For NEDO
Summary Report

Status Survey on International Joint R&D and Start-up Support

Automotive Industry Consulting Group

NRI Consulting & Solutions India Pvt. Ltd.

20th March 2022

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Executive Summary

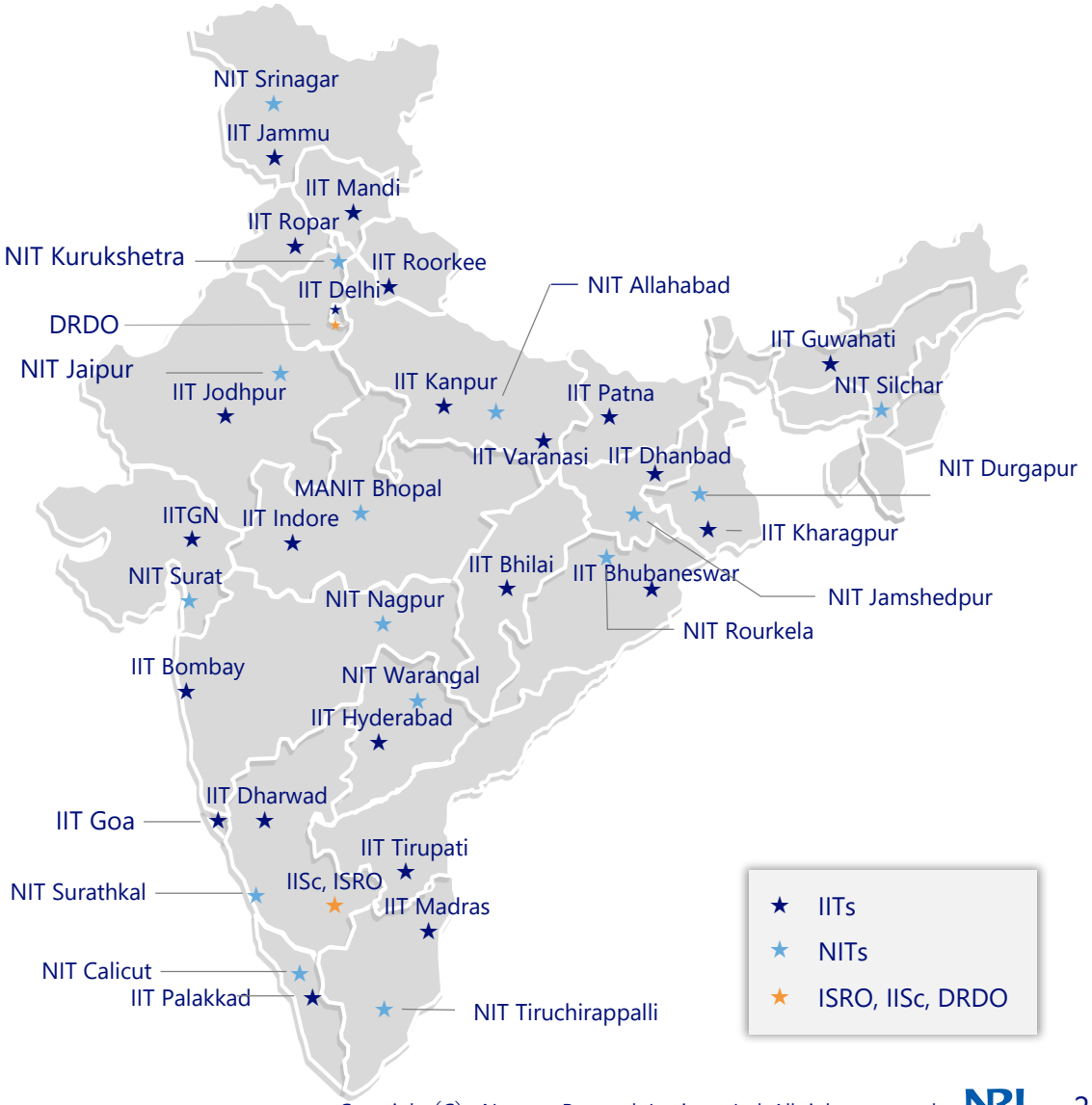
1. IITs, NITs, IISc, ISRO, DRDO comprise the premier and best ranked R&D institutes among the many institutes spread across India
2. Collaboration with Indian institutes and scholars provide benefits of cost savings, access to young talent, large market, high-end technology, and upskilled human resource
3. Older IITs (estd before 2008), IISc have higher degree of collaborations than newer IITs, NITs, DRDO and ISRO. ~75% collaborations are with academia, indicating a lack of international collaborative R&D with industry partners
4. USA, Canada and European nations are the frontrunners in terms of collaborations with Indian Institutes
5. Collaboration with Japan is not as significant, barring a couple of exceptions - IIT Hyderabad and IIT Guwahati
6. Strong faculty connections (as a result of higher studies, post-doc research), proactive efforts by agencies to create awareness, language comfort, and access to better job and career opportunities are some major reasons for higher degree of collaboration with West
7. Major challenges that limit Indo-Japan R&D collaboration are - lack of awareness, lack of faculty and industry network, absence of dedicated personnel for regular communication, and limited use of English as medium of communication
8. Although, collaboration with Japan is not as significant, inspiration can be taken from the successful case studies of JST-DAILAB, SATREPS, and JICA friendship program with IIT Hyderabad. Collaboration with Industry stakeholders is a critical success factor, as seen in the successful case of IIT Hyderabad Suzuki Innovation Centre. Presence of a 'champion' and sustained efforts over few years resulted in successful collaborations
9. Increasing dialogue, active information sharing platforms, higher networking between researchers and industry players, addressing language barriers, and better future job opportunities in Japan are the key drivers to enhance Indo-Japan collaborative research
10. Collaborations can be done at 3 levels– i) Multilateral ii) Bilateral and iii) a) Academia and b) Industry to Institute/Faculty level. Institute level collaborations are quickest while Multilateral and Bilateral modes need patience and longer time to develop
11. AI, IoT, semiconductors and electronics, smart agriculture, new energy are a few sectors which can be focused to leverage the complimentary strengths of India and Japan as well as benefit from the running govt. schemes
12. Key recommendations for enhancing start-up support include - Identification of priority sectors, increasing awareness/dialogue and funding support especially from top Japan based conglomerates, tech giants, banks, PE and VC firms

