Indian Institute of Technology, Hyderabad (IITH)
Republic of India

Republic of India
The Project for Future Researchers at IITH to Enhance Network Development with Scholarship of Japan (FRIENDSHIP), Phase 2

Project Completion Report
First Period

February 2023

JAPAN INTERNATIONAL COOPERATION AGENCY

PADECO Co., Ltd.

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Abbreviations and Acronyms

CEATEC	Combined Exhibition of Advanced Technologies
Co-PI	Co-Principal Investigator
COVID-19	Corona virus disease
C/P	Counterpart
DD	Double Degree
FRIENDSHIP	Future Researchers at IITH to Enhance Network Development with Scholarship of Japan
ICAST	International Student Conference On Advanced Science and Technology
IITH	Indian Institute of Technology Hyderabad
JCC	Joint Coordination Committee
JD	Joint Degree
JENESYS	Japan-East Asia Network of Exchange for Students and Youths
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JICA-FSA	JICA FRIENDSHIP Scholar's Association
METI	Ministry of Economy, Trade and Industry
MoU	Memorandum of Understanding
NEDO	New Energy an Industrial Technology Development Organization
OCS	Office of Career Services
PCR	Office of Public and Corporate Relations
PDM	Project Design Matrix
PI	Principal Investigator
P/M	Person-Months
PO	Plan of Operation
PR	Public Relations
R/D	Record of Discussion
SATRPS	Science and Technology Research Partnership for Sustainable Development
SDGs	Sustainable Development Goals
SDN	Software-Defined Networks
SoC	System-on-Chips
SPARC	Scheme for Promotion of Academic and Research Collaboration
SSP	Sakura Science Program
SNS	Social Networking Service

1. Progress

1.1 Progress of Inputs

1.1.1 Inputs from the Japanese Side

(1) Dispatch of Japanese Experts

The technical areas and P/M contributed by the experts thus far are shown in the table below.

Table 1-1: Assignment of Japanese Experts

No	Technical Area	Total P/M (Dec 2021–Feb 2023)		
		Field	Home	Total
1	Chief Advisor/Higher Education 1	0.60	1.95	2.55
2	Deputy Chief Advisor/Japan Desk Operation 1 (Organization Structure Development/ Career Support)	0.40	3.60	4.00
3	Higher Education 2/Engineering Education 1	0.17	0.33	0.50
4	Higher Education 3	0.50	1.70	2.20
5	Engineering Education 2	0.20	0.60	0.80
6	Japan Desk Operation 2 (FRIENDSHIP Scholarship Program/Monitoring/Academic Collaboration)	0.70	4.45	5.15
7	Japan Desk Operation 3 (Alumni Association Activity/Event Management/Industrial Collaboration/Coordinator)	0.83	3.52	4.35
8	Japan Desk Operation 4 (Portal site & Database Development/PR)	0.93	1.72	2.65
9	Japan Desk Operation 4 (Portal site & Database Development/PR)	0.00	0.45	0.45
10	Japan Desk Operation 5 (Promotion of attracting Japanese students to IITH 1)	0.17	0.70	0.87
11	Japan Desk Operation 2 (Monitoring 2)	0.00	1.00	1.00
12	Japan Desk Operation 2 (Monitoring 3)	0.00	1.00	1.00
13	Evaluation and Analysis	1.10	0.80	1.90
14	Japan Desk Operation 5 (Promotion of attracting Japanese students to IITH 2)	0.07	0.33	0.40
	Total	**5.67**	**22.15**	**27.82**

(2) Assignment of National Staff

National staff members were assigned and scheduled as shown in Table 1-2.

Table 1-2: Assignment of National Staff

No	Name	Position	Period
1	Dr. R. Sai Chandra Teja	National Consultant	February 2022~present
2	KITAOKA Kana	Project Coordinator	March 2022 (2 weeks)
3	Sangeeta Shrivastava	Project Administrator	April 2022~present

(3) FRIENDSHIP 2.0 Research Grants for India-Japan Research Collaborations

As the first batch of the FRIENDSHIP 2.0 Research Grant Program, the JICA Project Team issued a call for 18 applications and received 12 applications for academic collaboration. These 12 were selected and the program was implemented from April 2022 to November 2022. In the second batch, the JICA Project Team called for 10 applications and received 30 applications for academic collaboration and two applications for industry-university collaboration. Nine academic

collaborations and one industry-university collaboration were adopted, and the program started in January 2023.

(4) Long-Term Participants of the FRIENDSHIP 2.0 Scholarship Program

Under the FRIENDSHIP 2.0 Scholarship Program, part of the JICA's Knowledge Co-Creation Program, the JICA Project Team selected the final candidates for the first batch of 11 long-term participants (hereinafter referred to as "participants") who would be admitted as doctoral and research students in October 2022 and April 2023. The JICA Project Team assisted them in the admissions application process by coordinating with prospective supervisors of Japanese universities. However, five of the 11 candidates withdrew from the scholarship for personal reasons, leaving six participants. Fourteen applications were received for the second batch of participants to be admitted as doctoral and research students in October 2023 and April 2024, of which 10 candidates who met the application requirements were selected.

1.1.2 Inputs from the Indian Side

(1) Assignment of Counterpart Personnel

The assignment history of the counterpart personnel is shown in Table 1-3.

Table 1-3: Assignment of Counterpart Personnel (As of February 2023)

No	Personnel Plan in R/D	Name	Position	Period
1	Project Director	Prof. Murty B.S.	Director, IITH	December 2021~present
2	Project Manager	Prof. Pinaki Prasad Bhattacharjee	Dean, International and Alumni Relations	December 2021~April 2022
3	Project Manager	Prof. Panda Tarun Kanti	Dean, International Relations	April 2022~present
4	Facilitator	Prof. K. V. L. Subramaniam	Dean, Planning	December 2021~present
5	Facilitator	Prof. Saptarshi Majumdar	Dean, Academic	December 2021~present
6	Facilitator	Prof. C Krishna Mohan	Dean, Public and Corporate Relations	December 2021~January 2023
7	Facilitator	Prof. Kiran Kumar Kuchi	Dean, Research and Development	December 2021~September 2022
8	Facilitator	Prof. Chandra Shekhar Sharma	Dean, Sponsored Research and Consultancy	September 2022~present
9	Facilitator	Prof. Mudrika Khandelwal	Dean, Alumni Relations	April 2022 ~ December 2022
10	Facilitator	Prof. Mudrika Khandelwal	Dean, Alumni & Corporate Relations	January 2023~present
11	Facilitator	Prof. Shourya Dutta Gupta	Faculty-in-Charge of IITH Japan Cooperation Cell	January 2023~present
12	---	Dr. Karteek Sreenivasaiah	Faculty In-charge of Web Management, the Computer Center	December 2021~present
13	---	Radul Teja	Computer Center	December 2021~present
14	---	Pranitha Avvaru	Japan Desk staff in charge	December 2021~present
15	---	Azmath Ali SK	International Relations Department, Executive Assistant	December 2022~present

(2) Facilities and Equipment

The project office used in Phase 1 has been reserved in IITH as the office for this project and the Japan Desk. The current Japan Desk staff holds a second post International Relations Department and was stationed physically at the Japan Desk until October 2022. As of February 2023, the IITH Japan Desk staff supports the work related to the Japan Desk remotely from the International Relations Department office. In addition, a project administrator employed by the JICA Project Team has been working in the office since April 2022. The layout of the office was adjusted to allow students to visit and collect information about Japan and consult with staff, and was provided with Japanese books and goods, while shelves, computers and other items necessary for the Project Administrator's office were purchased by the JICA Project Team.

(3) Budget

The budget for Japan Desk activities was not limited, but was estimated on a case-by-case basis, and the Dean of International Relations received approval from the Director of IITH to execute the budget. There were no budget shortfalls that hampered activities.

1.2 Progress of Activities

The COVID-19 situation did not subside after the project started, and online meetings and national consultants were used to discuss, collaborate and conduct project activities with IITH. In April 2022, two members of the JICA Project Team, including the Chief Advisor, were finally able to travel to IITH, where they confirmed the current situation in IITH and held discussions with relevant parties in person. Two members of the JICA Project Team then travelled to IITH in August, followed by eight members in November, which enabled all members of the team to visit the area at least once and carry out activities there. The achievements of each activity are described below.

(1) Activities Related to the Overall Project

Activity 0-1: Develop the work plan

The work plan was prepared as scheduled. The JICA Project Team, after reviewing the past activities and achievements as well as assets that can be utilized, held discussions with IITH and prepared a work plan including the basic policy, implementation structure, and work process plan for the implementation of the work.

Activity 0-2: Conduct the baseline survey

The JICA Project Team and IITH agreed on the survey items and methods for the baseline survey, and collected and summarized the data from May to July 2022. Two local contractors were hired to conduct the survey in IITH. As the range of data to be collected was broad and it was necessary to request cooperation from each department of IITH, a letter requesting the survey was issued by the Dean of International Relations and the Director of IITH, and the cooperation of each department was requested with the letter when making enquiries to them, thereby ensuring efficient data collection. On the other hand, it was sometimes difficult to obtain the expected information because basic university management-related information and other information was not collected and managed in a measured manner within the IITH, or it was unclear which department within the IITH was responsible for managing the information. The findings were summarized in the baseline survey report.

Activity 0-3: Support the detailed planning survey

Based on the results of the baseline study, a detailed planning survey was conducted at IITH in November-December 2022. The survey was conducted by a member of the evaluation and

analysis team from the JICA Project Team together with JICA and IITH. The survey results were compiled into a detailed planning survey draft and submitted to JICA. As a result of this study, a policy for promoting India-Japan cooperation was confirmed. Details are provided in Chapter 4.

Activity 0-4: Implement regular project progress monitoring

Project progress monitoring was carried out based on the PDM and PO, and Monitoring Sheet Version 1 was prepared and submitted to JICA on 6 June 2022, after approval at the first JCC.

Activity 0-5: Implement public relations activities

The following publicity materials were prepared to publicize the activities of the Japan Desk and the project activities.

Table 1-4: PR Materials

Type of material	Objectives, targets, specifications, etc.
Japan Desk introductory leaflet	• Basic information to promote public knowledge of the Japan Desk. • For IITH faculty and students, Japanese university staff, Japanese business and industry associations, etc., and Indian business and industry associations, etc. • A4 size, color, English only
IITH introductory leaflet	• About IITH, FRIENDSHIP 2.0 and the Japan Desk • For Japanese university officials, Japanese business and industry associations, Indian business and industry associations, etc. • A4 trifold, color, Japanese/English
Japan Desk Brochure	• To make people aware of the services offered by the Japan Desk • For IITH faculty and students, Japanese university staff, Japanese business and industry associations, etc., and Indian business and industry associations, etc. • A4 size two- fold, color, Japanese/English
Japan Desk introductory video	• To promote interest in the Japan Desk by introducing its services, staff, etc. • For IITH faculty and students, Japanese university staff, Japanese business and industry associations, etc., and Indian business and industry associations, etc., and for the general public at large. • Two-minute video, posted on the portal, in English and Japanese
Japan Desk logo	• To create an image of the Japan Desk as a bridge between Japan and India cooperation and to make the Japan Desk more familiar and approachable to many people. • The logo was created by IITH students in the form of a contest. • For public relations purposes
FRIENDSHIP 2.0 logo	• JICA FRIENDSHIP logo inherited from FRIENDSHIP 1.0 and used to raise awareness of FRIENDSHIP • For public relations purposes
PR goods (pen with FRIENDSHIP 2.0 logo, paper bag, USB flash drive)	• Provided for publicity purposes when supporting in-kind by the Japan Desk.
Newsletters	• To introduce the Japan Desk activities conducted mainly through the project and the project activities. • Japanese universities, Japanese companies and industry associations, Indian companies and industry associations, IITH faculty and students, etc. • A4, about three to five pages, color, published in even months, up to Issue 3 in Japanese and English
PowerPoint material	• To introduce the Japan Desk and project activities at project promotional activities, seminars, etc.

(2) Activity for Output 1: Activities related to "Japan Desk is established at IITH"

Activity 1-1: Set up a Japan Desk by IITH and formulate an action plan

The Japan Desk Operational Plan was prepared in April 2022 and approved by the Director of IITH. The first Japan Desk Steering Committee meeting was held on 16 June 2022, where the Japan Desk Operation Plan, Japan Desk management structure and task forces were discussed and confirmed together with the project manager and facilitators. It was decided that the preparation of the Japan Desk Action Plan would be carried out by each Task Force, but the need arose to reorganize the activities of the Japan Desk and the activities of the project. This reorganization therefore took place during the detailed planning study conducted in November 2022, and an action plan was drawn up in December 2022. The structure was also reviewed by reorganizing the members of the Japan Desk Steering Committee into core and invited members. Details of the structure chart are described below in 1-10 Other Remarkable or Significant Issues Related to or Affecting the Project.

As mentioned above, a Dean of the International Relations was appointed to oversee the Japan Desk as a whole and two staff members of the International Relations Department were assigned to the Japan Desk as the staff members in charge of the Japan Desk, concurrently working in the same department. At the start of the project, they were stationed in the Japan Desk office, but due to the space limitation, they moved their office space to the International Relations Department office around early November 2022 and are currently working in the office while also working on the Japan Desk.[1]

Activity 1-2: Set up a portal site for coordinating India-Japan collaborations and assign dedicated staff to respond to inquiries

The Japan Desk portal was launched in May 2022. The portal site contains an introduction to the Japan Desk, information on the FRIENDSHIP 2.0 research funding program, information on the FRIENDSHIP 2.0 scholarship program, and other information on collaborative activities such as student exchange programs and external fellowships for studying in Japan, and is updated regularly. IITH staff assigned to the Japan Desk also use the information gathered on this portal site to provide information when responding to various referrals received at the Japan Desk. The work of updating the portal site has been carried out by the JICA Project Team through requests to the IITH Computer Centre staff, as the Japan Desk does not have sufficient manpower to do so. Under the action plan formulated this time, Japan Desk staff in charge of the portal site have been assigned, and the JICA Project Team members will provide lateral support to the Japan Desk staff in charge of the portal site, while the Japan Desk staff in charge of the portal site will be responsible for the future portal site management policy and work, including updating the portal site. The Japan Desk staff in charge of the portal site will carry out the main tasks. The total number of accesses (gross number) from May 2022, when the portal was launched, to January 2023 is as follows.

[1] According to interviews with staff members of the International Relations Department during the field assignment period from the end of January to the beginning of February 2023, a new consultant has been assigned to the International Relations Department since the summer of 2022, and the Department's operations are expanding on the advice of the consultant. The International Relations Department is expanding its operations based on the consultant's advice. However, according to the interview with the Director conducted during the field assignment, it was clearly stated that the priority of this staff member is to work at the Japan Desk.

Table 1-5: The Total Number of Accesses to the Japan Desk Portal Site

Category	Number of Accesses (descending order)	Number of Accesses from India and Japan
Japan Desk Main page	10,814	India 9,172, Japan 1,108
FRIENDSHIP Research Grant	5,262	India 4,328, Japan 646
FRIENDSHIP Scholarship	4,559	India 3,982, Japan 464
FRIENDSHIP Project	2,106	India 1,670, Japan 329
About us	1,541	India 1,077, Japan 381
What's new	1,142	India 869, Japan 152
Activity Highlights	1,124	India 834, Japan 236
Useful Link	868	India 537, Japan 143
Contact Us	234	India 185, Japan 29
Total	27,650	

The Japan Desk will also manage and operate the India-Japan collaboration database, which consolidates the achievements of India-Japan cooperation. In early February 2023, JICA project team also participated in the database development kick-off meeting held under the leadership of the faculty-in-charge of IJCC via IITH/online. At this meeting, the following work steps were identified: 1) The faculty-in-charge of IJCC will first visit the relevant Dean of the IITH departments to ask for their cooperation, and at the same time, estimate the amount of work involved in data collection, 2) The data items to be collected will be finalized by the faculty-in-charge of IJCC, referring to the model provided by the JICA project team and taking into consideration the feasibility of collecting data from within the IITH, 3) The data collection interface is expected to be Google Sheets, as this will allow the collaborating parties to input data as it arises. A summary table will be created from Google Sheets to Excel, etc. Tasks 1) and 2) will be conducted by the end of February 2023, and based on the calculated workload, the Project Team will discuss the allocation of manpower for data collection and input with the faculty-in-charge of IJCC.

Activity 1-3: Perform as one-stop consultation desk and support various activities related to academic and industrial collaboration between India and Japan

A new building where IITH's Administration Department will be located is scheduled for completion in late 2022, and there are plans for the Japan Desk to be in the same location. Academic Centre B #213, where the current Japan Desk is located, is a temporary space until the move to the new building, which has not yet been completed as of January 2023.

