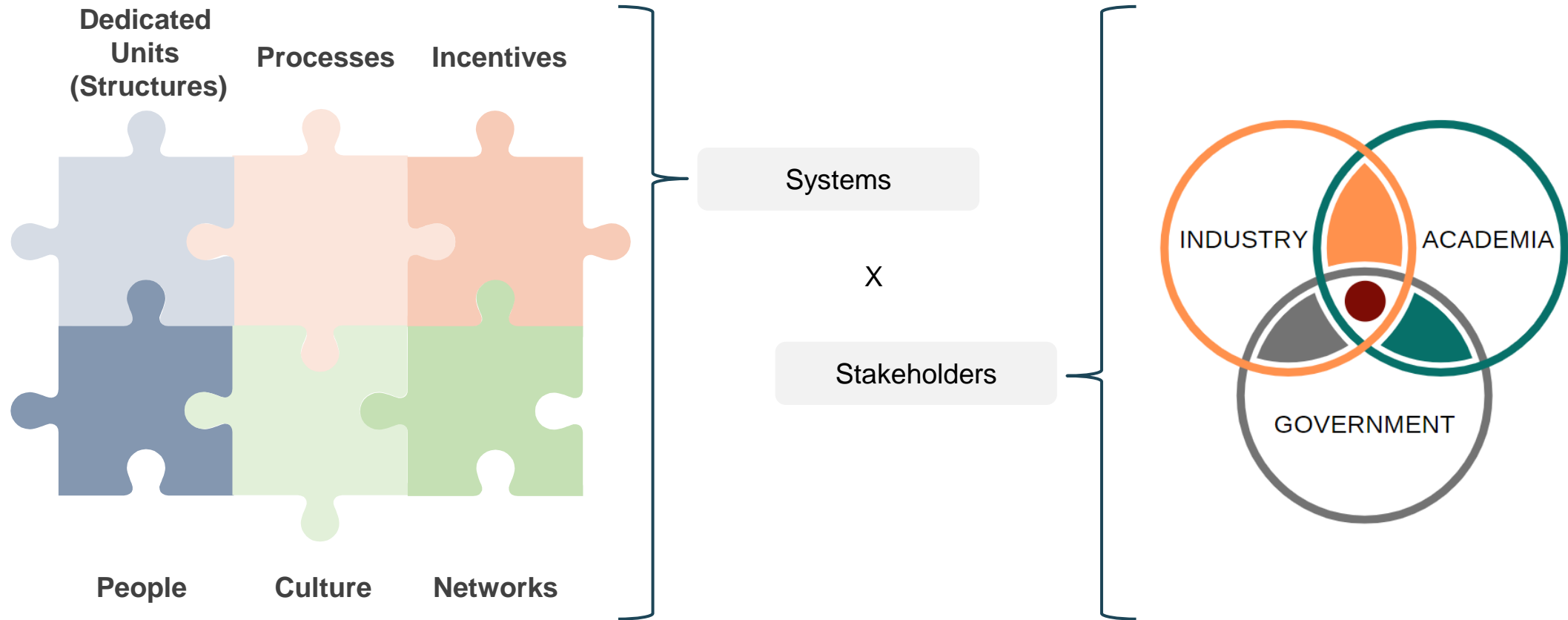
Source: FAST India Analysis

Notes:

1. Vetrova, I.F., Amerslanova, A.N., Yuretskaya, Y.S.: An overview of the main types of university control in the leading countries of the world. Lect. Notes Netw. Syst. 280, 996–1004 (2021). https://doi.org/10.1007/978-3-030-80485-5_111
2. Detailed analysis in appendix on slide 44

4

An effective research ecosystem is built on multiple systems working efficiently and collaborating well at the institute....