Premium Institutes in India

India has many R&D institutes across the length and breadth of the country. 41 premier institutes were studied for their international collaboration

41 Institutions and research organizations covered

- **23** Indian Institutes of Technology (IITs)
- **15** National Institutes of Technology (NITs)
- **3** Others (IISc, ISRO, DRDO)



Benefits of Collaboration with India

Collaboration with Indian institutes provide benefits of cost savings, access to young talent, large market, high-end technology, and upskilled human resource

Benefits	Details
Cost Savings	Lower cost of **talent, labor and raw material** hence that of setting up industries / production units
Access to young local talent	• Abundant **human resource** capabilities • **Brightest minds** sharpened through cut-throat competition
Access to a large market	**Diverse market** where different value propositions can be provided to different
High-end technology	Research outputs at par with international counterparts
Upskilled Human Resource	Working with Indian counterparts would **improve soft skills**: • Communication Skills • Flexibility in thought • Understanding local needs • Adjusting to local requirements

Source: Interaction with IITs and experts

Status of R&D Collaboration

Old IITs & IISc have more than 100 international R&D collaborations each in last five years; New IITs and NITs are increasing their R&D focus

Institutes	International Collaboration		Details
Old IITs	**~200** International R&D projects each (2015-20)	**Industry & Academia** engagements	• USA contributes highest to the joint R&D projects • Followed by UK, Canada, Japan, Germany, Australia • Japanese organisations have ties with all old IITs, & top collaborators for IIT Guwahati
New IITs	**~50** International R&D projects (2015-20) (IITI, IITH, IITGN)	**~10** International R&D projects (2015-20) (other IITs)	• US and Japan are the top collaborators for joint R&D • Japanese institutions and organisations are the top collaborators for IIT Hyderabad
IISc	**~140** International R&D projects (2015-20)		• Collaborations mainly include academia engagements • USA contributes highest to the joint R&D projects
DRDO & ISRO	**Funds R&D projects** at IITs, NITs, IISERs and IISc		• No international R&D collaboration data publicly available
NITs	**~15** International R&D projects (2015-20) (NIT Trichy, Surathkal, Jaipur, Durgapur)	**~5** International R&D projects (2015-20) (other NITs)	• USA contributes majority of joint R&D projects • Trichy, Surathkal, Jaipur and Kurukshetra are the only NITs having projects with Japanese universities (~1 each)