The Japan Desk office displays posters promoting the Japan Desk, various leaflets introducing the Japan Desk, and books and other items related to Japan, which visitors to the Japan Desk can easily pick up and browse. It has also started providing information on the following.

Japan Desk one stop window activities

1. Studying in Japan
2. Life and career while studying in Japan
3. Joint research with Japan
4. Research funding and external funding
5. Patents related to India-Japan joint research
6. Internships in Japanese companies (internships in Japan and in India)
7. IITH Alumni Association
8. Various events with Japan

In addition, the JICA project and the Japan Desk supported the organization of the following conferences conducted by IITH faculty members with various in-kind promotional materials (pens, bags to hold handouts, etc.), refreshments and other expenses.

- Computational Modeling of Damage and Seismic Vulnerability Assessment during Earthquake in Building System (12-13 May 2022)
- The 14th Asian Conference on Machine Learning (Japan Desk PR booth) (12-14 December 2022)

A total of 76 enquiries were received by the Japan Desk in the period December 2021 - December 2022. A breakdown is given in Table 1 4.

Table 1-6: Inquiries to the Japan Desk

Year/Month	Type of Enquiries	Number of Enquires	Enquirers
December 2021	FRIENDSHIP 2.0 Scholarship	4	IITH Student 2、IITH Faculty2
January 2022	FRIENDSHIP 2.0 Scholarship	7	IITH Student 7
	FRIENDSHIP 2.0 Joint Research	6	IITH Faculty 5 Japanese Faculty 1
February 2022	FRIENDSHIP 2.0 Joint Research	3	IITH Faculty 2 Japanese Faculty 1
March 2022	---	0	---
April 2022	Study in Japan	1	IITH Student 1
May 2022	---	0	---
June 2022	Consultation for students wishing to study in Japan (except for FRIENDSHIP Scholarship)	1	IITH student 1
	Internship opportunities in Japan	2	IITH student 2
July 2022	Consultation for students wishing to study in Japan (except for FRIENDSHIP Scholarship)	2	IITH student 2
	FRIENDSHIP 2.0 Scholarship	1	IITH student 1
	Internship opportunities in Japan	1	IITH student 1
	Joint research (academic collaboration)	1	IITH student 1
	Scholarship advice (except FRIENDSHIP)	1	IITH student 1
	Seminars and events	1	IITH student 1
	Others	1	IITH student 1
August 2022	FRIENDSHIP 2.0 Scholarship	21	IITH student 21
	Internship opportunities in Japan	1	IITH student 1
	Seminars and events	3	IITH student 5
	Others	2	IITH student 1, IITH faculty 1
September 2022	FRIENDSHIP 2.0 Scholarship	7	IITH student 1, IITH faculty 6
	General enquiries about Japan	1	IITH student 1
October 2022	---	0	---
November 2022	General enquiries about Japan	7	IITH student 7
December 2022	FRIENDSHIP 2.0 Scholarship	2	IITH student 2
	Total	76	IITH Student 58, IITH Faculty 16, Japanese Faculty 2

In order to further increase the number of inquiries from IITH faculty members, Japanese university faculty members, and Japanese companies, it is necessary to publicize the Japan Desk by holding various events hosted by the Japan Desk and exhibiting at CEATEC and other events, and to improve the recognition of the Japan Desk by posting the results of joint research, the Japan Desk Newsletter, various leaflets, etc. on the portal site. These activities are also included in the Action Plan.

Activity 1-4: Strengthen the alumni association as a support community for India-Japan collaboration

Interviews with FRIENDSHIP alumni as well as the Baseline Survey which was conducted in August 2022 revealed that there is no organization currently present or active that consists purely of FRIENDSHIP alumni. While a student association called JICA-FSA was established during Phase 1 of the project and consisted of both alumni and current FRIENDSHIP scholars, it is no longer active. Prior to COVID-19 and the completion of Phase 1 of the project, JICA-FSA contributed organizing events such as CONNECT IITH and orientation programs for new FRIENDSHIP participants, with the support of JICA. Although JICA-FSA is no longer operational, and there is no movement to establish a concrete group for former FRIENDSHIP participants, it was observed that alumni are willing to contribute to the betterment of the FRIENDSHIP scheme and support current participants when called upon individually. In addition, connections between seniors and juniors of FRIENDSHIP participants, especially within the respective universities they study in are present. Furthermore, informal groups and communities on social networking services (such as LINE, WhatsApp and Facebook), established among certain universities or regions continues to function, and connect both current and former FRIENDSHIP participants.

With the support of the founding members of JICA-FSA, the JICA Project Team has conducted the following activities to increase collaboration with the FRIENDSHIP alumni network, as a way to support current FRIENDSHIP participants.

I. Organized a face-to-face meeting (attended by seven alumni) in April 2022 with former leading members of JICA-FSA. The purpose of the event was to understand the current status of the JICA-FSA and to inform FRIENDSHIP alumni that Phase 2 of the project has begun,
II. Joined the JICA-FSA Facebook group and begun continuous posting from May 2022 onwards. The Facebook posts by the JICA Project Team include announcements of events organized by the Japan Desk, sharing of project newsletters, India-Japan collaboration events, etc., and self-introductions of JICA project members.
III. Offered support to migrate contents from the JICA-FSA website to the Japan Desk portal site. During the meeting in April, the JICA-FSA former leading members expressed concerns of losing their website domain registration later on in the year, and the JICA Project Team offered to establish a JICA-FSA page on the Japan Desk portal so current and future FRIENDSHIP scholars can continue to access information from the JICA-FSA page.
IV. Two alumni were invited as guest speakers to the pre-departure orientation (online) for new long-term trainees in August 2022 to share their experiences on doctoral research and careers.
V. Two alumni were invited as guest speakers to the PR session (online) for new long-term trainees in August 2022 to share their experiences on doctoral research in a Japanese university.
VI. Two alumni participated in the online exchange meeting for long-term trainees who completed their studies in September, sharing their career paths after graduation and networking among long-term trainees.

VII. The JICA Project Team facilitated organizing meetings among FRIENDSHIP and non-FRIENDSHIP scholars working in Japan, to strengthen the alumni network. A detailed description is made in Activity 3-4, Companies Approached for Industry-University Collaboration.

Activity 1-5: Advertise, promote, support a selection process and have orientation to JICA long-term trainees (FRIENDSHIP Scholarship students[2]) for further studies in Japan

The first batch of the FRIENDSHIP 2.0 Scholarship Program called 10 participants to be admitted to doctoral programs in October 2022. The application process began in December 2021 and was completed in February 2022. In January 2022, the JICA Project Team and the Japan Desk collaborated to hold a briefing session on application requirements, which was attended by about 50 IITH students. Fourteen applications were received for the 10 available positions, and document screening and online interviews were conducted. In Phase 2 of the project, with the aim of ensuring successful completion of the degree, the JICA Project Team set acknowledgment for research plans by IITH master's guides and prospective supervisors at Japanese universities as one of the application requirements. A total of 10 candidates were selected: four candidates who continued from the master's program and six new applicants. The JICA Project Team assisted the candidates in applying to universities, submitting JICA applications, and promoting communication between participants, their master's supervisors, and prospective supervisors to ensure a smooth start of their doctoral studies. In August 2022, the JICA Project Team and the Japan Desk collaborated to conduct a pre-departure orientation (online) to explain how to be prepared as a doctoral student and what to be expected as participants of the FRIENDSHIP 2.0 Scholarship Program. In addition, current participants and alumni served as guest speakers to share their experiences on doctoral research and careers.

In the process of preparation, two of the four candidates who were continuing from the master's program and two of the six new candidates declined the scholarship due to their own circumstances, resulting in the final number of participants in the first batch of six trainees. In addition, one candidate was selected from the Phase 1 participants to enter the doctoral program in April 2023 under a different selection schedule from the first batch, but declined the scholarship due to his own circumstances. In response to this result, in the second batch, the JICA Project Team plans to hold several exchange meetings between the candidates, current trainees, and alumni during the period before their departure date to provide information and promote networking, etc., so that the candidates will not lose interest in studying in Japan and will be able to make preparations.

In the second batch, the recruitment of 20 candidates who desire to enter doctoral programs from October 2023 was done more strategically with more time. As one of the strategies, the JICA Project Team set, as one of the requirements of the FRIENDSHIP 2.0 Research Grant Program, the involvement of one master student with the IITH research team and co-supervision by the IITH guide, the PI and the Japanese faculty, Co-PI. Although it was not mandatory for the students to study in Japan, the expectation was to encourage them to understand the research of the Co-PI and to be interested in studying in his/her laboratory.

The JICA Project Team encouraged students' studies in Japan through PIs in the mid-term monitoring of the Research Grant Program. The pre-announcement of the application was issued in July 2022 on the Japan Desk Portal, and about 55 IITH students attended the online PR event of the Scholarship Program held in August 2022. Current participants of the program, alumni, and experts on India-Japan collaboration presented the attractiveness of studying in Japan. The official

[2] FRIENDSHIP Scholarship students are referred to as "participants" in this report.

announcement was made on the Japan Desk Portal in October 2022, and a question-and-answer session on application requirements was held in November 2022. As a result of the advertisement, there were 14 applications, and 20 quotas were not fulfilled. It is assumed to be because of the requirement that applicants needed to obtain acknowledgement for their research plans by IITH master's guides and prospective supervisors at Japanese universities. Among 14 applications, four applications were cases in which IITH guides and prospective supervisors in Japan had collaborated through the Research Grant Program and the Scholarship Program of Phase 1 and Phase 2, and three applications were cases in which supervisors know each other. Thus, the requirement might be tough to be met by students whose IITH guides do not have any relationship with Japanese supervisors. However, in terms of the aim of ensuring successful completion of the degree, this requirement was suitable. From December 2022 to January 2023, document reviews and online interviews were conducted, and 10 candidates were selected.

In Phase 2 of the project, with the aim of ensuring successful completion of the degree, the JICA Project Team set acknowledgment for research plans by IITH master's guides and prospective supervisors at Japanese universities as one of the application requirements.

Activity 1-6: Monitor research progress of JICA long-term trainees (FRIENDSHIP Scholarship students) and support their career development

From December 2021 to June 2022, monitoring was conducted with six doctoral participants who had concerns about completing their degrees in September 2022 and one participant who had concerns about academic progress in the first year of the doctoral program. Three of the six participants received their degrees on time, one received a six-month scholarship extension due to research delays caused by the spread of COVID-19, and two participants switched to being privately funded students to pursue their degrees. One first-year doctoral participant had problems adjusting to life in Japan after coming to Japan, which hindered his research, according to an interview with his supervisor. The JICA Project Team will continue to monitor him closely.

In addition, an online exchange meeting was held in September 2022 as the final monitoring for the participants who completed the program in September 2022. Thirteen of the 19 eligible participants took part. The purpose of the exchange meeting was to hear about their outcomes of studying in Japan, and their experiences and career paths, as well as for participants to share and exchange experiences with other participants, and the meeting was successful in achieving its objective. The second part of the exchange meeting was also attended by alumni and provided a good opportunity for networking. Some SNS groups of the FRIENDSHIP alumni was introduced by the alumni. On the other hand, due to some participants' absence, it was not possible to obtain career information from them. Another challenge was it was not possible to communicate with each participant to discuss how to maintain sustainable collaboration between India and Japan. Thus, individual meeting will be conducted for the next time.

Monitoring was conducted from August 2022 to October 2022 for 19 participants scheduled to receive their degrees in March 2023 or later. Monitoring was conducted through online interviews (some face-to-face) with participants and their supervisors. The participants were interviewed about degree requirements and progress, degree review schedule, communication with their supervisors and laboratory members, and mental and physical health status to confirm the challenges of their academic progress. Subsequently, online interviews were conducted with their supervisors to obtain accurate information regarding degree completion and to confirm their view of the student's academic progress. As a result of the interviews, five participants (56%) among nine participants scheduled to complete in March 2023 and two participants (25%) among eight scheduled to complete in September 2023 had concerns about their degree acquisition on time. On the other hand, two participants scheduled to complete in September 2024 had no concerns. In some cases where there were concerns about degree completion, communication between the

participants and their supervisors was not smooth and, in some cases, the participants did not understand the degree requirements and their supervisor's view. Thus, the JICA Project Team intervened to promote their communication. For participants with concerns, a follow-up was conducted in January 2023 to check on the latest status.

In addition, the JICA Project Team started monitoring for six new participants in Phase 2, who started as research students or doctoral students in October 2022 in the period from November 2022. For the four doctoral participants, two of whom were participants from master's programs in Japan and the other two were new participants, the degree requirements and the degree review schedule were confirmed. For two new participants, their adjustment status in Japan was also confirmed. For the two research students, their adjustment status in Japan as well as their preparation status for the doctoral program application and entrance examinations were confirmed[3]. The monitoring for the four new participants was completed so far and no concerns were found.

The JICA Project Team also promoted academic collaboration between IITH and Japanese universities through monitoring. During the interviews with the current supervisors of the doctoral programs, the research fields of the participants' IITH master's guides were introduced to confirm their interest in joint research with IITH. During the First Period, the JICA Project Team and the Japan Desk coordinated the online first meeting between faculty members of IITH and the Tokyo Institute of Technology and faculty members of IITH and the University of Tokyo. It resulted in further discussion, and the University of Tokyo case led to the implementation of joint research in the FRIENDSHIP 2.0 Research Grant Program second batch, and a current FRIENDSHIP participant is one of the members of Co-PI's research team. The Tokyo Institute of Technology case is currently exploring future collaboration. The JICA Project Team will consider efficient and effective interventions for other Japanese supervisors who expressed interest in the collaboration with IITH.

The JICA Project Team also confirmed their desired career paths and job search status; the JICA Project Team provided participants with information on employment opportunities at research institutions and facilitated career guidance to participants by their supervisors. There were also requests for information on internships at Japanese companies. The timing of internship should be considered carefully not to disturb research. Thus, it is necessary to confirm opinions from supervisors. The JICA Project Team will introduce useful internship websites on the Japan Desk Portal. For new FRIENDSHIP participants, the JICA Project Team will also check their desires for internship and supervisors' opinion in the first monitoring.

In the First Period, the JICA Project conducted interviews with participants and supervisors, and it was found that the participants' own view of their academic progress may not be accurate. Therefore, it is more important to closely communicate with the supervisors and confirm accurate information and the supervisors' views. As the JICA centers also understood the challenges of academic progress through questionnaire surveys and communication with participants and supervisors, there are some overlaps that both the JICA Project Team and the JICA centers work on. Therefore, one of the improvement ideas that the JICA Project Team might focus on is the promotion of academic collaboration through interviews with supervisors from the Second Period onward.

[3] One of them came to Japan in January 2023 due to the delay of visa acquisition.

(3) Activities for Output 2: Activities related to "Academic collaboration between India and Japan is enhanced"

Activity 2-1: Select grantees and assist of joint research projects with Japanese universities or research institutions

Under the first batch of the FRIENDSHIP 2.0 Research Grant Program, IITH and the JICA Project Team have agreed in consultation to provide grants to a maximum of 18 research teams at a cost of INR 800,000 per team over eight months. For the first batch, the Japan Desk and the JICA Project Team collaborated in the recruitment process through internal IITH email notifications, application recommendations to IITH PIs and Japanese university Co-PIs in Phase 1, and recruitment orientation. Despite the short application period, 12 applications for academic collaboration were received. Subsequently, as described in the application guidelines, document screening and online interviews were conducted. In addition to the novelty and necessity of the research, the screening focused on the high sustainability of the collaboration with the partner team in Japan and the elaboration of the co-supervision plan for master students to facilitate their application for the second batch of the FRIENDSHIP 2.0 Scholarship Program, and all 12 applications were selected in March 2022, and the joint research began in April 2022.

Mid-term monitoring was conducted through online interviews with PIs in August 2022 to review the input to the research, research progress and outcomes, academic collaboration activities, and post-grant plans. In academic collaboration activities, it was confirmed whether co-supervision of IITH master's students was being conducted and, if not, the JICA Project Team reiterated the purpose of this program and promoted the implementation of academic collaboration activities including co-supervision. In October 2022, the results were confirmed through the submission of a final report from the PIs. Through the first batch of joint research, two academic papers co-authored by IITH and Japanese universities were published in international journals. In addition, 10 IITH master's students were co-supervised (see Activity 2-3 for details), seven special lectures and seminars were given by Co-PIs (see Activity 2-3 for details), and four PIs participated in seminars in Japan including online (see Activity 2-4 for details). The budget execution rate was more than 90% in 10 of the 12 cases and low in two cases (61% and 52%). This was due to the cancellation of travel to Japan due to the situation of the COVID-19 pandemic and the cancellation of procurement of consumables, but communication with PIs via online meetings and e-mail, and the use of existing consumables were conducted. As a result, all 12 collaborations were completed without problems. In addition, an online interdisciplinary research seminar by the Research Grant teams for IITH faculties and students was held in January 2023 for the purpose of sharing the outcomes of joint research and knowledge sharing among different research fields. The PIs shared the results of their research and exchanged opinions on how the research findings would contribute to Indian society, environmental and social issues, and the SDGs. About 50 people attended the seminar. Joint research outlines, results, the final report from PI and presentation materials of the interdisciplinary research seminar are shown in Attachments 3-1 to 3-4.