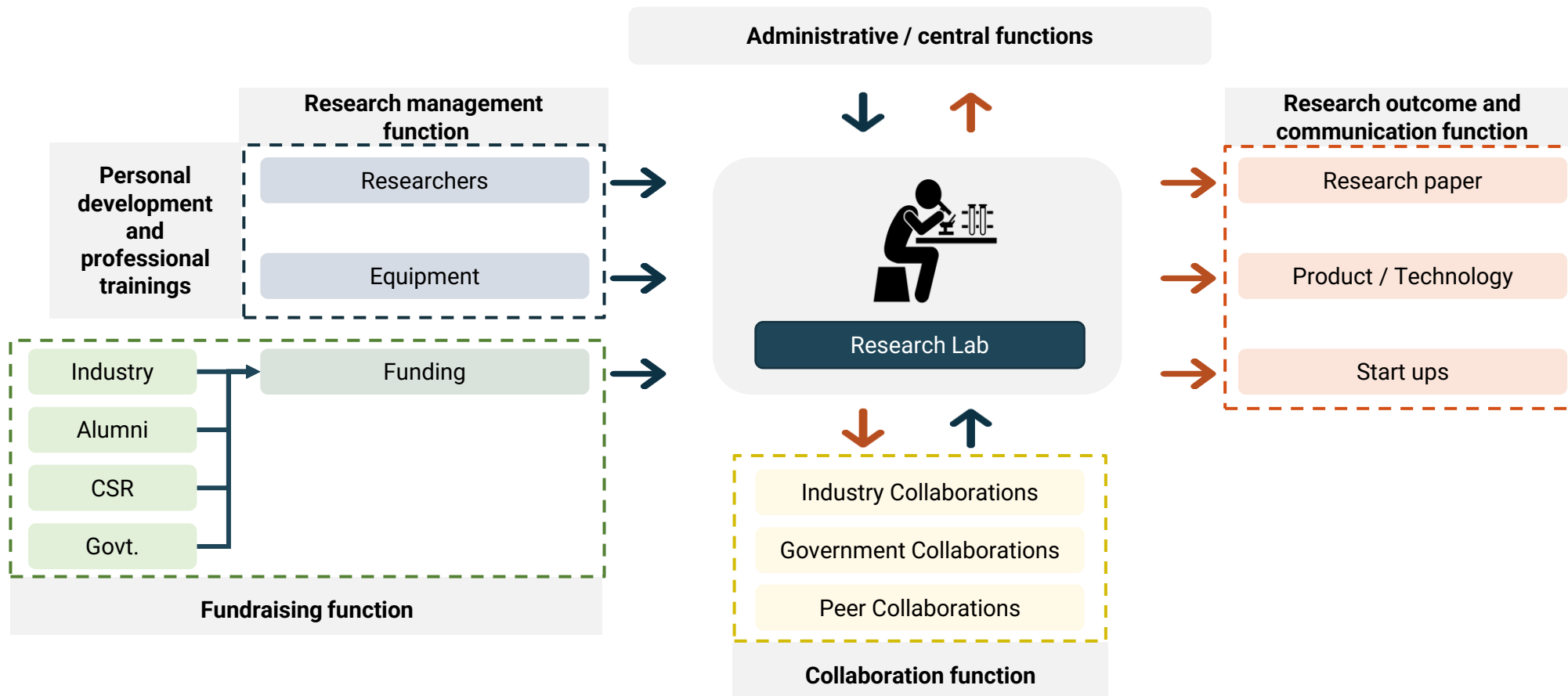


Source: FAST India Analysis

4 ...with continuous support to the researcher in the lab



A successful research lab is one that is enabled by multiple functionalities and trainings



Source: FAST India Analysis

Key Takeaways:



Why rankings are important and how to benefit from them?

- Rankings **may not be a perfect** measure of the quality of universities, **but** they are a **useful instrument**.
- Rankings **don't define the entirety** of any university's worth and value, but they do **measure progress** on various parameters. These systems offer a **basic quantitative standard**, to which universities can layer on further quality parameters as per their goals.
- Students see the rankings as an approximate measure for their own **employability in the future**, while administrators need this system to **evaluate progress on research**. The two agendas should remain separate, and some rankings (like NIRF) offer that by way of different sub-ranking systems.
- Indian institutions **should use some form of rankings**, NIRF or QS, to measure their own progress over time. They offer a standardized way of measuring progress, especially as Indian academia gets broader and deeper, with a target of 50% Gross Enrollment Ratio in higher education (including vocational education) by 2035 as per National Education Policy 2020.
- Administrators and policy makers should emphasize the use of rankings **only to measure your own progress** vis a vis others

Key Takeaways:



What next? Role of stakeholders:

	Government	Institute	Students
Key things to keep in mind about rankings	<ul style="list-style-type: none">Instrument to assess institute progress, not the end objective	<ul style="list-style-type: none">Track parameters over time to measure progress, do not game data	<ul style="list-style-type: none">Review rankings to assess institutes with a pinch of salt while noting the focus areas
Role in interventions	<ul style="list-style-type: none">Emphasise national strategic focus on research and faculty issues in academiaEnsure ease of doing research (funding, spending, hiring, etc.) by way of policy interventionsAssist in more / efficient funding (public + private) for academia	<ul style="list-style-type: none">Improve quality of research by providing appropriate systems and functionalities for assistance to all stakeholdersFacilitate increased stakeholder interactions (government, academic and industry)	<ul style="list-style-type: none">Participate in regular trainings for continued growth

Appendix A: Ranking Methodologies



QS World University Rankings



Focus area: University perception (academic and employer), research

About the ranking

Scope	1,500+ institutions globally
Data sources	Elsevier's Scopus database
Timing	Annually, September
Ranking organization	QS