Source: Institute Websites

Status of Start-up Support

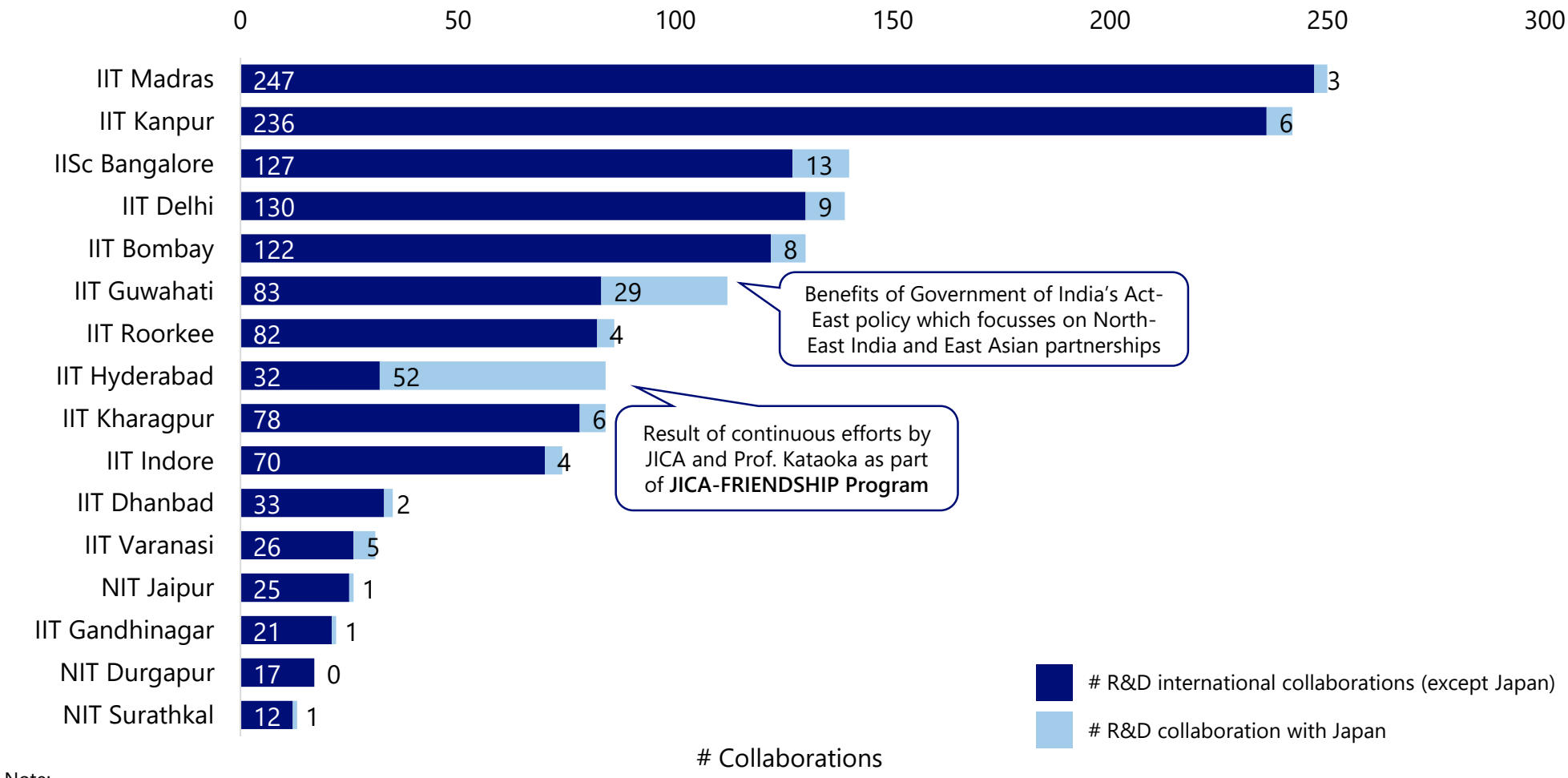
Old IITs are large producers of tech based start-ups with multiple incubators and public & private sector involvement including international funding sources

Institutes	Key Statistics	Details
Old IITs	**750+** Associated start-ups as of 2022 **INR 59B+** Funding raised based on just 2 IITs **MedTech, AI & IoT** Key focus area **Public & Private Sector** Funding received	• The old 7 IITs involve a mix of government schemes, private sector involvement and multiple in-house incubators covering wide areas • **No specific focus area** for the incubators, however, based on available data, Medical Technology is the most prominent space • **IIT Madras leads** with over 200 incubated start-ups attracting funding from international agencies including Japan
New IITs	**200+** Associated start-ups as of 2022 **INR 12.8M+** Funding support at IITBHU	• IIT BHU leads followed by IIT Gandhinagar and IIT Patna • Majority have a single incubation cell • Source of funding could not be tracked
IISc	**21** Incubated start-ups as of 2022 **Deep Science Start-ups** Key focus area	• 3 Incubation cells with support from public & private sector • Prominent area include Nanotechnology & Biotechnology
NITs	**330+** Associated start-ups as of 2022	• NIT Surat followed by Jaipur & Calicut contribute 80%+ to the associated start-ups including current incubates • Majority have a single incubation cell