In the second batch, IITH and the JICA Project Team discussed and agreed to grant up to 10 projects at a maximum of 2,000,000 Indian rupees per project for an implementation period of 23 months from January 2023 to November 2024. The preliminary notification was started in July 2022. The Japan Desk and the JICA Project Team collaborated to notify the program through the Japan Desk portal and conducted an orientation (attended by about 45 IITH faculty members in August 2022), and the official announcements began in October 2022. As a result, a large number of applications were received, 30 for academic collaboration and two for industry-university collaboration; from November to December 2022, document reviews by IITH faculties and interviews by the JICA Project Team were conducted. The same screening criteria as for the first batch were used, and a total of 10 applications, nine for academic collaboration and one for industry-university collaboration, were selected. Ten joint research outlines are shown in Attachment 3-5.

In the first batch of procurement, the JICA Project Team had to negotiate payment terms with local vendors, deal with procurement of a wide variety of consumables, and deal with delays in delivery dates. The JICA Project Team used international wire transfers to local vendors; there were some cases in which local banks refused to receive the money due to the strict surveillance by the Government of India for money transfers from overseas. Thus, the JICA Project Team discussed with JICA and IITH the procurement method for the second batch, and it was decided that the Sponsored Research & Consultancy department will open an project account, and international remittance will be made from Japan to this account after signing the Sponsorship Agreement. The JICA Project Team will manage the procurement as in the first batch, but the Sponsored Research & Consultancy department will issue purchase orders and make payment. Normally, account management and operation would involve a fee, but the fee has been waived. The original plan was to start procurement for the second batch in January 2023, but the start of the procurement will be postponed until after the end of February 2023.

Activity 2-2: Implement student exchange programs with Japanese educational institutions

In order to implement strategic student exchanges in the project, the JICA Project Team consulted with Japanese universities. Information was gathered on the possibilities and conditions for student exchange, especially regarding the funding sources for the activities.

< Kumamoto University >

The JICA Project Team discussed with Kumamoto University about ICAST, which Kumamoto University holds for its partner universities, and supported the informal participation of IITH students although IITH is not a partner of Kumamoto University. Eleven students participated online in ICAST held in December 2022, three students presented their research and eight students attended as audience members.

Kumamoto University has been utilizing SSP to invite students from partner universities in several countries with SDGs as keywords, and the JICA Project Team, in consultation with Kumamoto University, supported the online participation of students from IITH in the adopted FY2022 SSP. Five students participated in the program after the recruitment of participants at the Japan Desk. In addition, discussions are underway with Kumamoto University to make IITH a target university for invitations in the FY2023 recruitment. In addition, Kumamoto University is considering the possibility of concluding an MoU with IITH.

< The University of Tokyo >

In November 2022, the JICA Project Team conducted opinion exchanges with the University of Tokyo India Office and JICA India office on India-Japan academic collaboration centered on IITH. In addition, one FRIENDSHIP alumni presented their experiences in Japan at a study abroad seminar in Delhi in December 2022, organized by the University of Tokyo. In addition, IITH will promote itself at a regular webinar scheduled to be conducted by the University of Tokyo India Office in February 2023.

< Tokyo City University >

The JICA Project Team supported the IITH International Relations Division in concluding an MoU for future academic collaboration, with the signing ceremony to be held on January 26, 2023, during Prof. Murty's visit to Japan. In conjunction with this, the SSP for IITH students will be applied, and details of the program will be discussed in the future.

< Nagoya University >

After receiving an inquiry from an IITH student about the SSP, it was confirmed that the student was a student of the PI who was implementing the first batch of the FRIENDSHIP 2.0 Research Grant Program. Therefore, the JICA Project Team explained the SSP to Co-PI at Nagoya University and supported the application of the program on a joint research basis, resulting in the selection by the SSP.

< Shimane University >

The JICA Project Team conducted online interviews to support discussions between Shimane University faculty and IITH faculty on research collaboration, which resulted in the application for the SSP and a visit to Japan by six students and one faculty member. This further led to the implementation of joint research as described below in Activity 2-3.

In addition, the JICA Project Team provided assistance to the University of Tokyo for the invitation of 11 IIT students including six IITH students in December 2022 in the SSP, in booking and utilizing the JICA accommodation. The Japan Desk portal site provided information to IITH students on scholarships for studying in Japan and study abroad programs at Japanese universities to promote student exchange. Furthermore, eight students from IITH came to Japan in January-February 2023 under the Japan Friendship Ties Programs, JENESYS organized by the Ministry of Foreign Affairs of Japan, with the support of the Japan Desk.

Meanwhile, one student from Hokkaido University (Sep-Oct 2022) and one from Ritsumeikan University (Nov-Dec 2022) were short-term exchange students from Japan to IITH. Both were dispatched for a period of one month.

Activity 2-3: Support organizing collaborative activities with Japanese educational institutes such as joint supervision of graduate students, workshops, study programs and special lectures

The JICA Project Team facilitated the implementation of special lectures, workshops, and co-supervision by Japanese universities through the first batch of the FRIENDSHIP 2.0 Research Grant Program. In the program, PIs were required to have at least one master's student participate in their team and conduct co-supervision with Co-PIs. The JICA Project Team conducted a follow-up on the implementation of co-supervision and promotion of academic collaboration activities through mid-term monitoring. As a result, 10 master's students were jointly supervised and seven open seminars and special lectures were held by Co-PIs of Japanese universities. In the First Period, implementation was limited to individual collaboration between faculty members but, in the future, it will be necessary to link this to collaboration between IITH and Japanese universities as organizations.

Table 1-7: History of Implementing Seminars by Co-PIs of Japanese Universities

Japanese Partner	Topic	Modality	Implementation date
Nagoya University	Regulation of Voltage Gated-ion Channels	Online	August 2022
Ritsumeikan University	Waste Management and Life Cycle Analysis	Online	September 2022
National Institute of Informatics	Measuring and Mitigating Shortcuts in Natural Language Understanding	Online	November 2022
Shizuoka University	How Do Microbes Coexist?	Online	November 2022
Shizuoka University	Behaviors of Conjugative Plasmids in different Environmental Conditions	Online	November 2022
Ritsumeikan University	Liquid Crystalline Polymers	Offline	November 2022
Osaka University	Lanthanide-catalyzed Organic Transformations: Air Oxidation and Hydrosilylation	Online	December 2022

The JICA Project Team and the Japan Desk also facilitated research collaboration between Japanese universities and IITH researchers. Three of the four cases led to the adoption of the second batch of the FRIENDSHIP 2.0 Research Grant Program.

Table 1-8: History of Promoting Research Collaboration

Japanese university	How it started	Progress
Shimane University	Request from Shimane University	Selected in the second batch of the FRIENDSHIP 2.0 Research Program
The University of Tokyo	Matching of a doctoral supervisor with IITH master's guide through monitoring of a FRIENDSHIP participant	Selected in the second batch of the FRIENDSHIP 2.0 Research Program
Kumamoto University	Discussion about collaboration between IITH and Kumamoto University	Selected in the second batch of the FRIENDSHIP 2.0 Research Program
Tokyo Institute of Technology	Matching of a doctoral supervisor with IITH master's guide through monitoring of a FRIENDSHIP participant	Considering research collaboration

In addition, in the opportunity of an exchange of opinions organized by JICA, Prof. Murty discussed with Gifu University which has joint degree programs with IIT Guwahati. They agreed to consider collaboration between IITH and Gifu University including joint degree programs.

Dr Mahendra Kmar, the first batch FRIENDSHIP scholarship student, as a faculty member of IIT Varanasi, organized a joint workshop at IITH on 12-13 May 2022 with the National Research Institute for Disaster Science and Technology, where he worked in Japan. Support for this workshop was provided by the project in the form of stationery and refreshments from the Japan Desk for advertisement. Other collaborations between IITH and RIKEN on machine learning led to an invitation to an international conference in Hyderabad in December 2022, where the Japan Desk exhibited a booth to promote the functions of the Japan Desk.

At the strong request of Prof. Murty, activities to promote the invitation of Japanese students to IITH were added as a new activity in the middle of the First Period. Considering the level of

interest in studying in India on the Japanese side, and after discussions with IITH, it was decided to focus on inviting students for short-term study tours. An event was held on 7 February 2023 to promote IITH to Japanese universities and companies which organize tours to universities abroad for Japanese students. The maximum number of participants was 45, and 16 out of 19 respondents to the post-event questionnaire The maximum number of participants was 45, and 16 out of 19 respondents to the post-event questionnaire were satisfied with the day's events.

Activity 2-4: Assist IITH faculty members to participate in academic conferences and seminars in Japan

The JICA Project Team supported the participation of IITH faculty members in conferences and seminars in Japan throughout the first batch of the FRIENDSHIP 2.0 Research Grant Program. One PI came to Japan through the external fund, and another PI came to Japan through the Research Grant, and they had presentations at the seminars at Japanese Universities. Two PIs had presentations at the online seminars. The first batch of the Program was conducted for a short period of eight months and did not result in any presentations at conferences.

Table 1-9: History of Participation of IITH Faculty Members to Seminars in Japan

Japanese Partner	Topic	Venue	Implementation date
Shizuoka University	Dynamic Evaluation of Pharmaceutical Contamination and Antibiotic Bacterial in Indian River	Shizuoka University	October 2022
Ritsumeikan University	Luminescent Gold-Carbenes with Elusive Gold Hydrogen Bon	Ritsumeikan University	October 2022
Ritsumeikan University	Opportunities and Challenges in Life Cycle Sustainability Analysis in Waste Management and Resource Recovery	Online	October 2022
National Institute of Informatics	Language Generation in low-resource languages: Concerns and Considerations	Online	November 2022

(4) Activities for Output 3: Activity related to "Research and technology development and Industrial collaboration between India and Japan is enhanced"

Activity 3-1: Develop a database on researchers and research seeds of IITH for enhancing India-Japan academic-industrial collaboration

The JICA Project Team agreed with the Japan Desk to consider improvements such as adding a keyword search function to the Faculty's search page (https://iith.ac.in/people/faculty/), and incorporated this into the Japan Desk's 2023 Action Plan. As a result, each faculty member was instructed to submit keywords, etc., and the system has been improved so that searching by Research Interest keywords is now possible based on this information.

Activity 3-2: Select grantees and assist in joint research projects with Japanese companies

In the 1st Period, two batches of the FRIENDSHIP 2.0 Joint Research Grant Program were recruited. For the second batch, which began in January 2023, two industry-university applications were received, and one was selected. One of the selected cases was the result of a follow-up with a Japanese company at the request of an IITH faculty member, which led to a joint research project. In the future, we will support the deepening of the relationship through monitoring, with a view to advancing to the next research step with external funds or the

company's own funds, recruiting human resources from IITH, and collaborating on educational activities in environment-related education. For external funding, JICA's SDGs Business Model Formulation Survey with the Private Sector, SDGs Business Verification Survey with the Private Sector will be proposed to companies.

In addition, the JICA Project Team approached Japanese companies interested in collaboration with IITH. Major contacts include companies that participated in Japan Day organized by the JETRO, companies contacted when they participated in an international exhibition (CEATEC[4]), the Suzuki Innovation Center within IITH, companies that participated in the M2Smart Project, companies located in Hyderabad, companies where IITH graduates work, companies that have recruited human resources from IITH, companies that signed MoUs with IITH, and companies that recruited human resources from IITH. The JICA Project Team held meetings with these companies to find out their needs for developing new technologies and entering the Indian market. Also The Project promoted IITH's research and development capabilities, suggested the possibility of working with IITH researchers, and introduced Friendship joint research grant program.

Discussions with companies revealed that, in general, Japanese companies are trying to enter the Indian market and are highly interested in conducting demonstrations in India of products and technologies that have already been developed and tested, as well as in research for localization. On the other hand, it was also found that many companies were not familiar with the latest technological trends in India and therefore, were not interested in conducting R&D in India. In the 2nd Period, The Project is considering how to make this research fund more flexible. In addition, we propose to utilize large-scale research funds such as NEDO and SATREPS as a way to attract Japanese companies.

Activity 3-3: Organize internship programs in Japan

Internships for IITH students are centrally managed by OCS. The Department of Computer Science & Engineering and the Department of Electrical Engineering award credit for the Semester Internship as part of the academic program (not compulsory). The schedule of internships for the entire university is shown in Table 1-10.

Table 1-10: Internships Managed by OCS

	Summer Internship	Semester Internship
Participants	UG & PG students	UG students
CGPA Eligibility	NIL	8 points or more
Recruitment-Selection	July-October	July-October
Implementation	May-July (Maximum of 8 weeks, between the 6th and 7th semesters)	January-July (during the 6th Semester)

The recruitment – selection process for internships conducted by OCS is as follows.

Step 1: IITH invites companies
Step 2: Company submits Internship Registration Form
Step 3: IITH assigns a student coordinator to each company
Step 4: Pre-hiring process (interviews, tests)
Step 5: Final decision by company and student
Step 6: Company notifies student of offer of employment

[4] Combined Exhibition of Advanced Technologies: International exhibition of technologies and businesses aiming to realize Society 5.0 with a focus on IT- and AI-related industries

For postgraduate students, the possibility of an internship in a Japanese company involving travel to Japan is likely to increase, as internships are possible and flexible outside of the above schedule. The Project has been guiding Japanese companies about the above internship system and has been exploring opportunities with a view to offering online internships with Japanese companies in Japan and internships at Indian branches and corporations. With regard to IT human resources, Japanese companies are increasingly interested in hiring excellent students studying at IITs due to the rising labor costs in China and Vietnam and the growing reputation of India as an IT superpower and the IITs that support it. However, companies with no experience in hiring Indians cannot take the risk of hiring them out of the blue. The Project has found that such companies show a high interest in first seeing IIT students at work in an internship. When speaking with companies interested in hiring, we explain that in addition to IIT's own on-campus recruitment, in which selection is made after a short interview, the internship approach is also effective, enabling companies to consider employing the interns after carefully assessing them through the internship program. When talking to companies interested in hiring, we explained that the internship approach is effective and check them about the possibility of an internship.

Currently, several Japanese recruiting agencies are registered with OCS and are arranging internships as a business by connecting IITH students with Japanese companies. For example, Tech Japan Inc. has established an internship platform called "Tech Japan Hub" to connect Indian IT students, including IITH students, with Japanese companies. We will consider utilizing such private sector services more efficiently in the future.

On the other hand, internships in Japan for long-term trainees studying in Japan are niche and difficult to match the interests of students with the needs of companies, partly because FRIENDSHIP 2.0 scholars are doctoral students and their research areas are limited. We will try to respond to inquiries from students on a case-by-case basis. The most likely case would be a company affiliated with the supervisor, but if there is a technical match but no experience in accepting Indian students, the project could act as a liaison between the company and the student to help realize the internship. Another option is to utilize the alumni network. Companies and institutions approached for collaboration, including possible internships, are listed in the next section, Activities 3-4.

Activity 3-4: Support organizing collaborative activities with Japanese companies such as joint workshops, study tours and special lectures and follow up outputs of the activities

The Japan Desk's first joint activity with a Japanese company, the Japan Desk and Study Abroad Sommelier, Inc., a company that offers study abroad programs and consulting services to study abroad providers and educational institutions in Japan and abroad, held an online gathering on April 1, 2022, to exchange ideas on how to promote study abroad from Japan to IITH. The event was held online on April 1, 2022. The event was facilitated by Mr. Pranitha of the Japan Desk and aimed at promoting IITH to the company's representative who was invited as a guest. A lively exchange of opinions took place between the 15 participants and the guest. The company has continued to cooperate in the promotion of inviting Japanese students to IITH. This event was held shortly after the project was launched, and there were no materials available to introduce IITH and the Japan Desk in Japanese clearly, making it difficult for people to grasp the image of IITH and the Japan Desk. Since then, brochures and an introductory video have been created and are being used at the event.