Critique: Pros and Cons

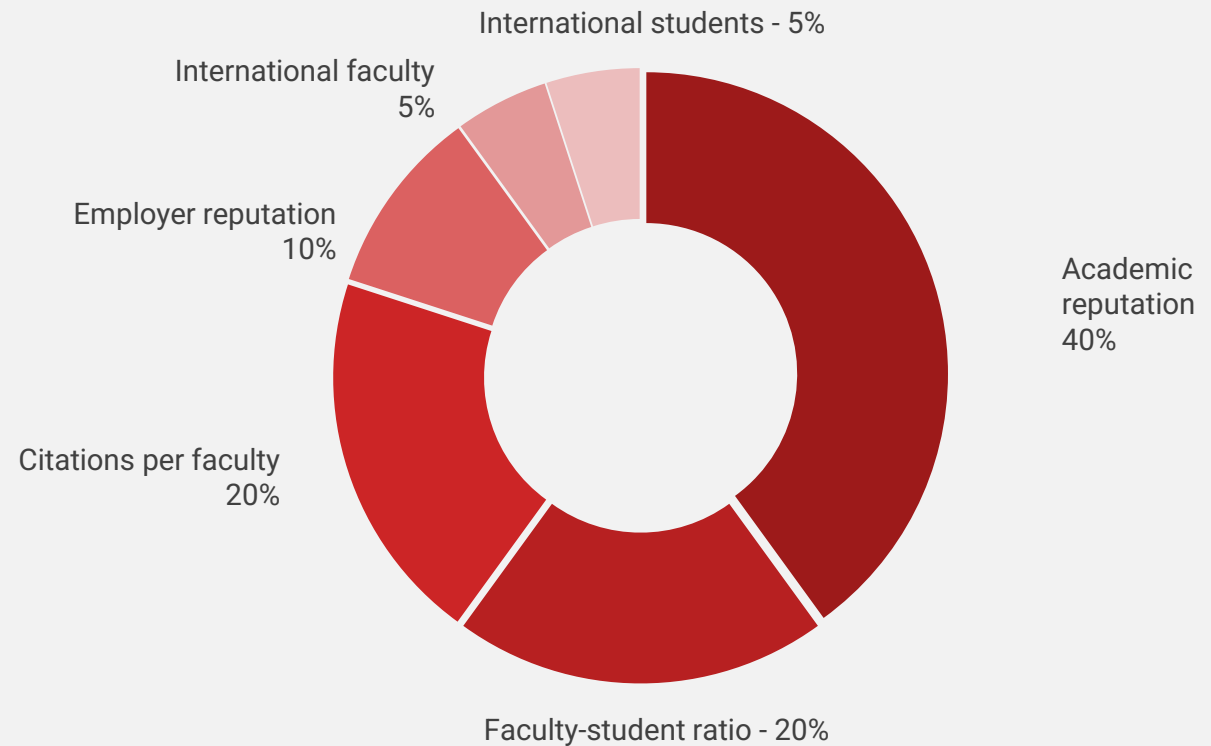


- Most widely used around the world
- Focused on both research and education



- Excessive focus on reputation

2023 Methodology



Times Higher Education World University Rankings



Focus area: University perception (academic and employer), research

About the ranking

Scope	~1,800 institutes across 104 countries
Data sources	Elsevier's Scopus database
Timing	Annually, October
Ranking organization	Times Higher Education (THE)