Source: Institute Websites

Institutes have large number of international collaborations but the number of collaborations with Japan is limited except for IIT Hyderabad and IIT Guwahati

Institute wise R&D Collaborations



Note:
- Only institutes with non zero international R&D collaborations have been included
- Data for years 2015-2021

Source: IIT Council & Institute Websites

Joint R&D: Strong Collaboration with West – Reasons

US and European countries have higher collaborations with Indian institutes due to faculty personal connections, proactive agencies and language overlap

	Awareness	Connection	Implementation
Country	**Proactive Agencies** Organizations like DAAD actively reach out for information dissemination	**Established Schemes** Well developed, advertised and resourceful schemes to benefit from	**Language Comfort** English is a primary or secondary language and is comfortably used as medium of communication
Institute/ Industry	**Scholarships** Alumni, legacy, industry run scholarships to encourage participation	**Alumni Network** Presence of past students and colleagues in academia and industry establishing strong alumni network	**Past Experience** Past collaborations reduce uncertainties and hurdles caused due to paperwork and admin related activities
Faculty	**R&D Overlap** Active R&D related discussions due to similar focus areas of research	**Faculty Connections** Colleagues and co-researchers during higher studies/post doc. research catalyze joint R&D collaborations	**Way of Working** Comfortable and understanding developed about counter-party's way of working

Source: Interaction with IITs

Joint R&D: Strong Collaboration with West – Case Studies

Case of IUSSTF, IITGN-Caltech and RBC-DSAI at IITM are three successful models of collaboration with the West

	Awareness	Connection	Implementation
Bilateral **Case: IUSSTF**	**Government Facilitation** Established via agreement between the **Governments of India & the USA** in March 2000 to formalize the 5 decade old relationship in S&T	**Nodal Agency** **IUSSTF promotes, catalyzes & seeds bilateral collaboration** in science, engineering & innovation via interactions of government, academia & industry	**Impact** • **15,000+** Scientific Project Beneficiaries • **1,638+** Interns & Fellows supported • **522+** Post-doc fellows nurtured • **10+** Sectors supported
Academia **Case: IITGN[1] - Caltech**	**Faculty Connection** Prof. Sudhir, then Director of IITGN had completed his studies from Caltech Prior connection facilitated collaboration	**Strengthened Alumni Network** • Multiple IITGN students pursue higher studies at Caltech • 10 Caltech students learn about Indian culture, arts, politics & tours each year	**Student Exchange** **10 students** from each university participate in student exchange per year 1 SURF in Caltech 2. India ki Khoj in IITGN
Industry **Case: RBC-DSAI[2] IITM[3]**	**R&D Overlap** RBCDSAI Centre was set up in 2017 as an outcome of the Interdisciplinary Laboratory for Data Science (ILDS) at IITM	**Strengthened Network** Center's **mandate** requires interaction with **industry and other universities**, including international student & faculty exchanges	**Implementation Plan** Bosch to invest **2.5 million Euros** over five years in the centre (2019-2024) Centre to undertake foundational research in many areas of AI and Data Science

Note:
1. IITGN: IIT Gandhinagar
2. RBC-DSAI: Robert Bosch Centre for Data Science and Artificial Intelligence
3. IITM: IIT Madras

Joint R&D: Challenges in Collaboration with Japan

For collaboration with Japan, the key challenges are - lack of awareness of research opportunities, fragile connections, and funding and language barriers

Awareness

Limited Information Dissemination

Absence of common platforms and/or forums for regular sharing of information

Lack of familiarity about research in both countries

Ignorance about research areas and work being done in other countries limits active discussions and engagements

Ignorance on Collaboration models

Lack of knowledge on ways of collaboration limits outreach and plans for joint R&D

Connection

Lack of Faculty Connections

Limited faculty connections in Japanese institutes as most researchers in India pursue higher studies in the West

Fragile Alumni Network

Strong alumni network helps in establishing connects and initiating discussions for potential future collaborations

Lack of Industry Network

Limited job opportunities in Japan results in fewer Indians joining Japanese industry and hence, lesser R&D outsourcing to Indian univ.