The above-mentioned event also provided an opportunity for the JICA Project Team to speak at the NAGOYA CONNECT event held on May 27, 2022, by Venture Café Tokyo, which deploys events and programs that bring together diverse people interested in innovation, and to promote

the project to startup entrepreneurs in Japan. The JICA Project Team took the opportunity to promote collaboration with IITH to startup entrepreneurs in Japan.

The second joint activity was an online study session on R&D needs of Japanese companies and collaboration with universities on August 22, 2022, with the cooperation of Mitsubishi Chemical Corporation, to which project member Dr. Sano belongs. The event was facilitated by the Project Manager, Prof. Tarun Panda. The participants learned about the company's R&D needs for new technologies and its concepts and examples of industry-university collaboration, and they exchanged opinions. Two researchers from Mitsubishi Chemical Corporation, including the director of the Materials Design Center, and Dr. Sano gave presentations and responded to questions; the Japan Desk and 17 interested faculty members participated from IITH, confirming the high level of interest.

On November 22, during his trip to IITH, Dr. Sano, Engineering Education Expert, held a seminar entitled "Let's address social issues together with Japanese industry - What are companies considering and confronting for sustainability? -," which was attended by six faculty members and 35 students from the Mitsubishi Chemical Group.

The JICA Project Team approached a number of companies to find partners for various future industry-university collaboration activities including companies with which IITH has already collaborated in the past through the 1st Phase of the Project, and promoted the attractiveness of IITH with a view to exchanges with IITH faculty and students, recruitment of students, acceptance of students for internships, joint research, and so on. At the current stage, Japanese companies' interest in IITH is biased toward recruitment and they do not have an image of joint activities. In the context of human resource recruitment, which is of high interest, the 2nd Period will start with small exchange activities targeting interested companies and lead to a wide range of joint activities. In addition, the Project would like to encourage businesspeople to visit IITH from the companies and institutions that participated in the promotional webinar for inviting students for short-term study tours to IITH held as part of the activities as described in Activity 2-3.

The names of the companies approached are listed in Table 1-11.

Table 1-11: Companies Approached for Industry-University Collaboration

Company Name	Background	Future Direction
Ryugaku Sommelier, Inc.	Interested in studying program at IIT	• Collaboration in the promotion of inviting Japanese students to study at IITH
Daiki Axis India Pvt. Ltd.	Japan Day Participating Company	• FRIENDSHIP 2.0 Joint Research
Pharm Foods International Co., Ltd.	FRIENDSHIP Scholars' working Companies	• Joint Research • Recruitment/Internship
AGC Corporation	Collaborating with IITH Prof. Kataoka	• Joint Research •
Kameda Seika Corporation	FRIENDSHIP Scholars' Employment Companies	• Joint Research • Recruitment/Internship
Nagoya Electric Works Co., Ltd.	M2Smart Project Participating Company	• Demonstration of M2Smart results in Hyderabad with IITH faculty • Recruitment/Internship
Aisin Corporation	IITH Campus Recruiter	• Joint Research • Recruitment/Internship
Mitsubishi Chemical Corporation	Project Expert Affiliation	• Joint Research • Recruitment/Internship
Mitsubishi Chemical Systems Corporation	Project Expert Affiliating company	• Joint Research • Recruitment/Internship

Company Name	Background	Future Direction
Toshiba Transmission & Distribution Systems (India)	Japanese companies near IITH	• Co-sponsored event with Japan Desk
Open Innovation Promotion Office, Nagoya University	University accepting long-term trainees	• Joint Research • Co-sponsored event for Faculty Exchange Program
Suzuki Innovation Center	Projects funded by Suzuki Corporation within IITH	• Co-sponsored event with the Japan Desk
Enrission Inc.	Operates a Shiru Café at IITH	• Recruitment/Internship • Co-sponsored event with the Japan Desk
Willings, Inc.	IITH OCS registered company	• Recruitment/Internship
Tech Japan, Inc.	IITH OCS registered company	• Recruitment/Internship
Zenken Corporation	IITH OCS registered company	• Recruitment/Internship
Satven Japan	CEATEC Participating Companies	• Recruitment/Internship
Mercari, Inc.	Recruiting IITH graduates	• Recruitment/Internship • Joint Research
Beyond Next Ventures, Inc.	MoU with IITH	• Recruitment/Internship
Worldscapte Business Solution, Network Co., Ltd.	Participating to the event with Prof. Murty	• Join Research • Joint Project
STATION Ai Co., Ltd.	Participating to the event with Prof. Murty	• Join Research • Co-sponsored event with the Japan Desk • Window to startups in Japan
Kinki Nippon Tourist Co., Ltd.	Participating to the event with Prof. Murty	• Study Tour to IITH • Co-sponsored event with the Japan Desk
JETRO Headquarters, Bangalore Office, New Delhi Office	Japan Day organizing institute.	• Co-hosted Japan Day • Recruitment/Internship • Business Support for FRIENDSHIP Alumni
The National Conference of the Association of Small Business Entrepreneurs		• Recruitment/Internship • Introduction of SMEs interested in India
NEDO New Delhi Office		• Joint research funding

Activity 3-5: Support technologies developed jointly by IITH and Japanese partners to be demonstrated at exhibitions and seminars in Japan

The Project in consultation with IITH, IITH participated in CEATEC 2022, which IITH exhibited continuously in the past. The purpose of the participation in the exhibition was to promote IITH, its researchers and research activities in related technologies, and IITH more broadly at the exhibition as part of the IITH's PR efforts, and to seek contact with Japanese companies and universities in various forms, including academic and industry-university collaboration, as well as employment with Japanese companies. IITH exhibited at CEATEC in three areas: a booth at the exhibition site, an online exhibition, and an online corporate seminar. Prof. Kiran Kuchi, Dean of Research & Development, was in charge of the exhibition (replaced by Prof. Chandra Shakhar Sharma just prior to the event) and recruited interested professors within the university. Five faculty members showcased their research at the booth and three faculty members presented their research at the online corporate seminar.

The faculty members who exhibited and the research topics they presented are listed in Table 1-12.

Table 1-12: CEATEC Participating Faculty

Faculty	Research Topic	Category
Dr. Chandra Shekhar Sharma Professor, Dean of Research & Development/Department of Chemical Engineering	Industry-University Collaboration for R&D at IITH	• Online Corporate Seminar
Dr. Kiran Kuchi Professor, Electrical Engineering Dept.	5G Technology: NB-IoT SoC	• Online Corporate Seminar • Booth & Online Exhibition
Dr. P. Rajalakshmi Professor, Electrical Engineering Dept.	NMICPS Technology Innovation Hub on Autonomous Navigation Foundation at IIT Hyderabad	• Online Corporate Seminar • Booth & Online Exhibition
Dr. Praveen Tammana Assistant Professor, Computer Science & Engineering	In-Network Security using SDN and P4 Programmable Data Planes	• Online Corporate Seminar • Booth & Online Exhibition
Dr. Maunendra Sankar Desarkar Associate Professor, Computer Science & Engineering	Natural Language Generation for Different Input Contexts	• Booth & Online Exhibition
Dr. C Krishna Mohan Professor, Computer Science & Engineering	Surveillance Video Analytics for Smart Cities using AI	• Booth & Online Exhibition

The booth exhibition attracted a total of 117 visitors, the breakdown of which is shown in Table 1-13.

Table 1-13: CEATEC Booth Exhibition Visitors

Category	No. of visitors
Private Company	91
Venture Capital	3
Japanese University	8
Research Institute	4
Others (JETRO, METI, etc.)	11
Total	117

In addition, the online corporate seminar attracted an audience of 124. The breakdown is shown in Table 1-14.

Table 1-14: Breakdown of Persons Attending the CEATEC Online Corporate Seminar

Category	Audience Members
Private Company	96
Japanese University	12
Research Institute	3
Others (JETRO, METI, etc.)	13
Total	124

Through various dialogues with visitors, we learned that Japanese companies in general are becoming more interested in India, especially in IIT, which is perceived as an excellent university and student body. However, there was no concrete interest in the specifics of IIT's research.

For those companies that were highly interested in IITH, we support activities that first bring them into contact with IITH, including registration with IITH's OCS to recruit students and exchange events such as company introductions to students, in addition to sending newsletters to companies that we have met through this exhibition. Follow-up is provided on an individual basis. Currently, one company is interested in registering with OCS and one company is interested in holding an exchange event, so we are coordinating with them.

In particular, companies that stop by local booths often have a certain amount of interest in India, and the venue is a good place for dialogue with such Japanese companies. It would be effective to send young IITH faculty members to the CEATEC venue in the future to experience dialogue with Japanese companies and raise awareness within IITH of industry-university collaboration with Japanese companies. Also, having Japanese companies engage in direct dialogue with IITH researchers would be effective in promoting India and the IITH.

Activities of progress management: Organize JCC meetings

During the First Period, JCCs were held on the following dates. The first JCC was conducted online and the second JCC was a hybrid of online and face-to-face meetings.

The first JCC	2 June 2022
The second JCC	1 December 2022

1.3 Achievement of Outputs

(1) Achievement of Outputs

Details of the achievement status of each output are shown in Table 1-15. Although it is difficult to evaluate the level of achievement numerically because no numerical targets have been set for each indicator, achievement and progress were confirmed for each output.

Table 1-15: Achievement of each Output on PDM

Output	Indicator	Achievement
Output 1: Japan Desk is launched at IITH	1.1. Japan Desk is established at IITH and operated with sufficient staffs and funds allocated by IITH sustainably and autonomously.	• Japan Desk Operational Plan and Action Plan have been drafted (April 2022). • Conducting two times of Japan Desk Steering Committee meetings (16 June 2022 and 3 February 2023) • Preparation of the Japan Desk Action Plan (December 2022). • Two staff members were assigned to the Japan Desk (holding two posts in the Japan Desk and another department). • There was no specific allocation for the budget, and the Dean IR executed the necessary expenses for each activity with approval from the Director as needed.

Output	Indicator	Achievement
	1.2. Japan Desk responds to inquiries from *** IITH students and *** Japanese institutions annually as a focal point of collaboration between India and Japan.	Total number of enquiries: 76 (IITH student 58, faculty of Japanese university 2)[5]
	1.3. *** or more accesses to the Portal Site of Japan desk are counted yearly since 1-year after launch.	27,650 accesses
	1.4. *** or more events for Friendship alumni program are held every year.	Completed: one event A hearing event was held in April 2022 to assess the current status of the alumni network and alumni interests.
Output 2: Academic collaboration between India and Japan is enhanced.	2-1. *** or more academic papers coauthored by IITH and Japanese academic institutions are published at international journals or conferences.	Ongoing: two papers (in the FRIENDSHIP 2.0 Research Grant 1st batch) Six other papers have been submitted or are under preparation.
	2.2. *** or more lecturers and workshops are jointly hold by IITH and Japanese academic institutes.	Ongoing: 12 Projects (in the FRIENDSHIP 2.0 Research Grant 1st batch) Three open seminars were held by IITH PIs. Nine open seminars and lectures were held by Japanese Co-PI.
	2.3. *** or more Master or PhD students are trained jointly by IITH and Japanese academic institutions.	Ongoing: 10 students (in the FRIENDSHP 2.0 Research Grant 1st batch) 10 IITH master students were co-supervised in the Program.
Output 3: Research and technology development and Industrial collaboration between India and Japan is enhanced.	3-1. *** or more accesses to database for academic and industrial collaboration are counted yearly since 1-year after launch.	Ongoing The design of the database is being discussed with IITH.
	3.2. *** or more lecturers and workshops are jointly hold by IITH and Japanese companies.	Ongoing: two events • Ryugaku Sommelier, Inc. Event • Mitsubishi Chemical Corporation Event
	3.3. *** or more joint research projects are implemented between IITH and Japanese companies.	No achievement yet. (IITH research was presented at one international exhibition.)
	3.4. *** or more technology developed by joint research between IITH and Japanese companies are displayed at seminars or exhibitions in Japan.	Ongoing:1 Participated in CEATEC 2022 to exhibit IITH research activities.

(2) Considerations on Effectiveness and Efficiency

At this time, it is difficult to assess effectiveness and efficiency.

[5] In addition, the Japan Desk received 16 enquiries from IITH faculty members on the FRIENDSHIP 2.0 Research Grant Program, FRIENDSHIP 2.0 Scholarship program, and other,

1.4 Achievement of the Project Purpose

(1) Achievement of Project Purpose

The progress to achieve the project purpose of "Establish a sustainable platform for academic and industrial collaboration between India and Japan at IITH" is shown in Table 1-16. At the one-year point after the start of the project, no significant progress has yet been made.

Table 1-16: Progress to Achieve the Project Purpose

Objectively Verifiable Indicators	Achievement
1. *** or more double or joint degree programs are agreed between IITH and Japanese institutions which accept trainees from IITH.	Ongoing: Currently examining the possibility of JD with Gifu University.
2. *** or more IITH laboratories are engaged in research exchanges with Japanese institutions which accept trainees from IITH.	No achievement yet.
3. *** or more MoUs are signed between IITH and Japanese industries.	Ongoing: One MoU MoU with Tokyo City Univ. (Jan. 2023) Renewed MoU with Osaka Univ. (Jul. 2022)
4. IITH and Japanese partners obtain collaboratively *** or more external research funds.	No achievement yet.

(2) DAC Evaluation Criteria (Observations on Relevance, Coherence, Effectiveness, Impact, and Sustainability)

Relevance

Relevance is HIGH. In "Vision 2020," which defines India's medium- and long-term future goals for the country, science and technology are positioned as the most important means to achieve goals. In addition, the latest policy goal document, Strategy for New India @75, advocates to become one of the top 50 countries in the Global Innovation Index by the World Intellectual Property Organization and others, and to invest 2% of GDP in R&D. The project is highly appropriate as it aims to contribute to the sustainable development of human resources for academic and industrial sectors in Japan and India by developing a self-sustaining and sustainable platform for academic collaboration between Japan and India in IITH.

Coherence

Coherence is HIGH. One of the priority areas of the Country Assistance Policy is "Strengthening Industrial Competitiveness," which is positioned under Development Agenda 2-3 "Human Resource Development and Human Resource Exchange Promotion" (Advanced Industrial Human Resource Development Program). The Japanese government is providing all-Japan support to IITH through industry, government, and academia. JICA is providing various forms of support, both soft and hard components, under the "Collaboration with IITH." This project is a part of the program that provides technical cooperation from the aspect of human resource development, focusing on the promotion of joint research and the acceptance of participants in the scholarship program.

Effectiveness

Following a detailed planning survey, conducted in November 2022, JICA, IITH, and the JICA Project Team held discussions to refine the PDM and developed the following revised draft project goals.

- Users of the Japan Desk evaluate Japan Desk's service that they received with a more than *** % satisfaction rate.
- Fifty or more MoUs are newly signed or renewed between IITH and Japanese academic institutions and/or industries after Phase 2 started.
- Among those newly signed MoUs between IITH and Japanese academic institutions and/or industries after Phase 2 started, more than 50% of MoUs are active, which means that some tangible collaborative activities have been carried out.
- More than 10 collaborative activities/programs between IITH and Japanese partners are carried out based on the institutional agreement other than MoUs.

In the First Period, through the FRIENDSHIP 2.0 Research Grant Program, co-supervision of IITH master's students with Japanese Co-PIs and academic collaboration activities were promoted. In addition, the JICA Project Team has promoted the implementation of student exchange programs and research collaboration with Japanese universities such as the University of Tokyo, Tokyo City University, Tokyo Institute of Technology, Kumamoto University, and Shimane University. By building on the achievements of academic collaboration, the JICA Project Team encourages the conclusion of MoUs and implementation of joint activities and programs based on agreements among organizations in the future. In the area of industry-academic collaboration, the JICA Project Team has approached mainly Japanese companies that have cooperated in Phase 1, communicated the attractiveness of IITH, including its strong R&D capabilities and diversity of research fields, and gathered opinions from Japanese companies on collaboration with the IITH. Based on the results of these activities, the JICA Project Team will promote interactions between IITH faculty and students and Japanese companies, internships for students, and joint research, leading to the conclusion of MoUs.

Since the role of the Japan Desk has been clarified through the Detailed Planning Survey, the JICA Project Team and the Japan Desk will accelerate India-Japan collaboration by strengthening the functions of the Japan Desk based on the Action Plan.

Efficiency

Due to the impact of the spread of COVID-19, the first phase of the JICA Project Team members' field trip was initially planned for only one trip in November 2022, and during the period without travel, the JICA Project Team utilized online meetings and local staff to discuss and collaborate with IITH and conduct project activities without any delay.