Critique: Pros and Cons

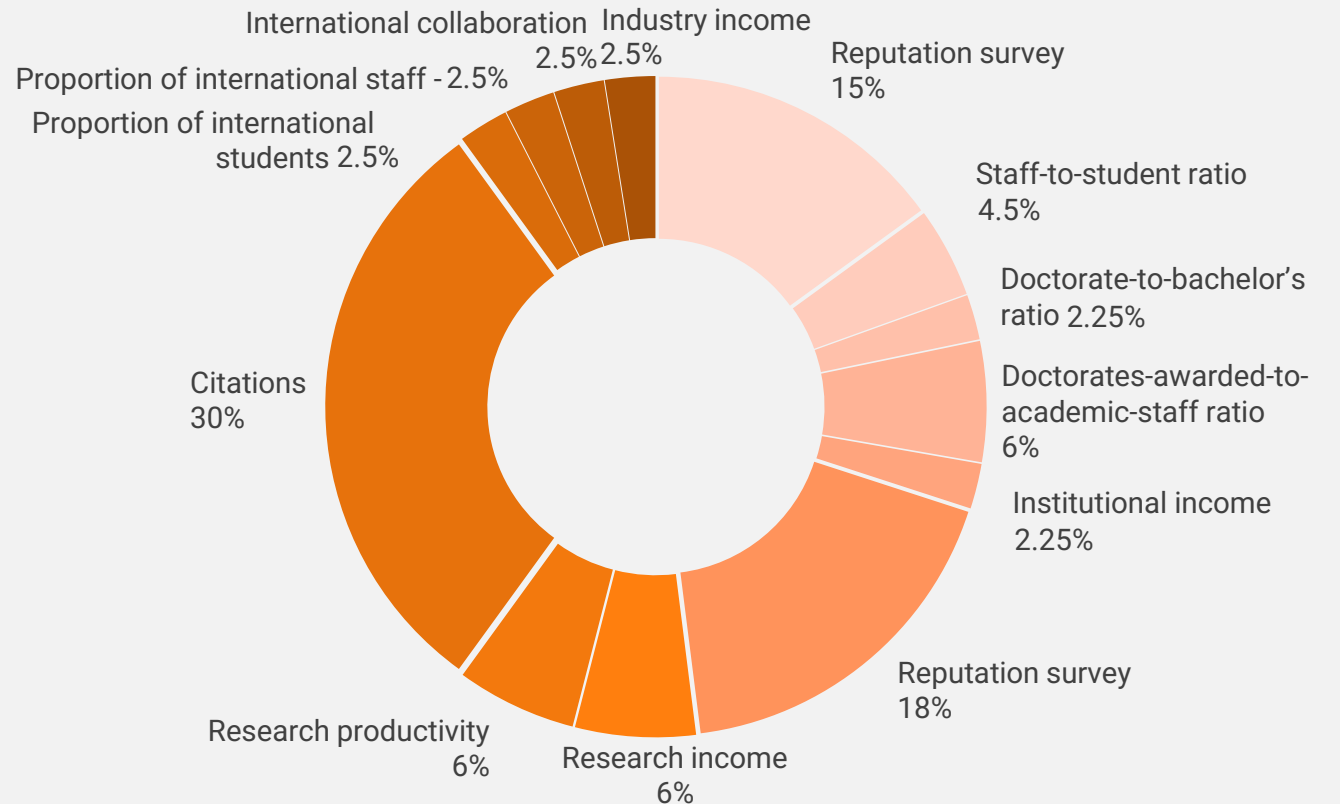


- Well rounded, focused on research quality
- Includes funding from industry



- Doesn't include metric on high quality research
- Lack of transparency has led to institute dropouts

2023 Methodology



US News Rankings



Focus area: High quality and absolute research parameters

About the ranking

Scope	2,000 across 95 countries
Data sources	Clarivate, Web of Science
Timing	Annually
Ranking organization	US News and World Report

Critique: Pros and Cons



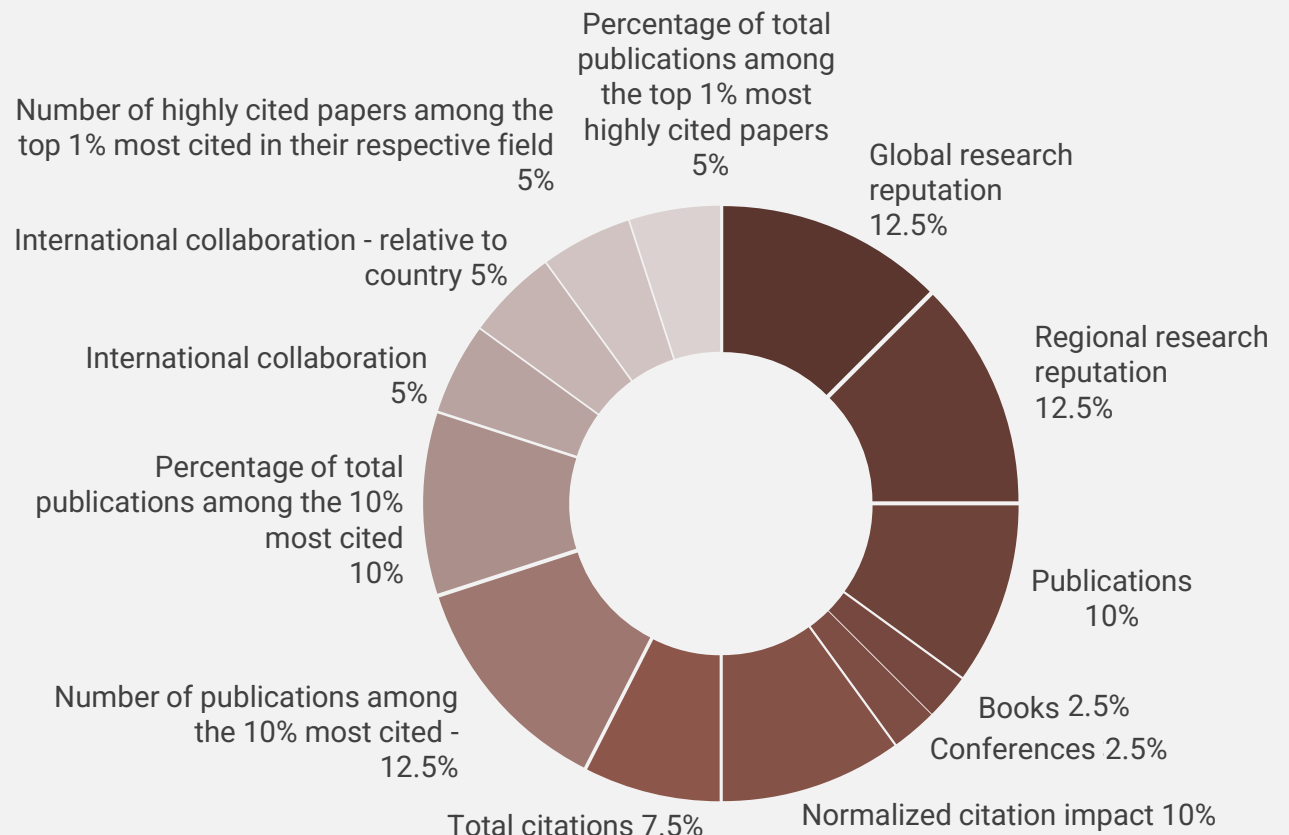
- Focus on top level research
- Many aspects (books, conferences) measured
- Measures depth of international collaborations



- No measure of faculty strength or patents
- Not widely followed, mostly used for university selection

Source: US News website, FAST India Analysis

2023 Methodology



Shanghai's ARWU Rankings



Focus area: Research excellence

About the ranking

Scope	2500+ institutes ranked
Data sources	Clarivate, Web of Science
Timing	Annually
Ranking organization	Shanghai Jiao Tong University