Implementation

Lack of Funding and Resources

Shortcomings in funding and resources one of the major hurdles for meaningful and long term joint R&D collaboration

High Language Barriers

Cultural dissimilarities and lack of comfort in using English fluently as medium of communication

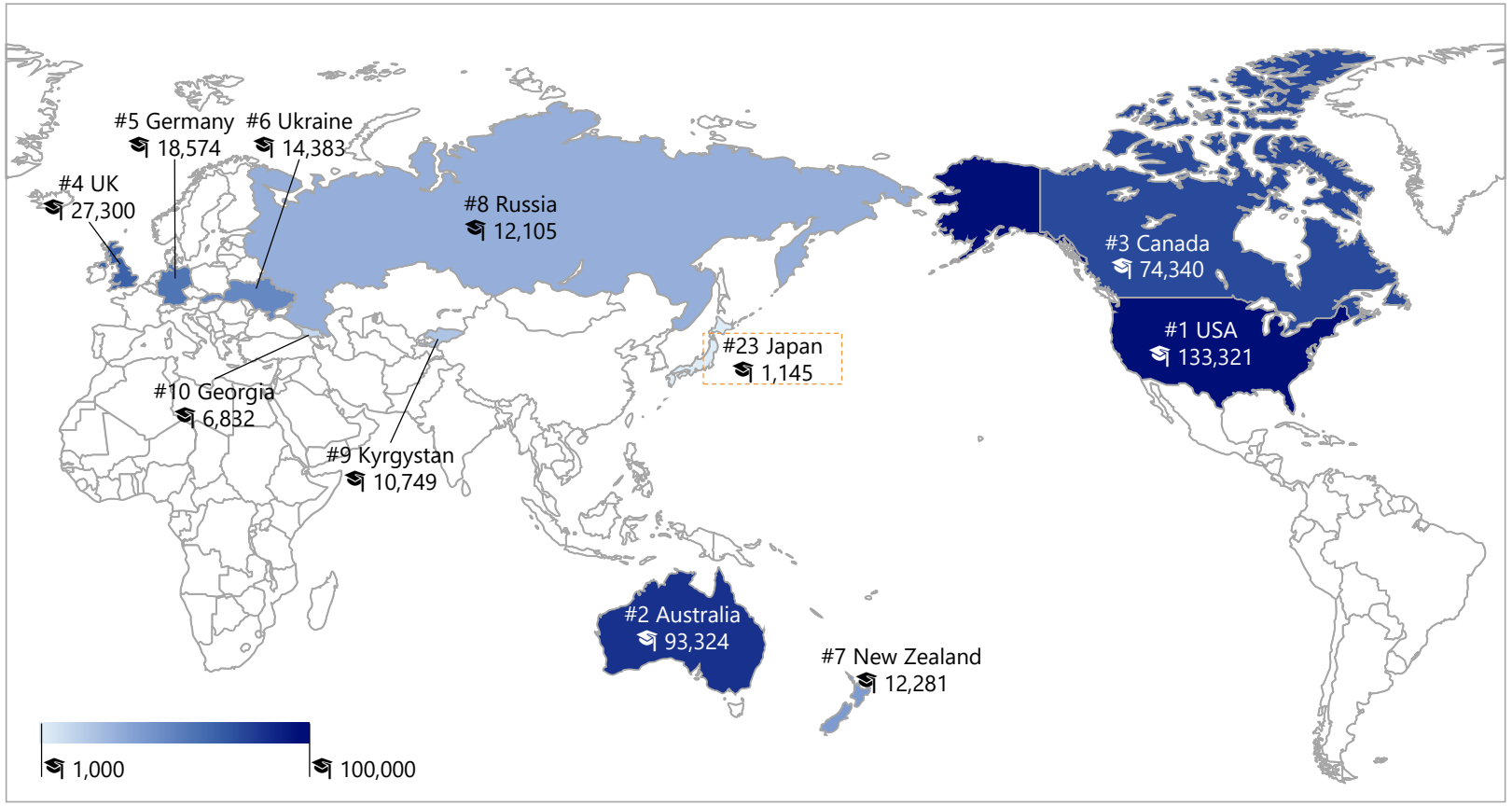
Absence of a Central Nodal Agency

No one single point-of-contact to reach out for assistance for any funding, regulatory or admin related issues

Student Exchange: Outbound Students from India

Outbound Indian students are highest in US, Australia & Canada while Japan lags far behind at 23rd rank with just ~0.25% of total outbound students from India