In April 2022, when the outbreak of COVID-19 had subsided, the first trip of the team members was realized in order to further promote local activities, resulting in an acceleration of understanding of IITH's current situation and discussion with relevant parties. Subsequently, the team traveled in August and November 2022 while confirming the status of COVID-19 and, in the First Period of the project, project activities were promoted through three field trips. On the other hand, it was difficult to carry out activities within the limited period of the field trips. In addition, it proved difficult to maintain the motivation of C/Ps in remote activities. Based on this experience, in the Second Period, it is necessary to increase the number of local activities by the team members and to work in collaboration with the Japan Desk.

Impact

At this time, it is difficult to assess.

Sustainability

Activities were organized in the detailed planning survey conducted in November 2022, and an action plan was prepared in December 2022. Through face-to-face discussions between the JICA

Project Team and the Japan Desk in the field, the role of the Japan Desk was clarified, and the importance of the organizational structure and capacity development to function as a hub in detail was made clear. It was proposed and confirmed that the IJCC would be established to coordinate all IITH cooperation activities with Japan, and that the Japan Desk would play a central role in the cell, thereby establishing a system for more organized management of India-Japan cooperation in the IITH. In addition, the IITH Japan Desk Steering Committee was restructured so that it can make decisions on Japan Desk policies and operations more efficiently and effectively by reducing the number of its steering committee members. With the establishment of this structure, it can be judged that organizational sustainability is being established.

1.5 Changes of Risks and Actions for Mitigation

Risk factors related to the project and actions taken to mitigate them are listed in Table 1-17:.

Table 1-17: Risk Factor and Action for Mitigation

No.	Risk Factor	Action for Mitigation
1	The project precondition is "The restrictions on the movement of people due to COVID-19 are gradually being relaxed." However, COVID-19 cases were spreading in India in January 2022.	The JICA Project Team had planned to expedite the first travel to India from November 2022 to January to February 2022. However, the travel was suspended in accordance with JICA's country-specific infectious disease control measures due to the increasing number of COVID-19 cases in January 2022. Continuous efforts were made to gather information to enable the experts to travel promptly after the suspension was lifted. In addition, online discussions with IITH continued and activities were carried out.
2	Procreant for Joint Research was at a risk of facing delays, since the JICA Project Team was unable to open a local bank and was unable to conduct payment at a timely manner.	The JICA Project Team took measures to avoid payment and procurement delays by conducting international wire transfer from Japan as well as limiting selection of vendors who are able to accept international wire transfer. Japanese experts also brought cash during each visit, and cash payments were made to vendors for whom international remittances were not possible.

1.6 Progress of Actions Undertaken by JICA

The actions taken by JICA to address the risk factors are described in Table 1-18.

Table 1-18: Risk Factor and Action Taken by JICA

No.	Risk Factor	Action for Mitigation Undertaken by JICA
1	The project precondition is "The restrictions on the movement of people due to COVID-19 are gradually being relaxed." However, COVID-19 cases were spreading in India in January 2022.	JICA shared the latest local information and travel policy with the JICA Project Team.

1.7 Progress of Actions Undertaken by IITH

The actions taken by IITH to address risk factors are described in Table 1-19.

Table 1-19: Risk Factor and Action Taken by IITH

No.	Risk Factor	Action for Mitigation Undertaken by IITH
1	The project precondition is "The restrictions on the movement of people due to COVID-19 are gradually being relaxed." However, COVID-19 cases were spreading in India in January 2022.	IITH provided information on the latest inspection situation in India and IITH's infection control policy to the JICA Project Team and suggested suitable timing for traveling to India.

1.8 Progress of Environmental and Social Considerations

Based on JICA's guidelines, this project is classified as Category C regarding environmental and social considerations, so there are no special factors that need to be considered.

1.9 Progress of Considerations on Gender/Peace Building/Poverty Reduction

The Project promotes gender equality by being gender-sensitive in the FRIENDSHIP 2.0 Research Grant Program, FRIENDSHIP 2.0 Scholarship Program, and all other activities, and by always capturing gender data in baseline surveys and monitoring surveys. The JICA Project Team will always respect the diversity of participants. In the FRIENDSHIP 2.0 Research Grant Program selection process, attention was also paid to technologies that contribute to improving the community environment.

1.10 Other Remarkable or Significant Issues Related to or Affecting the Project

Considerable Issues Discussed in the Detailed Plan Survey

A Detailed Planning Survey was conducted in November 2022 and a second JCC was held in December 2022 toward the full-scale activity period of the project activities. The main policies confirmed and agreed upon are as follows.

(1) Japan Desk Structure

Its name will be changed from the Japan Desk to IITH Japan Desk to more clearly indicate that the Japan Desk is an organization by IITH for IITH.

The composition of the members of the Steering Committee, the body that formulates and approves the Japan Desk's operational plan and action plan and monitors the activities of the Japan Desk, was changed. Specifically, the Japan Desk Steering Committee will be chaired by the Dean of International Relations and will include the Dean of Sponsored Research & Consultancy, Dean of Alumni and Corporate Relations, Faculty in Charge of IITH Japan Cooperation Cell, Japan Desk Staff, and the JICA Project Team as key members to facilitate more intensive communication, decision-making, and actual activities. The other deans will be invited to committee meetings and are expected to carry out related activities in line with the decisions of the key members. In addition, as a result of IITH's reorganization, the Dean of Research and Development's operations were expanded and split into two separate entities: the Dean of Sponsored Research and Consultancy and the Dean of Innovation, Translation and Startups. The former, being more focused on research, became a core member of the Steering Committee, while the latter became an invited member. The Steering Committee will meet every three to four months. The new organizational chart is as follows.

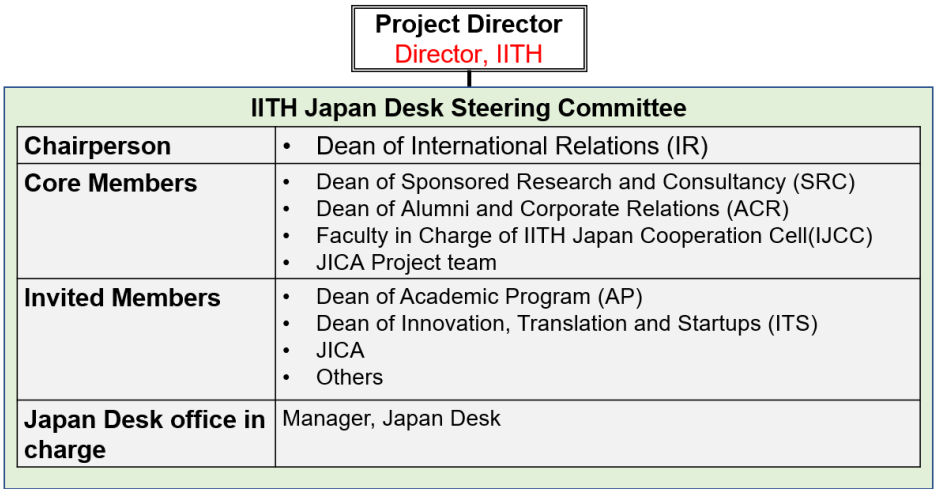


Figure 1-1: Newly Composed Japan Desk Steering Committee

As described in Activity 1-1, staff members are assigned to work concurrently with the International Relations Department. However, as the work of the International Relations Department has expanded, the concurrent staff members have become extremely busy, and a request from the Dean of International Relations/Chair of the IITH Japan Desk Steering Committee to the Dean for additional staff was also raised at the 2nd JCC, but has not yet been realized. Although the Director has clearly stated that the priority duties of the concurrent staff are those of the Japan Desk, in reality, the priority duties lie with those of the International Relations Department. This is partly due to the fact that the Director of International Relations and the Japan Desk Steering Committee Chair are the same person. In this context, with the official launch of the IJCC, a faculty-in-charge of IJCC has been appointed, and as the first concrete practical step, the development of a Japan-India collaboration database will be started under the lead of the faculty-in-charge of IJCC. The workload for the IJCC/Japan Desk will be presented and a request for additional staff for the IJCC/Japan Desk is being considered again.

The Japan Desk Action Plan will promote the following 10 main activities. Among them, the main pillars of its role will be to operate a portal site, build a database of various activities related to cooperation and exchange between IITH and Japan, and function as a one-stop window that effectively uses this information.

IITH Japan Desk Action Plan for 2023

1. Japan Desk Steering Committee
2. One-stop service desk
3. IITH Japan Desk portal site
4. IITH Japan collaboration database
5. IITH researchers and research seeds to enhance India-Japan collaborations
6. Joint events (cultural interactions with school children)
7. Campus tour for Japanese visitors
8. Support for the alumni association of IITH students studied/working in Japan
9. Public relations
10. FRIENDSHIP Research Grant Program and FRIENDSHIP Scholarship Program (mainly taken care of by the JICA Project Team)

(2) Establishment of IJCC

A new IJCC will be established to coordinate all IITH cooperation activities with Japan, and the Japan Desk will play a central role in the Cell. Office space for the IJCC was proposed. A proposal for the establishment of the IJCC was submitted by the Dean of International Relations to the Director of IITH in January 2023.

Based on that proposal, a structure chart for the IJCC, IITH Japan Desk, and other related organizations was drafted at the second IITH Japan Desk Steering Committee meeting held in early February 2023, as shown in the figure below.

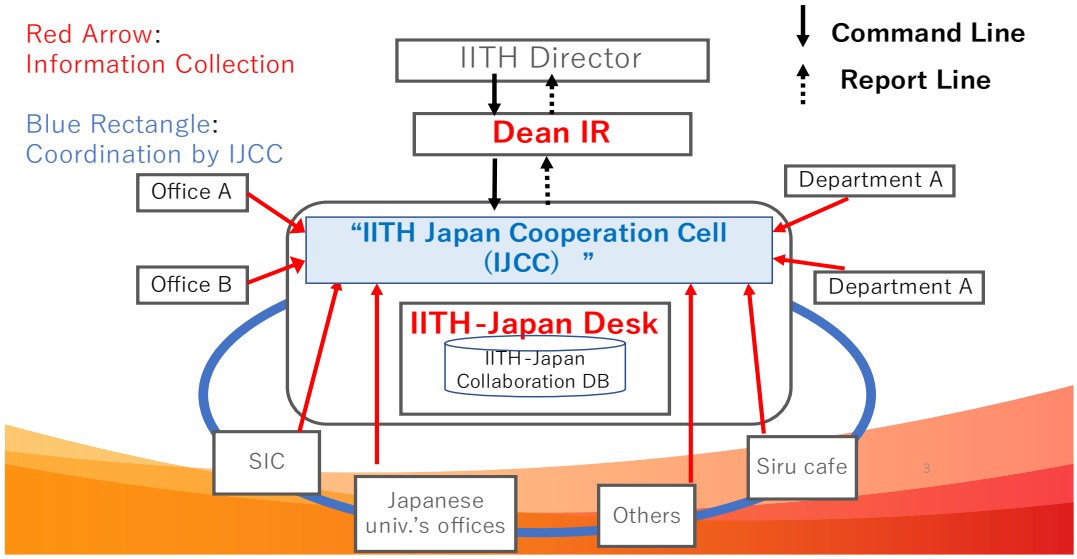


Figure 1-2: The Drafted Structure Chart

The roles of the IJCC and IITH Japan Desk were discussed at the same Steering Committee meeting as follows and are currently being finalized within IITH.

< Role of IJCC >

IJCC is established in order to bring all the information of Japan related activities in IITH and take place a central role in all activities related to Japan by Japan Desk, Siru café, and SIC etc.

- To become the channel to collect data about the collaborations with Japan scattered around IITH.
- To make a policy to improve the collaboration with Japan and create a synergy among activities carried out by the different entities inside IITH.
- To coordinate among the different entities dealing with collaborative activities with Japan

< Role of Japan Desk >

Japan Desk is the implementation body of IJCC.

- To store the data about the collaborations with Japan, which is collected through IJCC, into IITH-Japan collaboration database, and manage it.
- To utilize database by itself as well as let other entities inside IITH utilize the database.
- To carry out activities that are written on Japan Desk Action Plan.

(3) Targeted Science and Engineering Fields

Initially, this project focused on five areas but, based on the expansion of IITH's target areas, it was decided to expand the target areas of this project to the following nine areas. However, the activities of this project will be carried out regardless of these target fields. There will be no change in the composition of the consortium, which consists of Japanese universities and other organizations.

1. Energy, Environment and Climate Change Studies
2. Next-Generation Communication Technology
3. Nanomaterials, Nanosciences and Nanotechnology
4. Sustainable Development
5. Design, Materials, and Manufacturing
6. Artificial Intelligence and Robotics
7. Biosciences and Healthcare
8. Breakthrough Fundamental Sciences
9. Humanity, Culture, and Future Societies

(4) Building Sustainable Relationships between IITH and Japanese Universities

In order to build a sustainable relationship between IITH and Japanese universities, the following policies were confirmed.

- It was recognized that JD/DD programs are effective for sustainable and strong cooperation between IITH and Japanese universities. However, since the formation of JD/DD with Japanese universities is not easy due to Japanese laws and regulations, we will accumulate co-supervision through this project, joint research through other sources of funding, and doctoral programs for FRIENDSHIP scholars.
- We will ensure that young faculty members newly joining IITH will have opportunities for exchange with Japan on a priority basis.
- Promote visits to IITH by students and faculty from Japanese universities.

(5) Building Sustainable Relationships between IITH and Japanese Industry

Explore possibilities for activities with Japanese companies with whom IITH has MoUs in order to build sustainable relationships with Japanese companies and industry associations, and to promote the recruitment of IITH students by Japanese companies.

(6) Effective Collaboration with the Consortiums

On the occasion of Director Prof. Murty’s visit to Japan in January 2023, exchanges were held with members of the IITH Support Consortium. The consortium will continue to be actively utilized in the future.

(7) Utilizing Alumni Resources

Former FRIENDSHIP Scholars and IITH alumni who have worked or studied in Japan are an important resource with great potential for strengthening India-Japan collaborations, and we will actively utilize their networks.

2. Delay of Work Schedule and/or Problems

The original plan envisioned that the baseline survey would be completed by August 2022 and the detailed planning survey by September. In reality, planning for the baseline survey was done from February to April, data was collected and consolidated from May to July, and data compilation and reporting was carried out from August to September. Data collection took longer than expected due to the wide range of data to be collected, which were scattered throughout the IITH. The detailed planning survey needed to be conducted based on the results of the baseline survey, so the schedule was adjusted, and the detailed planning survey was undertaken from late October to mid-December and summarized in a report.

As a result, the project completion date was pushed back from the originally scheduled mid-December 2022 to mid-February 2023, but this schedule adjustment had no impact on other activities.

3. Modification of the Implementation Plan

No changes to the implementation plan have occurred.

4. Current Activities of the Government of India to Secure Project Sustainability after its Completion

In the National Education Policy 2020[6], the Indian Ministry of Human Resource Development points out that knowledge creation and research are essential for growing and sustaining a large and vibrant economy, uplifting society, and inspiring the nation to continually rise to new heights. The policy cites Japan as a powerful knowledge society, one that has achieved intellectual and material wealth through new knowledge in the sciences and prominent and fundamental contributions to the arts, language, and culture, and has strengthened and uplifted not only its own civilization but also those aspects of other civilizations around the world. This indicates that they have high expectations for Japan in terms of knowledge creation and research, including in science and engineering.

Furthermore, India's Ministry of Education's Annual Report 2020-2021[7] states that the Japanese Ministry of Education has posted an invitation for government-sponsored international students on its portal site, indicating that the ministry is promoting study in Japan. The report also states that the SPARC was launched in 2018 and supports about 600 joint research projects, and Japan is among the 28 countries that are eligible for this program.