Critique: Pros and Cons

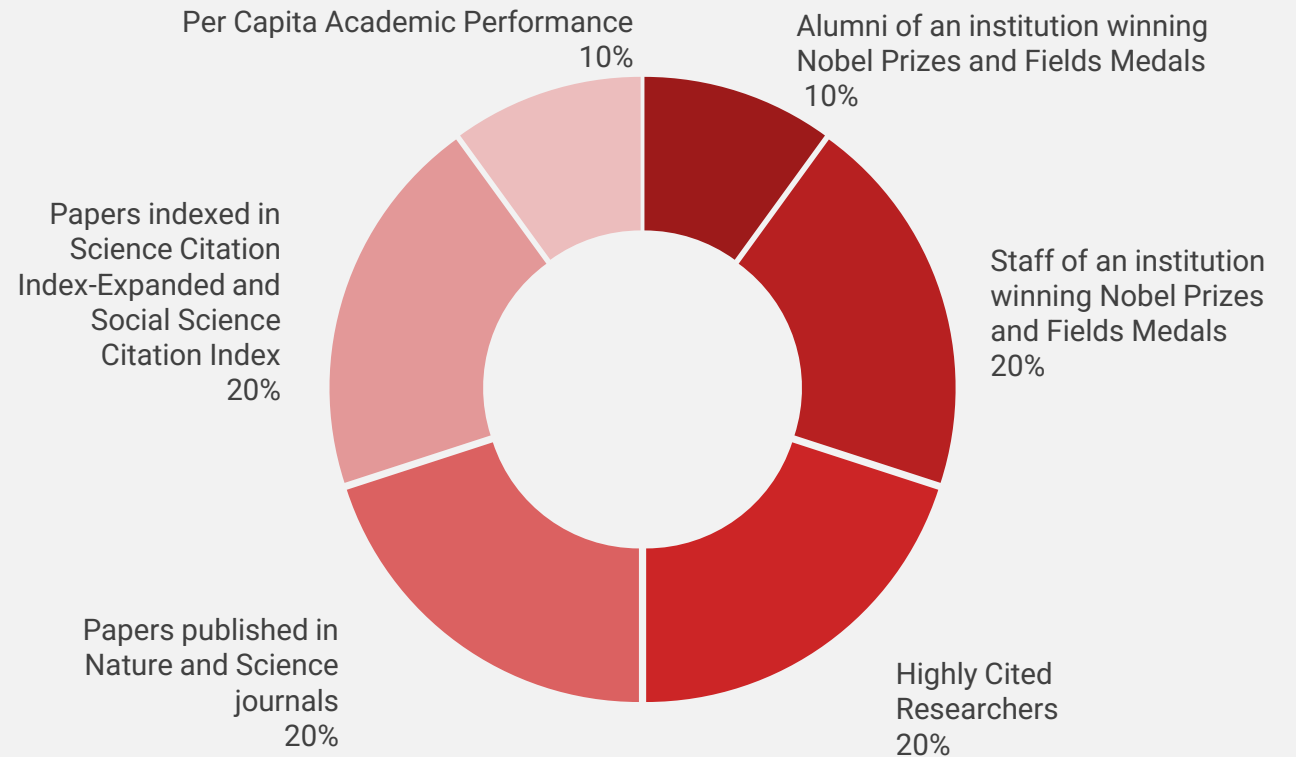


- Measures only very high-quality parameters (Nobel Prizes, articles in Nature and Science, etc)



- Not applicable to most institutions
- Very niche metrics

2022 Methodology



NIRF Research Rankings



Focus area: Comprehensive evaluation for Indian academia

About the ranking

Scope	~180 institutes across India
Data sources	NIRF Survey, Scopus, Web of Science, PUBMED & FT 45
Timing	Annually, July-September
Ranking organization	NIRF