Indian Outbound Students (Top 10 nations + Japan)



Source: UNESCO Website, Data for year 2019

Student Exchange: Challenges with Japan

Bottlenecks and challenges in education, professional career, and living environment are some major hurdles for increasing outbound Indians to Japan

Education

Awareness
Institutes are low on international rankings with insufficient awareness in India

Choice
Very few English speaking faculty hence limited English courses

Practicality
High living cost and few scholarships

Career

Difficult to get Jobs
Companies do not recognize foreign degrees, previous record and it is difficult to switch jobs

Slow Career Development
Companies do not reward merit and everyone is treated the same

Language Environment
Very few people speak English; all documentation and environment is Japanese

Work Culture
Non-flexible hours with too many rules

Life

Living Environment
Everything around is in Japanese and life support systems for foreigners are missing

Family issues
Spouses of foreign workers have no work opportunity and the cost of child education is high

Lack of Familiar people
Scarce no of Indians and close ones leading to loneliness

Source: NRI Analysis

JICA Friendship program is a successful case that effectively created long-term collaboration and reaped stellar results

	Awareness	Connection	Collaboration
	2007-2012	2012-2020	Future Plans 2022-2025
Key Success Factors	Government of India was seeking out support for funding new IITs	Prof. Kataoka championed the coordination between the institute and agencies	Establishment of "Hubs" connecting both industry and academia to increase collaboration
Activities	IITH infrastructure financing by JICA	• Scholarships • R&D visits • MoUs & job opportunities with Japanese Industries	• Doctoral scholarship programs • Joint research grants
Achievements	• **ODA loans** for campus development • **6/19** building designed by Japan through JICA	• **136** students availed **scholarships** • **271 faculty visits** conducted • **13 MoUs** with Japanese Companies signed	• **30 doctoral** students scholarship • **Japan Desk** • **18 Joint projects** within 2 years

IITH and Suzuki Motor join hands to establish Suzuki Innovation Center (SIC) to further the industry and academia collaboration between India and Japan

	Awareness	Connection	Collaboration
	2022 – Future Plans		
Activities	• Suzuki Innovation Center (SIC) at IIT Hyderabad is a result of cumulative success stories between Suzuki Motor Corporation and IIT Hyderabad over the years • Alumni of IIT Hyderabad -- Vipul Nath Jindal and Prathyusha Thammineni, have led the whole initiative from ground-up	Philosophy of the programme: • Create inclusive value for the Indian & Japanese societies • Support **skill development** and **exchange of human resources** between India and Japan	• IIT Hyderabad and Suzuki to work closely to **identify and address** broad challenges **on and beyond mobility** • **3-year contract** has been signed to start (SIC) which will be operated as a platform for open innovation among **industries, academia, and startups**

Enhancing Indo-Japan Joint R&D: Recommendations

Increasing dialogue, dissemination of information and higher networking between researchers are some of the key recommendations for enhancing joint R&D

⦿ High ○ Medium △ Low

	Recommendation	Description	Current Status	Targets of Recommendation: Academia	Industry	Govt.
Awareness	Conduct Information Dissemination sessions	• Magazines/articles/online events including success stories & achievements for increasing awareness of Japanese R&D progress and efforts	△ No organized efforts with regards to Japan	✓		✓
	Conduct Academic Events	• Promote awareness and networking through seminars, conferences and workshops • Promote cross-publication of research journals	△ Being organized by different agencies but not continuous; Less compared to west	✓	✓	
	Facilitate Industry visits	• Organise one-to-one industry visits (one industry, one Indian institute) as industry collaborations are confidentiality bound	○ Need to be increased with Japan and its Indian counterparts		✓	✓
Connection	Address Language Barriers	• Caution for usage on a common language of instruction (English) for Indian students and scholars at Japanese institutions	△ Japanese is the current medium of instruction across Japan	✓		✓
	Promote Mobility Programs	• Increase incentives for PhD and post doc research • Increase exchange, internship and scholarship opportunities for students, researchers & faculty	△ With only a few agencies providing programs, Japan constitutes only 0.25% of Indian outbound students	✓		✓
Collaboration	Utilize Bilateral MoUs effectively through EoIs and RfPs	• Float EoIs and RFPs on a particular themes and interested institutes, faculty, scholars could submit proposals	△ EoI/RfP though DST/DBT are few in numbers and not continuous		✓	✓
	Constitute a centralized Agency	• Establish multilateral forums to catalyse long-term scientific collaboration • Single PoC for industry & academia at host institute	△ R&D Forums are less compared to west; Japan desks are few due to long time and effort commitment			✓