[end of document];

[6] https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf
[7] https://www.education.gov.in/sites/upload_files/mhrd/files/document-reports/AR-MoE-Eng.pdf

Project Monitoring Sheet I （Revision of Project Design Matrix）

Project Title: The Project for Future Researchers at IITH to Enhance Network Development with Scholarship of Japan (FRIENDSHIP), Phase 2

Implementing Agency: Indian Institute of Technology Hyderabad (IITH)

Target Group: Students intending to be researchers or engineers and academic staff of IITH and other academic or industrial institutions in India or Japan, Faculty members of IITH

Period of Project: December 2021 - May 2027

Project Site: IITH

Version 02

Dated: 14th, February 2023

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Human resources which contribute to academic and industrial development in India and Japan are continuously produced through a platform for academic and industrial collaborations between two countries at IITH.	1.*** or more IITH students, including scholarship grantees, obtain positions at Japanese or Indian academic or industrial institutions.	➢Record by IITH ➢Related journals and reports ➢Interviews with institutions	Preconditions ➢There are no major changes to the international and bilateral political and economic environment which promote collaboration between Japan and India. ➢There are no major changes to Japanese assistant policy to IITH and IITH's university management policy. ➢The restrictions on movement of people in the COVID-19 is gradually being relaxed.	No achievement yet	
	2.IITH and Japanese partners collaboratively obtain *** or more large-scale competitive research funds.			No achievement yet	
	3.IITH and Japanese partners jointly applies for *** or more patents annually.			No achievement yet	
	4.*** or more outcomes of joint researches by IITH and Japanese partners are utilized in academic or industrial sectors.			No achievement yet	
Project Purpose					
To establish a sustainable platform for academic and industrial collaborations between India and Japan at IITH.	1.*** or more double or joint degree programs are agreed between IITH and Japanese institutions which accept trainees from IITH.	➢Record by IITH ➢Related journals and reports ➢Interviews with institutions		Ongoing: Currently examining the possibility of JD with Gifu University	
	2.*** or more IITH laboratories are engaged in research exchanges with Japanese institutions which accept trainees from IITH.			No achievement yet	
	3.*** or more MoUs are signed between IITH and Japanese industries.			Ongoing: One MoU MoU with Tokyo City Univ. (Jan. 2023) Renewed MoU with Osaka Univ. (Jul. 2022)	
	4.IITH and Japanese partners obtain collaboratively *** or more external research funds.			No achievement yet	
Outputs					
1.Japan Desk is launched at IITH.	1.1.Japan Desk is established at IITH and operated with sufficient staffs and fund allocated by IITH sustainably and autonomously.	➢Record by IITH ➢Interviews with institutions	External conditions ➢Sufficient number of IITH students (including graduates) who wish to have long-term training in the master's and doctoral courses in Japanese universities. ➢Major portion of graduates of long-term trainees of the project remain at industry and academic institutions in Japan and India. ➢The interest and demand for India in Japanese academic and industrial sectors has not diminished.	Ongoing •Japan Desk Operational Plan and Action Plan have been drafted (April 2022). •Conducting two times of Japan Desk Steering Committee meetings (16 June 2022 and 3 February 2023) •Preparation of the Japan Desk Action Plan (December 2022). •Two staff members were assigned to the Japan Desk (holding two posts in the Japan Desk and another department). *There was no specific allocation for the budget, and the Dean IR applied to the Director for approval and execution of the necessary expenses for the activities as needed.	
	1.2.Japan Desk responds to inquiries from *** IITH students and *** Japanese institutions annually as a focal point of collaboration between India and Japan.			Ongoing Total number of enquiries: 76 (IITH student 58, faculty of Japanese university 2)	
	1.3.*** or more accesses to the Portal Site of Japan desk are counted yearly since 1-year after launch.			Ongoing 27,650 accesses	
	1.4.*** or more events for Friendship alumni program are held every year.			Completed: one event A hearing event was held in April 2022 to assess the current status of the alumni network and alumni interests.	
2.Academic collaboration between India and Japan is enhanced.	2.1.*** or more academic papers coauthored by IITH and Japanese academic institutions are published at international journals or conferences.	➢Record by IITH ➢Related journals and reports ➢Interviews with institutions		Ongoing: two papers (in the FRIENDSHIP 2.0 Research Grant 1st batch) Six other papers have been submitted or are under preparation.	
	2.2.*** or more lecturers and workshops are jointly hold by IITH and Japanese academic institutes.			Ongoing: 12 Projects (in the FRIENDSHIP 2.0 Research Grant 1st batch) Three open seminars were held by IITH PIs. Nine open seminars and lectures were held by Japanese Co-PI.	
	2.3.*** or more Master or PhD students are trained jointly by IITH and Japanese academic institutions.			Ongoing: 10 students (in the FRIENDSHP 2.0 Research Grant 1st batch) 10 IITH master students were co-supervised in the Program.	
3. Research and technology development and Industrial collaboration between India and Japan is enhanced.	3.1.*** or more accesses to database for academic and industrial collaboration are counted yearly since 1-year after launch.	➢Record by IITH ➢Related reports ➢Interviews with institutions		Ongoing. Database specifications are being discussed with IITH.	
	3.2.*** or more lecturers and workshops are jointly hold by IITH and Japanese companies.			Ongoing: two events •Ryugaku Sommelier, Inc. Event •Mitsubishi Chemical Corporation Event	
	3.3.*** or more joint research projects are implemented between IITH and Japanese companies.			No achievement yet. (IITH research was presented at one international exhibition.)	
	3.4.*** or more technology developed by joint research between IITH and Japanese companies are displayed at seminars or exhibitions in Japan.			Ongoing: 1 case. A presentation of IITH research activities was made at an international exhibition, CEATEC 2022.	

Activities	Inputs		Pre-Conditions
	The Japanese Side	The Indian Side	
1.Japan Desk is established at IITH. 1-1.To set up a Japan desk by IITH and formulate action plan 1-2.To set up a portal site for coordinating India-Japan collaborations and assign dedicated staff to respond to inquiries 1-3.To perform as one-stop consultation desk and support various activities related to academic and industrial collaboration between India and Japan 1-4.To strengthen the alumni association as a support community for India-Japan collaboration 1-5.To advertise, promote, support a selection process and have orientation to JICA long-term trainees for further studies in Japan 1-6.To monitor research progress of JICA long-term trainees and support their career development 2.Academic collaboration between India and Japan is enhanced. 2-1.To select grantees of JICA research funds and assist of joint research projects with Japanese universities or research institutions 2-2.To implement student exchange programs with Japanese educational institutions 2-3.To support organizing collaborative activities with Japanese educational institutes such as joint supervision of graduate students, workshops, study programs and special lectures 2-4.To assist IITH faculty members to participate in academic conferences and seminars in Japan 3.Research and technology development and Industrial collaboration between India and Japan is enhanced. 3-1.To develop a database on researchers and research seeds of IITH for enhancing India-Japan academic-industrial collaboration 3-2.To select grantees of JICA research funds and assist of joint research projects with Japanese companies 3-3.To organize internship programs in Japan 3-4.To support organizing collaborative activities with Japanese companies such as joint workshops, study tours and special lectures and follow up outputs of the activities 3-5.To support technologies developed jointly by IITH and Japanese partners to be demonstrated at exhibitions and seminars in Japan	a) Experts (Chief Advisor/Higher Education, Higher Education (Engineering), Japan Desk operation, Joint research); b) Research funds for India-Japan research collaborations for covering expenses for equipment, consumables, travel and so forth. Financial support is provided to IITH faculty members, while Japanese counterparts are provided with travel assistance only; c) Long-term Training in Japan (Scholarships for IITH graduates to study in Japan).	a) Facilitators (Director and Manager) in charge of the Project; b) Operational budget, office space and dedicated staffs for Japan Desk; c) Office space for the project operation at IITH; d) Office space for Japanese faculties and researchers at IITH; e) Expenses for joint research operation (maintenance fee for equipment, fellowships for students) ; f) Credentials or identification cards; g) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by JICA; h) Available data (including maps and photographs) and information related to the Project; i) Basic running expenses necessary for the implementation of the Project; j) Information as well as support in obtaining medical service; k) Security-related information as well as measures to ensure the safety of the JICA experts:	The restrictions on movement of people in the COVID-19 is gradually being relaxed. <Issues and countermeasures> <Issue> 1) The JICA Project Team had planned to expedite the first travel to India from November 2022 to January to February 2022. However, the travel was suspended in accordance with JICA's country-specific infectious disease control measures for increasing the number of COVID-19 infection in January 2022. 2) Procreant for Joint Research faced delays, since the JICA Project Team was unable to open a local bank and was unable to conduct payment at a timely manner. <Countermeasures> 1) Continuous efforts were made to gather information to enable the experts to travel promptly after the suspension was lifted. In addition, online discussions with IITH continued and activities were carried out. JICA shared the latest local information and travel policy with the JICA Project Team. IITH provided the latest inspection situation in India and IITH's infection control policy to the JICA Project Team, and suggested the suitable timing for traveling to India. 2) The JICA Project Team took measures to avoid payment and procurement delays by conducting international wire transfer from Japan as well as limiting selection of vendors who are able to accept international wire transfer. Japanese experts also brought cash during each visit, and cash payments were made to vendors for whom international remittances were not possible.

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 02
Dated 14th Feb 2023

Project Title: The Project for Future Researchers at IITH to Enhance Network Development with Scholarship of Japan (FRIENDSHIP), Phase 2

Inputs	Plan/Actual	2021	2022				2023				2024				2025				2026				2027		Remarks	Monitoring: Issue	Monitoring: Solution
		IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II			
Expert																											
Chief Advisor/Higher Education 1	Plan																										
	Actual																										
Deputy Chief Advisor/Japan Desk Operation 1 (Organization Structure Development/ Career Support)	Plan																										
	Actual																										
Higher Education 2/Engineering Education 1	Plan																										
	Actual																										
Higher Education 3	Plan																										
	Actual																										
Engineering Education 2	Plan																										
	Actual																										
Japan Desk Operation 2 (FRIENDSHIP Scholarship Program/Monitoring/Academic Collaboration)	Plan																										
	Actual																										
Japan Desk Operation 3 (Alumni Association Activity/Event Management/Industrial Collaboration/Coordinator)	Plan																										
	Actual																										
Japan Desk Operation 4 (Portal site & Database Development/PR)	Plan																										
	Actual																										
Japan Desk Operation 4 (Portal site & Database Development/PR) 2	Plan																										
	Actual																										
Japan Desk Operation 5 (Promotion of attracting Japanese students to IITH 1)	Plan																										
	Actual																										
Japan Desk Operation 2 (Monitoring 2)	Plan																										
	Actual																										
Japan Desk Operation 2 (Monitoring 3)	Plan																										
	Actual																										
Evaluation and Analysis	Plan																										
	Actual																										
Japan Desk Operation 5 (Promotion of attracting Japanese students to IITH 2)	Plan																										
	Actual																										
Joint Research 1	Plan																										
	Actual																										
Joint Research 2	Plan																										
	Actual																										
Joint Research 3	Plan																										
	Actual																										
Joint Research 4	Plan																										
	Actual																										
Joint Research 5	Plan																										
	Actual																										
FRIENDSHIP 2.0 Research Grants for India-Japan Research Collaborations																											
FRIENDSHIP 2.0 Research Grants for India-Japan Research Collaborations	Plan																										
	Actual																										
Long-Term Participants of FRIENDSHIP 2.0 Scholarship Program																											
Long-Term Participants of FRIENDSHIP 2.0 Scholarship Program	Plan																										
	Actual																										

Activities / Sub-Activities	Plan/Actual	2021	2022				2023				2024				2025				2026				2027		Responsible Organization: Japan	Responsible Organization: IITH	Achievements	Issue & Countermeasures
		IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II				
Output 1: Japan Desk is launched at IITH.																												
1-1.To set up a Japan desk by IITH and formulate action plan	Plan																										Ongoing The Project is undergoing renewed discussions and minor revisions on the Japan Desk Operational Plan with the newly appointed Project Manager.	Prior to the completion of the Operational Plan, activities related to the selection of long-term participants of FRIENDSHIP 2.0 Scholarship Program and proposals of FRIENDSHIP 2.0 Research Grant Program were completed with the Project Director according to the plans indicated in the technical cooperation deliverables, resulting in no delay.
	Actual																											
1-2.To set up a portal site for coordinating India-Japan collaborations and assign dedicated staff to respond to inquiries	Plan																										Ongoing The portal site is under construction, and the basic structure and design have been completed. It will be launched on a trial basis in May. The concept of the Japan-India collaborative database was discussed.	
	Actual																											
1-3.To perform as one-stop consultation desk and support various activities related to academic and industrial collaboration between India and Japan	Plan																										Ongoing A physical space for the Japan Desk has been tentatively established at IITH, and the Japan Desk started operation with one staff.	
	Actual																											
1-4.To strengthen the alumni association as a support community for India-Japan collaboration	Plan																										Ongoing Several alumni have been invited to events organsied by Japan Desk and the JICA project team during the first year of the project implementation.	
	Actual																											
1-5.To advertise, promote, support a selection process and have orientation to JICA long-term trainees for further studies in Japan	Plan																										Ongoing 6 participants entered to Japanese universities in October 2022. Advertisement of the FRIENDSHIP 2.0 Scholarship Program 2023 started from July 2022, and 10 candidates were selected in January 2023.	
	Actual																											
1-6.To monitor research progress of JICA long-term trainees and support their career development	Plan																										Ongoing Monitoring was conducted to grasp the academic progress through interviews with participants and supervisors. In September 2022, 16 participants obtained the degree, 1 participant was approved for the scholarship extension, and 2 participants extended the doctoral program at their own expenses. Academic collaboration has been promoted through monitoring.	
	Actual																											

Output 2: Academic collaboration between India and Japan is enhanced.				
2-1.To select grantees of JICA research funds and assist of joint research projects with Japanese universities or research institutions	Plan / Actual		Ongoing 12 academic collaborations were assisted from April to November 2022 in the first batch. 9 academic collaboration research proposals were selected from 30 applications in the second batch. They started joint research from January 2023.	Procurement in the second batch was delayed as the JICA Project Team could not conduct international wire transfers due to risks of being refusal by local banks. As a result of a discussion with JICA and IITH, it was decided that the Sponsored Research & Consultancy department will open a project account to receive money from Japan and make payments to local vendors. The procurement will start after the end of February 2023. The JICA Project Team discussed with IITH for creating a bank account for the project at IITH, but it is still under consideration.
2-2.To implement student exchange programs with Japanese educational institutions	Plan / Actual		Ongoing Student exchnage programs were promoted with Kumamoto University, the University of Tokyo, and Nagoya University. 1 MOU were concluded with Tokyo City University on 26th January 2023.	
2-3.To support organizing collaborative activities with Japanese educational institutes such as joint supervision of graduate students, workshops, study programs and special lectures	Plan / Actual		Ongoing 7 open seminars and special lectures were held by Co-PIs of Japanese universities and 10 master's students were jointly supervised in the first batch of the FRIENDSHIP 2.0 Research Grant Program. Assisting research collaboration was resulted in 3 joint research. IITH discussed the possibility of the Joint Degree program with Gifu University. An event for promoting the invitatino of Japanese students to IITH were held in February 2023.	
2-4.To assist IITH faculty members to participate in academic conferences and seminars in Japan	Plan / Actual		Ongoing 4 IITH faculty members gave presentations at seminars at Japanese universities (2 members came to Japan, 2 members joined online)	
Output 3: Research and technology development and Industrial collaboration between India and Japan is enhanced.				
3-1.To develop a database on researchers and research seeds of IITH for enhancing India-Japan academic-industrial collaboration	Plan / Actual		Keyword search function was added to the People page of IITH website.	
3-2.To select grantees of JICA research funds and assist of joint research projects with Japanese companies	Plan / Actual		Two applications and selected one project in the second batch of the Joint Research. They started joint research from January 2023.	IPR can be an issue to start the research. Procurement in the second batch was delayed as described in Activity 2-1.
3-3.To organize internship programs in Japan	Plan / Actual		No progress yet The JICA Project Team has been encouraging companies to host internship studetns from IITH and discusswith with recruting agent companies.	
3-4.To support organizing collaborative activities with Japanese companies such as joint workshops, study tours and special lectures and follow up outputs of the activities	Plan / Actual		Ongoing One event was conducted with a Japanese relevant institutions to promote study tour to IITH from Japan.	
3-5.To support technologies developed jointly by IITH and Japanese partners to be demonstrated at exhibitions and seminars in Japan	Plan / Actual		Ongoing Participated in CEATEC 2022.	
Duration / Phasing	Plan / Actual			

Monitoring Plan	Plan / Actual	2021	2022				2023				2024				2025				2026				2027		Remarks	Issue	Solution
		Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅰ	Ⅱ			
Monitoring																											
Joint Coordination Committee	Plan / Actual																										
Set-up the Detailed Plan of Operation	Plan / Actual																										
Submission of Monitoring Sheet	Plan / Actual																										
Reports/Documents																											
Work Plan	Plan / Actual																										
Baseline Survey Report	Plan / Actual																										
Endline Survey Report	Plan / Actual																										
Project Completion Report	Plan / Actual																										
Operational plan and action plan, including Japan Desk operational rules and organizational structure	Plan / Actual																										
FRIENDSHIP Scholarship Program Implementation Plan	Plan / Actual																										
Monitoring Report for Long-Term Participants	Plan / Actual																										
Career Support Report for Long-Term Participants	Plan / Actual																										
Alumni support activity report	Plan / Actual																										
FRIENDSHIP 2.0 Research Grant Program Implementation Plan	Plan / Actual																										
Progress report for FRIENDSHIP 2.0 Research Grant Program	Plan / Actual																										
Completion report for FRIENDSHIP 2.0 Research Grant Program	Plan / Actual																										
Academic Collaboration Activity Progress Report	Plan / Actual																										
Progress Report on Industry-Academia Collaboration Activities	Plan / Actual																										
Leaflets and pamphlets	Plan / Actual																										
Public Relations																											
To implement public relations activities	Plan / Actual																										