Critique: Pros and Cons



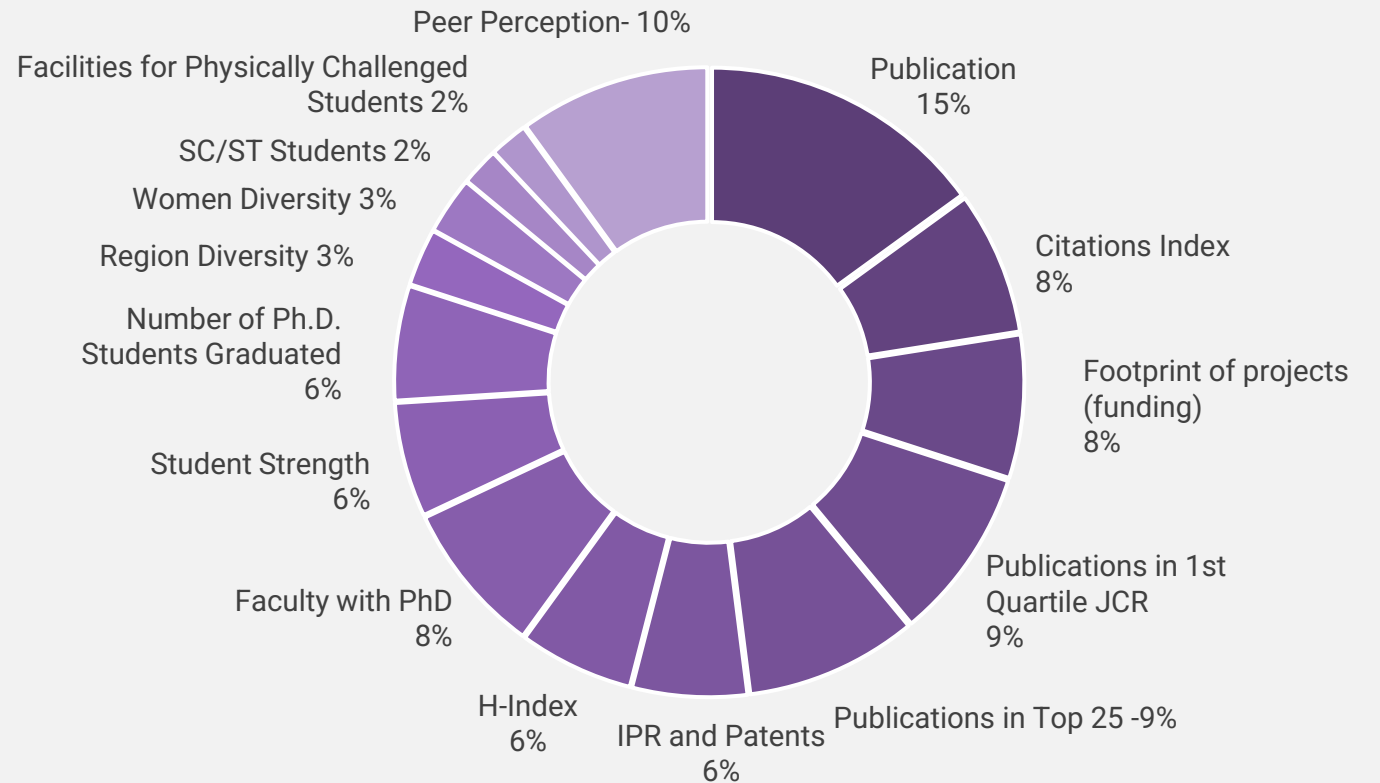
- Well rounded
- Reflects India's diversity concerns
- Focus on both Quality and Quantity
- Less focus on perception



- Not globally comparable
- Inward focused
- No measure on international diversity

Source: NIRF website, FAST India Analysis

2022 Methodology



Appendix B: Detailed Analysis



How to get into QS Top 100? Sensitivity Analysis



Changes Across Parameters

	IISC		
	Current	10% Change	40% Change
Academic reputation	37.6	41.4	52.6
Employer reputation	22.9	25.2	32.1
Faculty student ratio	56.3	61.9	78.8
Citations / faculty	100.0	100.0	100.0
Int'l faculty ratio	11.7	12.9	16.4
Int'l student ratio	1.9	2.1	2.7
Total Score	49.3	52.2	61.0
Implied Rank	155	140	92

	IIT Bombay		
	Current	10% Change	40% Change
Academic reputation	53.3	58.6	74.6
Employer reputation	86.5	86.5	86.5
Faculty student ratio	25.8	28.4	36.1
Citations / faculty	55.1	60.6	77.1
Int'l faculty ratio	3.9	4.3	5.5
Int'l student ratio	1.6	1.8	2.2
Total Score	46.4	50.2	61.5
Implied Rank	172	153	92

	IIT Delhi		
	Current	10% Change	40% Change
Academic reputation	49.0	53.9	68.6
Employer reputation	79.2	79.2	79.2
Faculty student ratio	27.7	30.5	38.8
Citations / faculty	65.2	71.7	91.3
Int'l faculty ratio	2.6	2.9	3.6
Int'l student ratio	1.7	1.9	2.4
Total Score	46.3	50.2	61.7
Implied Rank	174	153	92

Changes in Key Parameters

	IISC		
	Current	Faculty Δ	ReputationΔ
Academic reputation	37.6	37.6	49.0
Employer reputation	22.9	22.9	30.0
Faculty student ratio	56.3	70.0	70.0
Citations / faculty	100.0	100.0	100.0
Int'l faculty ratio	11.7	11.7	11.7
Int'l student ratio	1.9	1.9	1.9
Total Score	49.3	52.0	57.3
Implied Rank	155	140	108

	IIT Bombay		
	Current	Faculty Δ	ReputationΔ
Academic reputation	53.3	53.3	69.0
Employer reputation	86.5	86.5	86.5
Faculty student ratio	25.8	50.0	70.0
Citations / faculty	55.1	70.0	70.0
Int'l faculty ratio	3.9	3.9	3.9
Int'l student ratio	1.6	1.6	1.6
Total Score	46.4	54.2	64.5
Implied Rank	172	129	82

	IIT Delhi		
	Current	Faculty Δ	ReputationΔ
Academic reputation	49.0	49.0	64.0
Employer reputation	79.2	79.2	79.2
Faculty student ratio	27.7	50.0	70.0
Citations / faculty	65.2	70.0	70.0
Int'l faculty ratio	2.6	2.6	2.6
Int'l student ratio	1.7	1.7	1.7
Total Score	46.3	51.7	61.7
Implied Rank	174	143	92