Source: Interaction with IITs, NRI Analysis; EoI: Expression of Interest; RfP: Request for Proposal

Enhancing Indo-Japan Joint R&D: Typical Details of Collaboration Models

Budget of different collaboration models depends on the scale, frequency and domain of collaboration

Institute Level

Type	Description	Budget / Finances	Stakeholders: Academia	Stakeholders: Industry	Stakeholders: Govt.
Consortiums aimed towards specific issue/sector	Conduct symposiums, seminars and networking events focused on a domain	Depends on the scale of the consortium, frequency of events, etc.	✓	✓	
Scholarships	Provides opportunities and financial support for study abroad programs	Stipend of 1K~1.2K USD/m[1]	✓		
Internship Program	Provides work/R&D experience for students by Companies/Universities for a short duration of upto 3 months	Recruiter provides for student's stipend (inclusive of living & travel expenses)	✓	✓	
Joint Courses / Workshops	Faculty share insights / learning on a predefined topic to fellow faculty or students	Depends on duration of joint course/workshops	✓		
Faculty Exchange Program	Faculty operates abroad at one of their university's partner institutions	Host country bears faculty's living expenses	✓		
Student Exchange Program	Students study abroad at one of their university's partner institutions	Host country bears student's living expenses	✓		
Joint Degrees	Joint degree are awarded collectively by 2 or more institutes	Depends on the structure of the joint degree	✓		
Consultancy Project	Individual faculty or faculty group contributes towards Industry R&D with defined deliverable & timeline	95.64k USD on average[2]	✓	✓	
Chair Professorship	Includes person appointed as a Professor of the University excluding Emeritus/Honorary/Visiting/Adjunct Profs.	The professor is paid within the professorial salary range (2K – 3K USD[3])	✓		

Source: Interaction with IITs

[1]MEXT Study in Japan (Monbukagakusho); [2]IITD 2017-2021 Average Data, [2] IITR Professor salary 2020

Enhancing Indo-Japan Joint R&D: Typical Details of Collaboration Models

Budget of different collaboration models depends on the scale, frequency and domain of collaboration

Bilateral/Multilateral

Type	Description	Budget / Finances	Stakeholders		
			Academia	Industry	Govt.
Call for Proposals	They are a method of calling a proposal for carrying out a project from researchers	Depends on the aim, scale and impact of the call	✓		✓
Seed Fund	Institutes allocate seed fund to develop plans for long-term programs integrating academics, students and researchers from participating universities	Depends on purpose of the seed fund (10k-30k USD[1])	✓	✓	✓
Collaborative R&D Projects	Funds for required research expenses and equipments	77.08k USD on average[2]	✓	✓	✓
Research Labs	Allows basic and applied research work by the participating institutes	Depends on the scale of the lab and its domain of work	✓	✓	✓

Source: Interaction with IITs

[1]IITK Seed Fund Data; [2]Average calculated based on IIT Delhi data for 2017-2021

Enhancing Indo-Japan Start-up Support: Collaboration Models

Accelerator programs, ecosystem support, funding, market/technology sharing, mentorship & joint product development are common collaboration models

Benefits	Details
Funding Start-ups	Encouraged funding support from Japanese conglomerates, tech giants, banks, PE and VC firms to fuel and take part ownership in the growing start-up ecosystem in India
Join Product Development	Benefit from the low cost of development and manufacturing in India by providing the Japanese best-in-class technical know-how for developing hardware based products
Mentorship	Mentorship and guidance by industry veterans to the booming number of young Indian entrepreneurs
Market/Technology Exchange	Opportunities to access the huge Indian market by sharing the latest technologies and manufacturing systems & processes
Industry Collaboration Platform	Platform where start-ups and industries from both nations can add collaboration opportunities (projects & requirements), increasing awareness and promoting collaboration

Incubation centres are largely flexible and open to different models, and collaboration can be worked out basis stakeholders' preferences and priorities

Source: Interaction with IITs and experts

Non Exhaustive

Many top academic institutions, industries, and public agencies are already collaborating with Indian institutes

Academia Partners

AIST
HOKKAIDO UNIVERSITY
九州大学 KYUSHU UNIVERSITY
KYOTO UNIVERSITY FOUNDED 1897
慶應義塾大学 Keio University Tokyo, Japan
大阪大学 OSAKA UNIVERSITY
名古屋大学 Nagoya University
RIKEN
国立大学法人 静岡大学 Shizuoka University
東京大学 THE UNIVERSITY OF TOKYO
TOHOKU UNIVERSITY
東京工業大学 Tokyo Institute of Technology
山形大学 Yamagata University