<Legend >
- Fixed-term plan
- Continuous plan
- Fixed-term result
- Continuous result
- Field assignment (actual)

Attachment 3-1: Outlines of the FRIENDSHIP 2.0 Research Grant Program 2022（As of 14th February, 2023)

ID	PI			Research Topic	Co-PI			Implementation Result
	Name	Sex	Department		Name	Organization	Deparment	
AC2022-1	Bhargava Anamika	F	Biotechnology	Challenging the Paradigm: Activating T-type Calcium Channel Isoform Cav3.1 for Breast Cancer Therapeutics	Maturana Andres Daniel	Nagoya University	Laboratory of Animal Cell Physiology, Graduate School of Bioagricultural Sciences	- Completed. - Sakura Science Program (Accepted)
AC2022-2	Panda Tarun Kanti	M	Chemistry	Atom Economic Hydroboration of C X Unsaturated Bonds as Green Method for Organic Synthesis	Tsurugi Hayato	Osaka University	Graduate School of Engineering Science	- Completed. - FRIENDSHIP 2.0 Research Grant 2023 (AC)
AC2022-3	Ganesan Prabu Sankar	M	Chemistry	Organo Gold(I) Molecules to Materials	Tsutsumi Osamu	Ritsumeikan University	Department of Applied Chemistry	- Completed. - Publishment of 2 co-authored papers for international journals. - 1 student who received co-supervision was selected as a candicate of the FRIENDSHIP 2.0 Scholarship Program 2023 to be expected to enter to Co-PI's lab.
AC2022-4	Chatterjee Pritha	F	Civil Engineering	Microalgae-Microbial Fuel Cell (mMFC): An Integrated Process for Removal of Xenobiotics in Sewage and Simultaneous Electricity Generation	Matsuura Norihisa	Kanazawa University	Faculty of Geosciences and civil Engineering,Institute of Science and Engineering	Completed.
AC2022-5	Abhinav Kumar	M	Electrical Engineering	Enhancing User Mobility in Cellular networks through Machine Learning	Yamaguchi (Shigetomi) Rie	The University of Tokyo	Social ICT Research Center, Graduate School of Information Science and Technology	The percentage of budget execution was low, but the research was completed.
AC2022-6	Subrahmanyam Challapalli	M	Chemistry	Plasmon enhanced photoelectrochemical water splitting	Biju Vasudevan Pillai	Hokkaido University	Research Institute for Electronic Science	- Completed. - 1 student was seelcted as a candidate of the FRIENDSHIP 2.0 Scholarship Program 2023 and is expected to be expected to enter to Co-PI's lab.
AC2022-7	Bhattacharjee Pinaki Prasad	M	Materials Science and Metallurgical Engineering	Development of novel cost-effective eutectic high entropy alloys with superior mechanical properties	Tsuji Nobuhiro	Kyoto University	Materials Science and Engineering	Completed.
AC2022-8	Desarkar Maunendra Sankar	M	Computer Science & Engineering/Artificial Intelligence	Generating natural language descriptions/summaries of data tables	Aizawa Akiko	National Institute of Informatics (NII)	Digital Content and Media Sciences Research Division	The percentage of budget execution was low, but the research was completed.
AC2022-9	Shanmugam Suriya Prakash	M	Civil Engineering	Experimental Investigation on Fracture Behavior of High Strength Steel Reinforced Concrete using Acoustic Emission	Kawasaki Yuma	Ritsumeikan University	Civil Engineering	Completed.
AC2022-10	Bhattacharyya Debraj	M	Civil Engineering	Understanding the Fate and Effects of Pharmaceutically Active Compounds, Per- and Polyfluoroalkyl Substances in Contaminated Water Bodies and in Treatment Plants	Futamata Hiroyuki	Shizuoka University	Institute of Green Science and Technology	- Completed. - FRIENDSHIP 2.0 Research Grant 2023 (IC)
AC2022-11	Dutta Gupta Shourya	M	Materials Science and Metallurgical Engineering	Colloidal Crystal Materials Group, Research Center for Functional Materials	Fudouzi Hiroshi	National Institute for Materials Science (NIMS)	Colloidal Crystal Materials Group, Research Center for Functional Materials	Completed.
AC2022-12	Selvaraj Ambika	F	Civil Engineering	Application and Life Cycle Analysis of Waste-based Biochar for Water Treatment	Yoshikawa Naoki	Ritsumeikan University	Department of Civil and Environmental Engineering	Completed.

<Note>
AC: Academic Collaboration
IC: Industrial Collaboration

Attachment 3-2: Research Grant 2022 Result Summary (As of 15th November, 2022)

ID			AC2022-1	AC2022-2	AC2022-3	AC2022-4	AC2022-5	AC2022-6	A2022-7	AC2022-8	AC2022-9	AC2022-10	AC2022-11	AC2022-12
PI			Dr. Bhargava Anamika	Dr. Panda Tarun Kanti	Dr. Ganesan Prabu Sankar	Dr. Chatterjee Pritha	Dr. Abhinav Kumar	Dr. Subrahmanyam Challapalli	Dr. Bhattacharjee Pinaki Prasad	Dr. Desarkar Maunendra Sankar	Shanmugam Suriya Prakash	Dr. Bhattacharyya Debraj	Dr. Dutta Gupta Shourya	Dr. Selvaraj Ambika
Co-PI (Organization)			Dr. Maturana Andres Daniel (Nagoya University)	Dr. Tsurugi Hayato (Osaka University)	Dr. Tsutsumi Osamu (Ritsumeikan University)	Dr. Matsuura Norihisa (Kanazawa University)	Dr. Yamaguchi (Shigetomi) Rie (The University of Tokyo)	Dr. Biju Vasudevan Pillai (Hokkaido University)	Dr. Tsuji Nobuhiro (Kyoto University)	Dr. Aizawa Akiko （National Institute of Informatics (NII)）	Dr. Kawasaki Yuma （Ritsumeikan University）	Dr. Futamata Hiroyuki （Shizuoka University）	Dr. Fudouzi Hiroshi （National Institute for Materials Science (NIMS)）	Dr. Yoshikawa Naoki (Ritsumeikan University)
Output		International Journals (co-authored)	NA	1 paper (submitted)	2 papers (published) 1 paper (accepted)	NA	Working on the first draft	NA	NA	NA	1 paper (submitted)	1 paper (drafted)	Planned	2 papers (drafted)
		Conference Proceedings (co-authored)	NA	NA	NA	NA	NA	NA	NA	NA	1 paper (submitted)	1 paper (drafted)	NA	1 paper (accepted)
		Patent Application	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Input to research		Research Equipment	Stereozoom microscope LED illuminator	Chiller Deep freezer Magnetic stirrer	Hot air oven Temp controlled stirres Fumehood	Workstation Conductivity meter Magnetic stirrer pH Electrode	Laptop Workstation	Spin coater High temperature furnace	Mobile workstation Laptop	GPU workstation	AE sensors Strain gauges	Real-time PCR machine and accessaries Multichannel pipette	Laser Optical table	Workstation UV visible spectroscopy Laptop
		Visits to Japan	NA	NA	PI in Sep 2022	NA	NA	NA	PI for 1 year (JSPS Invitational Fellow)	NA	Master student for 3 months (by other fund)	PI for 4 days (DST-JSPS project), doctor student for 4 months (Suzuki Foundation) , master student for 10 days (DST-JSPS project)	NA	NA
		Visit by Japanese research team member	NA	NA	Co-PI in Nov 2022 (by other fund)	NA	NA	Co-PI (by other fund)	NA	NA	NA	NA	NA	NA
		International conferences	NA	NA	MTIC-XIX in India in Dec 2022 (by other fund)	NA	NA	NA	NA	NA	Indian Structural Integrity Society in India (master student, by other fund)	ACESD 2022 in Nov 2022 in Japan (other fund)	NA	NA
		Registration (including online conferences)	NA	NA	MTIC-XIX in India in Dec 2022 (by other fund)	NA	NA	242nd ECS in USA in Oct 2022 (by other fund)	NA	NA	Indian Structural Integrity Society in India (master student, by other fund)	ACESD 2022 in Nov 2022 in Japan (other fund)	NA	NA
		Expense (% of execusion against budget)	INR 762,515 (95%)	INR 786,568 (98%)	INR 795,803 (99%)	INR 369,780 (90%)	INR 490,998 (61%) <Reasons of gap> Cancellation of consumable procurement due to the delay of request from the PI due to his sickness. Cancellation of traveling to Japan because of the COVID-19 pandemic situation.	INR 791,765 (99%)	INR 744,766 (93%)	INR 303,844 (52%) <Reasons of gap> Cancellation of consumable procurement due to the price issue. Cancellation of traveling to Japan because of the COVID-19 pandemic situation.	INR 799,922 (99%)	INR 794,811 (99%)	INR 750,583 (94%)	INR 800,000(100%)
Collaboration with Japanese Partner	Academic development through collaboration	Record of collaborative academic activities	1 online seminar by Co-PI	One online seminar by Co-PI	1 seminar by PI 1 seminar by Co-PI 4 seminar/lectures by students	Online discussion	Co-PI has been invited for an online seminar. Confirmation is pending.	Online discussion	Planned	1 seminar by PI 1 seminar by Co-PI	NA	1 seminar by PI 2 seminars by Co-PI team	Online discussions	1 seminar by PI 1 sembar by Co-PI
		Plan of collaborative education programs (Double/Joint degree)	NA	Looking for joint-cosupervision program	PI and Co-PI are in constant touch with IITH/Ritsumeikan to actively participate in the double/joint degree progrems.	NA	Ongoing joint co-supervisin of master's thesis	Co-supervision of a FRIENDSHIP participant who enrolled in Oct 2022	NA	Drafting proposals for joint program statements	Joint PhD guidance	Joint supervision of an IITH doctor student by IITH-Shizuoka sandwich program.	Joint supervision under the IITH-NIMS program (MOU)	NA
		Plan of collaborative lectures in 2023 or later	Planned	Planned	Joint workshop in March 2023 by PI at IITH Joint workshop in January 2024 by Co-PI at Ritsumeikan University Joint seminar in July 2024 by PI at IITH Joint seminar in July 2024 by Co-PI at Ritsumeikan University	NA	Planned	NA	NA	NA	Workshop in Dec 2022 at IITH.	Series of lectures by PI and Co-PI.	Lectures by Co-PI to IITH students in Spring 2023 semester	Planned
	Co-supervision of master's students		One master student	One master student	One master student	One master student	2 master students	One master student	NA	One student	One master student	2 master students	One master student	One master student
	Action plan for furthre collaboration (Financial Resources/Research Grants)		Sakura Science Program (Accepted) IJCSP Mobility Grant (Applied) ICMR Adhoc Grant (Accepted)	Core Research Grant (CRG) (SERB-India) (Applied)	India-Japan Joint Research Laboratory Programme to DST-JST (Planned) JASSO internship fellowship (Planned) JSPS post-doc fellowship (Planned)	FRIENDSHIP 2.0 Research Grant 2023 (Applied)	Joint project funding like SATREPS, SI-CORP, and joint industry funding etc. (Planned)	Joint projects (Planned)	NA	Planning a proposal	FRIENDSHIP 2.0 Reesarch Grant 2023 (Applied)	SATREPS and other funding opportunities at national and international level (Planned)	IITH-NIMS program for exchange students/faculty (Planned)	FRIENDSHIP 2.0 Research Grant (Applied) Indo-Japan bilateral proposal call (Planned)

Attachment 3-3:
Final Report for the FRIENDSHIP 2.0 Research Grant Program 2022

FRIENDSHIP 2.0

Research Grant 2022

Final Report

ID: AC2022-1

Research Topic: Activating T-type calcium channel isoform Cav3.1 for breast cancer therapeutics

Name of PI: Dr Anamika Bhargava

Date: 14.11.2022

Table

1 Implementation of Research

1-1 Research Team Members

	Name	Position	Department / Organization	Responsibilities
PI	Dr Anamika Bhargava	Associate Professor	Biotechnology Department, Indian Institute of Technology, Hyderabad	Overall responsibility for the project
Researcher 1	Ms Tharunika Subramanian	MTech (Masters) student	Biotechnology Department, Indian Institute of Technology, Hyderabad	Cell culture, maintenance and treatment of T-47D cells with Cav3.1 activator SAK3, Effect of SAK3 on cellular proliferation and migration of T47D cells
Researcher 2	Ms Yashashwini	Senior research fellow, Doctoral Student	Biotechnology Department, Indian Institute of Technology, Hyderabad	Cell culture, Effect of SAK3 on cellular calcium and intracellular calcium stores using intracellular fluorescence imaging using calcium dyes
Researcher 3	Mr Ankush Sharma	Junior research fellow, Doctoral Student	Biotechnology Department, Indian Institute of Technology, Hyderabad	Effect of SAK3 on CaMKII and P38 MAPK activation in T-47D cells using western blotting
Researcher 4	Mr Narasimha	Research Associate	Biotechnology Department, Indian Institute of Technology,	Proliferation, qPCR experiments and training of master's student Tharunika

	Name	Position	Department / Organization	Responsibilities
			Hyderabad	
Co-PI	Dr Andres Maturana	Associate Professor	Graduate School of Bioagricultural Sciences Department of Applied Biosciences, Nagoya University	Collaboration with PI/Co-supervising students

1-2 Summary of Research (Research Question and Findings)

1) Research Question

To analyze if activation of Cav3.1 T-type calcium channels by SAK3 leads to inhibition of proliferation of receptors positive breast cancer cells

2) Research Findings (Do NOT disclose details of findings; it might impede applying for a patent)

i. Activation of Cav3.1 T-type calcium channels by SAK3 led to increase in proliferation of receptors positive breast cancer cell (T47D cell line) at 200nM SAK3 concentration contrary to our hypothesis.

ii. This was supported by calcium Imaging experiments which revealed significant increase in cytosolic calcium in the presence of SAK3 at a concentration of 200nM.

1-3 Research Outputs to Date

1) Publications (Underline the authors from the Co-PI team)

- International Journals (Author, Year, “Title,” *Journal*, Vol., pp.)

  N/A
- Conference Proceedings (Author, Year, “Title,” *Proceedings*, Vol., pp.)

  N/A
- Others

2) Patent Applications N/A

Filing Number	Date	Name of Invention	Inventors

1-4 Future Challenges

1) Next Goal/Plan of Research

Experiments were done with T47D cells so far, and differential expression of protein of interest was present. Increased expression of the Cav3.1 is present in MCF-7 cells, so we will once again use MCF-7 cells to

see if our hypothesis may work. However, our work has reiterated the fact that T-type calcium channels are involved in proliferation and blocking them may be therapeutic also in receptor positive breast cancer cells.

2) Next Financial Resources/Research Grants (Obtained/Applied for/Drafting)

i. IJCSP Mobility Grant with DST for PI team to travel to Japan for further collaboration is applied for (result tentatively in March 2023). Same is applied by Co-PI to travel to India.

ii. ICMR Adhoc Grant is technically approved, sanction letter and grant release is awaited.