Notes:

1. Top 100 average faculty student ratio score is 67.7; Top 100 average citations per faculty score is 72.2

Top 100 Threshold: 58.8

How to get into QS Top 200? Sensitivity Analysis



Changes Across Parameters	IIT Madras			IIT Kanpur			IIT Kharagpur		
	Current	10% Change	40% Change	Current	10% Change	40% Change	Current	10% Change	40% Change
	Academic reputation	38.0	41.8	53.2	32.6	35.9	45.6	30.2	33.2
Employer reputation	58.3	64.3	81.6	49.3	54.2	69.0	48.3	53.1	67.6
Faculty student ratio	27.6	30.4	38.6	17.4	19.1	24.4	13.0	14.3	18.2
Citations / faculty	58.3	64.1	81.6	79.0	79.0	79.0	86.4	86.4	86.4
Int'l faculty ratio	2.8	3.1	3.9	2.3	2.5	3.2	3.7	4.1	5.2
Int'l student ratio	1.4	1.5	2.0	1.2	1.3	1.7	1.1	1.2	1.5
Total Score	38.4	42.3	53.8	37.4	39.6	46.1	37.0	39.0	44.9
Implied Rank	250	214	134	264	235	177	270	242	190

Changes in Key Parameters	IIT Madras			IIT Kanpur			IIT Kharagpur		
	Current	Δ Top 200	Δ Top 100	Current	Δ Top 200	Δ Top 100	Current	Δ Top 200	Δ Top 100
	Academic reputation	38.0	38.0	38.0	32.6	32.6	32.6	30.2	30.2
Employer reputation	58.3	58.3	58.3	49.3	49.3	49.3	48.3	48.3	48.3
Faculty student ratio	27.6	45.0	70.0	17.4	45.0	70.0	13.0	45.0	70.0
Citations / faculty	58.3	58.3	70.0	79.0	79.0	79.0	86.4	86.4	86.4
Int'l faculty ratio	2.8	2.8	2.8	2.3	2.3	2.3	3.7	3.7	3.7
Int'l student ratio	1.4	1.4	1.4	1.2	1.2	1.2	1.1	1.1	1.1
Total Score	38.4	41.9	49.2	37.4	42.9	47.9	37.0	43.4	48.4
Implied Rank	250	219	159	264	205	164	270	201	162

Notes:

1. Top 100 average faculty student ratio score is 67.7; Top 100 average citations per faculty score is 72.2
2. Top 100 - 200 average faculty student ratio score is 47.3; Top 100 - 200 average citations per faculty score is 54.7

Top 200 Threshold: 43.6

How to get into QS Top 300? Sensitivity Analysis



Changes Across Parameters

	IIT Roorkee		
	Current	10% Change	40% Change
Academic reputation	16.6	18.3	23.2
Employer reputation	23.9	26.3	33.5
Faculty student ratio	9.6	10.6	13.4
Citations / faculty	94.5	94.5	94.5
Int'l faculty ratio	1.1	1.2	1.5
Int'l student ratio	2.5	2.8	3.5
Total Score	30.0	31.1	34.5
Implied Rank	369	347	307

	IIT Guwahati		
	Current	10% Change	40% Change
Academic reputation	15.1	16.6	21.1
Employer reputation	16.9	18.6	23.7
Faculty student ratio	9.5	10.5	13.3
Citations / faculty	96.3	98.0	96.3
Int'l faculty ratio	3.4	3.7	4.8
Int'l student ratio	1.3	1.4	1.8
Total Score	29.1	30.5	33.1
Implied Rank	384	359	325

	IIT Indore		
	Current	10% Change	40% Change
Academic reputation	4.7	5.2	6.6
Employer reputation	4.3	4.7	6.0
Faculty student ratio	42.1	46.3	58.9
Citations / faculty	88.7	90.0	88.7
Int'l faculty ratio	2.5	2.8	3.5
Int'l student ratio	0.0	1.0	1.0
Total Score	28.6	30.0	33.0
Implied Rank	396	369	327

Changes in Key Parameters

	IIT Roorkee		
	Current	Δ Top 300	Δ Top 100
Academic reputation	16.6	16.6	16.6
Employer reputation	23.9	23.9	23.9
Faculty student ratio	9.6	45.0	70.0
Citations / faculty	94.5	94.5	94.5
Int'l faculty ratio	1.1	1.1	1.1
Int'l student ratio	2.5	2.5	2.5
Total Score	30.0	37.1	42.1
Implied Rank	369	274	217

	IIT Guwahati		
	Current	Δ Top 300	Δ Top 100
Academic reputation	15.1	15.1	15.1
Employer reputation	16.9	16.9	16.9
Faculty student ratio	9.5	45.0	70.0
Citations / faculty	96.3	96.3	96.3
Int'l faculty ratio	3.4	3.4	3.4
Int'l student ratio	1.3	1.3	1.3
Total Score	29.1	36.2	41.2
Implied Rank	384	284	226