Industry Partners

AsahiKASEI
DENSO
I'm beside you
muRata INNOVATOR IN ELECTRONICS
FUJITA CORPORATION CO.,LTD.
Nagoya NAGOYA ELECTRIC WORKS CO., LTD.
NEC
NTT Group
TAKANO
Rakuten
SHARP
SUZUKI
TOSHIBA Leading Innovation
TOYOTA
Tech Japan

Public Agencies and Other Organisations

Embassy of India Tokyo, Japan
Embassy of Japan in India 在インド日本国大使館
JAXA
JICA
JETRO JAPAN EXTERNAL TRADE ORGANIZATION
JST
NEDO

Source: IIT Council, Institute websites

Joint R&D: Key Focus Areas

AI, IoT, electronics, semiconductors, new energy are few interesting areas for joint R&D. These are also supported by Government of India programs

#	Theme	Description	Government of India Programs
1	 AI, IoT and ICT	Japanese companies lack expertise in software industry and can source one of the best talents in the world in the field from India	Digital India
2	 Electronics and Semiconductors	Electronics and semiconductors are some of the top strengths of Japan and industry is expected to grow massively in India in the near future	Make in India, Production Linked Incentive Scheme
3	 Transportation and Supply-Chain	Japanese expertise could be used in the upcoming booming sector in India to increase efficiency and achieve cost reduction	Smart City Mission
4	 New Energy	Various bio and alternate fuel research is conducted at IIT Guwahati and there is also a bio-refinery for bio-fuel in Assam	National Action Plan on Climate Change, Hydrogen Energy Mission
5	 Collaborative Robotics (Cobotics)	IIT Delhi has set-up a Technology Innovation Hub for Cobotics and Japanese Academia and Industry could collaborate for the same	Start-up India
6	 Smart Agriculture and Fishery	Japan's advanced agriculture practices can open immense growth opportunities to the large but technologically weak Indian agriculture sector	Indian Council of Agricultural Research

Source: Interaction with IITs, NRI Analysis

Enhancing Indo-Japan Joint R&D: Support Programmes – Japan

Various policies and schemes have specific focus areas and intervention that can be leveraged to increase collaborations with Indian institutes across domains

Support Programmes	Domains	Details
SICORP	Multidisciplinary	• Collaborative Research Projects • JST funds Japanese researchers (SICORP) & counterpart researcher obtain funding from funding agencies in respective countries
JSPS-Indo-Japan Cooperative Science Programme (IJCSP)		• Funding support for Collaborative Research Projects
JICA-FRIENDSHIP (with IIT Hyderabad)		• Student exchange • Collaborative Research Projects • Funding for research projects • Industrial collaboration
Sakura Science		• Short-term (3 weeks) student exchange programs
Collaboration Hubs for International Research Program (CHIRP)	Information & Communication Technology	• Funding support for Collaborative Research Projects
SATREPS	Climate & Environment	• Funding support for Collaborative Research Projects • JST supports on Japanese side • JICA supports counterpart developing nations
R&D Program for Promoting Innovative Clean Energy Technology	Clean & Renewable Energy Tech	• Funding support for Collaborative Research Projects

Source: Desktop Research

Enhancing Indo-Japan Joint R&D: Support Programmes – India

Various policies and schemes have specific focus areas and intervention that can be leveraged to increase collaborations with Indian institutes across domains

Support Programmes	Domains	Details
Scheme for Promotion of Academic & Research Collaboration (SPARC)	 Multidisciplinary	• Visits and long-term stay of top international faculty • Visits by Indian students for training and experimentation • Joint development of niche courses
Global Initiative of Academic Networks (GIAN)		• Jointly supervised lectures and courses
Visiting Advanced Joint Research (VAJRA)		• Overseas research internships for students • Research programs for scientists and faculty
India-Japan Education Program (IJEP)		• Intensive courses; Remote teaching • Joint short term programs • Internships & Joint degrees
India-Japan Joint Research Laboratory Programme	 Information & Communication Technology	• Funding support for Collaborative Research Projects
Asia Pacific Network (APN) for global change research Grant	 Climate & Environment	• Support collaborative regional research, scientific capacity development, and strengthen linkages between the science, policy & practitioner communities

Source: Desktop Research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