	IIT Indore		
	Current	Δ Top 300	Δ Top 100
Academic reputation	4.7	4.7	4.7
Employer reputation	4.3	4.3	4.3
Faculty student ratio	42.1	45.0	70.0
Citations / faculty	88.7	88.7	88.7
Int'l faculty ratio	2.5	2.5	2.5
Int'l student ratio	0.0	0.0	0.0
Total Score	28.6	29.2	34.2
Implied Rank	396	388	312

Notes:

1. Top 100 - 200 average faculty student ratio score is 47.3; Top 100 - 200 average citations per faculty score is 54.7
2. Top 200 - 300 average faculty student ratio score is 44.8; Top 200 - 300 average citations per faculty score is 41.0

Top 300 Threshold: 35.2

Highly-cited papers: Detailed analysis



Country	2008-2010	2018-2020	Implied CAGR for 2008-2018	Assumed CAGR for 2018-2028	To Beat #5		To Beat #3	
					2028-2030	Implied rank	2028-2030	Implied rank
China	9,011	46,352	17.8%	17.8%	238,432	1	238,432	1
USA	36,910	36,680	-0.1%	0.5%	38,514	2	38,514	2
Italy	7,420	8,772	5.8%	5.8%	10,690	3	10,690	4
UK	6,477	7,246	1.7%	1.7%	10,370	4	10,370	5
India	3,450	6,073			8,841	5	10,691	3
Australia	2,941	5,099	5.7%	5.7%	8,840	6	8,840	6
Germany		4,926	1.1%	1.1%	8,106	7	8,106	7
Spain	4,078	4,509	2.9%	2.9%	5,093	8	5,093	8
Canada	4,568	4,231	1.0%	1.0%	4,986	9	4,986	9
France	2,903	3,845	-0.8%	0.5%	4,443	10	4,443	10

Indian context:

Year	1	2	3	4	5	6	7	8	9	10	
If 6.0% CAGR	# of papers	5,223	5,537	5,871	6,224	6,599	6,997	7,418	7,865	8,339	8,841
	YoY addition	297	315	334	354	375	397	421	447	474	502
If 8.1% CAGR	# of papers	5,323	5,752	6,215	6,716	7,257	7,842	8,473	9,156	9,894	10,691
	YoY addition	397	429	463	501	541	585	632	683	738	797

Cost of improving QS rankings: Faculty and Infrastructure



In INR Crore	Current Staff Expenditure ⁽¹⁾	% of total Expenditure	Current Faculty Student Score on QS	At faculty score of 45 across institutes		At faculty score of 70 across institutes	
				Implied Staff Cost	% Change	Implied Staff Cost	% Change
IISc	322	46.6%	56.3	322	0%	401	24%
IIT Bombay	574	66.1%	25.8	1,001	74%	1,556	171%
IIT Delhi	268	43.5%	27.7	435	62%	677	153%
IIT Madras	484	60.0%	27.6	789	63%	1,227	154%
IIT Kanpur	398	52.4%	17.4	1,028	159%	1,599	302%
IIT Kharagpur	370	46.9%	13.0	1,281	246%	1,993	438%
IIT Roorkee	272	33.2%	9.6	1,274	369%	1,982	629%
IIT Guwahati	207	43.5%	9.5	980	374%	1,525	637%
IIT Indore	54	36.9%	42.1	58	7%	90	66%
Total	2,948			7,168		11,050	

Notes:

1. Total staff expenditure (faculty + administration) inclusive of all employee benefits as of last reported year. Reported as Establishment Expenses / Staff Payments and Benefits

2. Implied expenditure = Implied staff cost to attain mentioned score + 25% infrastructure cost

Proof of linearity: Faculty-student scores in QS



Institute	Faculty student score	Faculty student ratio
MIT	100	3.0
Source	QS data	US News
IIT Delhi	27.7	10.8
Source	QS data	IIT Delhi public information
<i>Implied ratio (MIT to IIT Delhi)</i>	3.6	3.6
Banaras Hindu University (BHU)	14.8	20.4
Source	QS data	BHU public information
<i>Implied ratio (MIT to BHU)</i>	6.8	6.8

QS Rankings and Shanghai's ARWU Ranking Correlations



Correlation between data for all QS ranked institutes and a subset of Shanghai's ARWU ranking (Top 300 + Indian institutes)

		Shanghai Ranking Parameters							
		Rank	Alumni	Award	HiCi	NN&S	Pub	PCP	Overall Score
QS Ranking Parameters	Rank	0.64	(0.41)	(0.41)	(0.46)	(0.52)	(0.46)	(0.38)	(0.53)
	Academic Reputation	(0.62)	0.52	0.49	0.51	0.64	0.57	0.51	0.66
	Employer Reputation	(0.52)	0.42	0.43	0.40	0.51	0.48	0.43	0.55
	Faculty Student	(0.41)	0.42	0.40	0.38	0.47	0.35	0.36	0.49
	Citations per Faculty	(0.31)	0.15	0.18	0.39	0.33	0.34	0.41	0.35
	International Faculty	(0.03)	0.21	0.22	0.33	0.29	0.09	0.46	0.30
	International Students	(0.14)	0.31	0.31	0.30	0.32	0.13	0.43	0.35
	Overall Score	(0.65)	0.54	0.52	0.59	0.68	0.58	0.61	0.71

Data in green indicates correlation coefficient of higher than 0.5 / lower than (0.5)