2 Input to Research

2-1 Research Equipment

Item	Place of Installation	Date of Installation	Current Status
Stereozoom Microscope	BT222, CS&ICB Lab	August 2022	Working
LED illuminator	BT222, CS&ICB Lab	October 2022	Working

2-2 Visits to Japan

Visitor	Period	Activities (Academic/Research)	Outputs
Ankush Sharma	21 days (to be done in Jan 2023)	T-type calcium channel expression, verification and current recording in HEK293 cell line	Functional characterization of T type calcium channel deletion mutants

2-3 Visits by Japanese Research Team Members N/A

Visitor	Period	Activities (Academic/Research)	Outputs

2-4 Solutions Taken under the COIVD-19 Pandemic

N/A

2-5 International Conferences N/A

1) Trips

Conference	Visitor	Period	Outputs

Conference	Visitor	Period	Outputs

2) Registration (including online conferences) N/A

Conference	Speaker	Date	Country	Outputs

2-6 Execution Status of Budget

Item Category	Consumption (amount spent in INR)	Budget (as listed in the research plan, INR)	Consumption % (Consumption / Budget x 100)
Research equipment	389296	389296	100
Consumables	354397	395491	89.6
Registration fees	0	15100	0
Travel	0	0	0

3 Collaboration with Japanese Partner

3-1 Academic Development through Collaboration

1) Record of Collaborative Academic Activities (including online activities; except co-supervision of 'I's master's students)

Date	Collaborative Academic Activity (Topic of Lecture/Open Seminar)	Speaker	Outputs
26.08.2022	Regulation of voltage gated-ion channels	Dr Andres Maturana	Dr Andres talked about regulation of expression of Id2 by Aldosterone and role of Id2 as a transcriptional repressor for L and T type calcium channels, particularly Cav3.1 in cardiomyocytes. Students and audience gained novel insights into regulation of ion channels

2) Plan of collaborative education programs (Double/Joint degree)

N/A

3) Plan of collaborative lectures in 2023 or later

Will be planned during visits as part of ongoing collaboration

3-2 Co-supervision of Master's Students

1) Record of Co-supervision

Student: Tharunika Subramanian

Co-supervisor: Dr Andres Maturana

Discussions were done through Zoom Meeting

(If two or more students have been co-supervised, use one table for each student)

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs
29-07-2022	Experiments to test the effect of SAK3 on T47D cells	• Block calcium channels and observe if SAK3 can bring rise in cytosolic calcium • Overexpress HEK cells with cav3.1 and cav3.3 and test for lowest and highest range in which increase in cytosolic calcium is seen
19-08-2022	Calcium Imaging with T47D cells	• MTT assay must be repeated with T47D cells • Calcium Imaging to be done with T47D cells at 200 nM SAK3 concentration
02-09-2022	Calcium Imaging with T47D cells at lower drug concentration	• Calcium Imaging to be done with lower concentration (0.01 nM) SAK3 • Calcium Imaging to be repeated with 200 nM SAK3 in T47D cells

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs
16-09-2022	Perfusion experiment with T47D cells	• Perfuse T47D cells with Krebs, 200nM SAK3, 50μM Ni and 300μM Ni for 5 minutes each
30-09-2022	Modifications in Perfusion Experiment	• Perfuse T47D cells with only SAK3 for 4 minutes • Perfuse T47D cells with 50μM and 300μM Nickel for 4 minutes each • Perfuse T47D cells with 20mM KCl
14-09-2022	Perfusion Experiment and Proliferation Assay with Nickel	• Add Nickel to T47D cells prior to adding SAK3 • Experiment to be done with 50μM and 300μM of Nickel • Proliferation Assay to be done with 50μM and 300μM of Nickel
28-10-2022	I. Proliferation assay with Nickel using T47D cells II. Proliferation assay with MCF-7 cells at different SAK3 concentrations	• Proliferation assay with Nickel to be repeated • Proliferation Assay with MCF-7 has to be performed • SAK3 must be present in Krebs during washing steps while performing Calcium Imaging

2) Candidates of FRIENDSHIP 2.0 Scholarship 2023

Name	Prospective Supervisor	Research Plan
Tharunika Subramanyam	Dr Andres Maturana	Regulation of voltage gated T-type calcium channels (detailed plan is

		under development)

3) Master's Thesis (as outputs of the FRIENDSHIP 2.0 research; by students of India and Japan)

Author	Thesis Title	Status
Tharunika Subramanian	Activating T-type calcium channel isoform Cav3.1 for breast cancer therapeutics	Ongoing (Submission in June 2023)

4) Dissertations (as outputs of the FRIENDSHIP 2.0; by students of both India and Japan)

Author	Dissertation Title	Status
NA		

5) Next Plan of Co-supervision

Name	Status (Master/Doctor)	Prospective Co-supervisor	Research Topic
To be determined			

3-3 Action Plans for Further Collaboration

1) Financial Resources/Research Grants (Obtained/Applied for/Planned)

- IJCSP Mobility Grant with DST for PI team to travel to Japan for further collaboration is applied for (result tentatively in March 2023). Same is applied by Co-PI to travel to India.
- ICMR Adhoc Grant is technically approved, sanction letter and grant release is awaited.
- Drafting other Research Grants as an when advertised for research grant to both sides.

2) Potential Industrial/Social Application of Research Outputs

Our research will have an indirect impact on society as focus towards novel targets for breast cancer.

3-4 Lessons Learnt and Challenges for Future Collaboration

1) Lessons learnt

It was my first exposure to collaboration with Japanese PI and it has been a good one. Dr Andres gave many helpful suggestions to the students in my lab.

2) Challenges for future collaboration and potential solutions

It would be desirable to have research grant for both the PI and Co-PI labs for true collaboration and enthusiasm from both sides.

FRIENDSHIP 2.0

Research Grant 2022

Final Report

ID:

Research Topic: Aluminum Catalyzed Selective Hydroboration of C-X Unsaturated Bonds as Green Method for Organic Synthesis

Name of PI: Tarun Kanti Panda

Date: 12-11-2022

Table

1 Implementation of Research

1-1 Research Team Members

	Name	Position	Department / Organization	Responsibilities
PI	Tarun Kanti Panda	Professor	Chemistry	Overall responsibility for the project implementation
	Priyankar Mandal	Master student	Chemistry	Synthesis of Ligand and Metal complexes suitable for Al metal complexes.
	Ravi Kumar	PhD student	Chemistry	Synthesis of Al complexes and selective hydroboration with alkynes.
	Kulsum Bano	PhD student	Chemistry	Synthesis of Al complexes and selective hydroelementation.
Co-PI	Dr. Hayato Tsurugi	Associate Professor	*Graduate School of Engineering Science, Osaka University*	*Monitoring the project periodically through online/vedioconferencing, optimization and super-vising the master students and giving inputs to improprove the process.*

1-2 Summary of Research (Research Question and Findings)

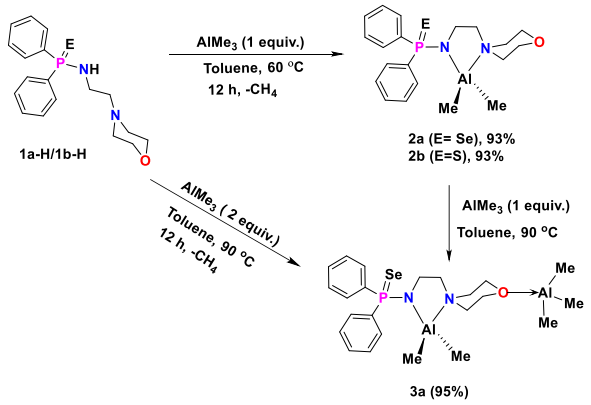
1) Research Question

Developing simple and efficient catalytic systems using earth-abundant Al-metal with a good functional group tolerance is intriguing to yield compounds with multiple value added products using hydroelementation reaction.

2) Research Findings (Do NOT disclose details of findings; it might impede applying for a patent)

The synthesis and characterisation of two mononuclear aluminium alkyl complexes with the general composition, $[Al(Me)_2\{Ph_2P(E)N(CH_2)_2N(CH_2CH_2)_2O\}]$ (E = Se (2a); S (2b)) and a binuclear aluminium complex $[Al(Me)_2\{Ph_2P(Se)N(CH_2)_2N(CH_2CH_2)_2O\}(AlMe_3)]$ (3a) are described. The catalytic efficiency of all the aluminium alkyl complexes was investigated for the chemoselective addition of secondary amines,

alcohols, thiols, and phosphine oxide to heterocumulenes under solvent-free and mild conditions. The binuclear aluminium alkyl complex 3a displayed a proficient single-site catalyst for the insertion reactions leading to the synthesis of a variety of products such as urea, biuret, isourea, isothiourea, phosphorylguanidine, and quinazolinone derivatives, compared to the mononuclear analogues. The binuclear Al complex 3a represents the first example of a single competent catalyst involving a low-cost and eco-friendly main-group metal catalyst for the chemoselective insertion of electron-rich secondary amines, alcohols, thiols, and phosphine oxide as well as for guanylation/cyclisation of acid aminoester with heterocumulenes under solvent-free conditions either at room or mild temperature. The binuclear aluminium metal complex 3a exhibited a high tolerance toward heteroatoms and functional groups, giving the corresponding insertion products in high yields and selectivity.



1-3 Research Outputs to Date

1) Publications (Underline the authors from the Co-PI team)

- International Journals (Author, Year, "Title," *Journal*, Vol., pp.)

K. Bano, S. Sagar, H. Tsurugi, T. K. Panda, Addition of E-H (E = P, N) onto C≡X (X = N, CH) Bond Catalyzed by Flexible Amidophoshphinoselenide Supported Magnesium Alkyl Complex, **2022**, **submitted**.

- Conference Proceedings (Author, Year, "Title," *Proceedings*, Vol., pp.)

None

- Others

2) Patent Applications : None

Filing Number	Date	Name of Invention	Inventors

1-4 Future Challenges

1) Next Goal/Plan of Research

The importance of aluminium as a catalyst is its high abundance in the earth's crust, comparable efficiency as a transition metal catalyst (with relatively less expense) and greater appeal from the perspective of sustainability. Thus, a suitable design of the Al-catalyst is capable of changing the typical reactivity of alkynes with HBpin to produce the expected hydroboration product. In this case, the role of amine to generate intramolecular FLP type catalyst is crucial to furnish high chemo-selectivity towards the formation of C(sp)-H borylation product. In general, we believe the next goal will be on the scope of aluminium complexes as catalysts in the hydroboration reaction to provide a deep insight into the properties of various aluminium complexes and their progressive development over the years. This will lead to a better understanding of their catalytic properties and mechanisms, which could help develop more reactive and selective aluminium complexes for use in hydroelementation reactions.

2) Next Financial Resources/Research Grants (Obtained/Applied for/Drafting)

Financial resources are necessary to carry out the next part of this research. PI has applied FRIENDSHIP 2.0 Research Grant 2023 and Core Research Grant (CRG) (SERB-India) for financial support. The initial results are very important to demonstrate the proof of concept. Thus the preliminary findings from this work are very useful for this purpose.

2 Input to Research

2-1 Research Equipment

Item	Place of Installation	Date of Installation	Current Status
Chiller	Synthetic Organometallic Chem, Lab, Chemistry Block	08/08/22	Fully functional
Deep Freezer	Synthetic Organometallic Chem, Lab, Chemistry Block	29/10/22	Fully functional
Magnetic Stirrer	Synthetic Organometallic Chem, Lab, Chemistry Block	05/07/22	Fully functional

2-2 Visits to Japan : Not able to made this time due to Covid- 19 pandemic.

Visitor	Period	Activities (Academic/Research)	Outputs

2-3 Visits by Japanese Research Team Members : Not able to made this time due to Covid- 19 pandemic.

Visitor	Period	Activities (Academic/Research)	Outputs

2-4 Solutions Taken under the COIVD-19 Pandemic

PI and Co-PI had monitored the project periodically through several online/vedio conferences, and Co-PI co-supervised the master students and gave inputs to improve the research progress.

2-5 International Conferences : PI has made an international conference held in India. 27th ISCB International Conference 16-19 November 2022 (**ISCBC-2022**). PI gave an invited lecture at this conference.

1) Trips

Conference	Visitor	Period	Outputs

Conference	Visitor	Period	Outputs

2) Registration (including online conferences) : None

Conference	Speaker	Date	Country	Outputs

2-6 Execution Status of Budget

Item Category	Consumption (amount spent in INR)	Budget (as listed in the research plan, INR)	Consumption % (Consumption / Budget x 100)
Research equipment	491513	491513	100%
Consumables	295055	300000	98.35%
Registration fees	0	0	
Travel	0	0	

3 Collaboration with Japanese Partner

3-1 Academic Development through Collaboration

1) Record of Collaborative Academic Activities (including online activities; except co-supervision of 'I's master's students)

Date	Collaborative Academic Activity (Topic of Lecture/Open Seminar)	Speaker	Outputs
5-12-2023	Lanthanide-catalyzed Organic Transformations: Air Oxidation and Hydrosilylation"	Prof. Hayato TSURUGI	The talk is scheduled on 5th December 2022.
9-6-2022	Project monitoring discussion zoom call.	Prof. Hayato TSURUGI And Tarun K. Panda	The progress of the work was discussed next work schedule was made.
7-7-2022	Project monitoring discussion zoom call.	Prof. Hayato TSURUGI And Tarun K. Panda	The progress of the work was discussed next work schedule was made.
1-8-2022	Project monitoring discussion via zoom Call.	Prof. Hayato TSURUGI And Tarun K. Panda	The progress of the work was discussed next work schedule was made.
26-8-2022	Project monitoring discussion via zoom call.	Prof. Hayato TSURUGI And Tarun K. Panda	The progress of the work was discussed next work schedule was made.
21-10-2022	Project monitoring discussion and new proposal drafting via Zoom call.	Prof. Hayato TSURUGI And Tarun K. Panda	The progress of the work was discussed and new project proposal was drafted

2) Plan of collaborative education programs (Double/Joint degree)

We came to know that the double degree and joint degree are slightly challenging at Japanese Universities. We are looking for joint co-supervision program.

3) Plan of collaborative lectures in 2023 or later

We are planning for collaborative lectures in 2023 too. The dates are not fixed yet.

3-2 Co-supervision of Master's Students

1) Record of Co-supervision

Student: Priyankar Mandal

Co-supervisor: Prof. Hayato Tsurugi

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs
5-8-2022	Project monitoring - Synthesis of fluorinated ketones	The challenges were addressed
8-8-2022	Project monitoring - Synthesis of fluorinated ketones	The challenges were addressed – new methods are proposed/tried
10-8-2022	Project monitoring - Synthesis of fluorinated ketones	The challenges were addressed – new methods are proposed/tried
11-9-2022	Project monitoring – catalytic activity improvement	The challenges were addressed – new methods are proposed/tried
22-9-2022	Project monitoring – catalytic activity improvement	The challenges were addressed – new methods are proposed/tried

2) Candidates of FRIENDSHIP 2.0 Scholarship 2023

Name	Prospective Supervisor	Research Plan
Priyankar Mandal	Prof. Hayato Tsurugi or may be another Professor.	The student is interested to work in organometallic chemistry.

3) Master's Thesis (as outputs of the FRIENDSHIP 2.0 research; by students of India and Japan)

Author	Thesis Title	Status
Priyankar Mandal	Selective Hydroelementation of C-X Unsaturated Bonds usinf Al - catalyst	Ongoing

4) Dissertations (as outputs of the FRIENDSHIP 2.0; by students of both India and Japan)

Author	Dissertation Title	Status
Ravi Kumar	Al – catalyzed Organic transformation	ongoing

5) Next Plan of Co-supervision

Name	Status (Master/Doctor)	Prospective Co-supervisor	Research Topic
Rituparna Sinha	Master	Dr. Hayato Tsurugi	Al catalyzed polymerization
Shweta sagar	PhD	Dr. Hayato Tsurugi	Al catalyzed co-polymerization

3-3 Action Plans for Further Collaboration

1) Financial Resources/Research Grants (Obtained/Applied for/Planned)

Financial resources are necessary to carry out the next part of this research. PI has applied FRIENDSHIP 2.0 Research Grant 2023 and Core Research Grant (CRG) (SERB-India) for financial support. The initial results are very important to demonstrate the proof of concept. Thus the preliminary findings from this work are very useful for this purpose.

2) Potential Industrial/Social Application of Research Outputs

Not yet.

3-4 Lessons Learnt and Challenges for Future Collaboration

1) Lessons learnt

It is important to have synergy between PI and Co-PI during collaborative research. Thus a visit of each other's Institute is very important.

2) Challenges for future collaboration and potential solutions

The duration of the project was very short. There were still covid-19 restrictions during the first phase of the project. Still, PI has continuously discussed/monitored the project was done. In the future, the duration of the project should be longer to achieve tangible targets.

Organo Gold(I) Molecules to Materials

FRIENDSHIP 2.0 Research Grant 2022

Annual Progress Report

for

JICA FRIENDSHIP 2.0 Research Grant 2022

Dr. Ganesan Prabu Sankar

Professor

Department of Chemistry

IIT Hyderabad

Kandi, Sangareddy, Telangana-502285

భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్
भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

November 2022

FRIENDSHIP 2.0

Research Grant 2022

Final Report

ID: FRIENDSHIP 2.0, Phase 2 (AC-2022)

Research Topic: Organo Gold(I) Molecules to Materials

Name of PI: Ganesan Prabusankar

Date: 01.08.2022

Table

1 Implementation of Research

1-1 Research Team Members

	Name	Position	Department / Organization	Responsibilities
PI	Dr. Ganesan Prabusankar	Professor	Chemistry/IIT Hyderabad	Overall responsibility for the project implementation
Research Assistant	Mr. Abhilash Sahu	MSc	Chemistry/IIT Hyderabad	Synthesis & characterization of NHC -Au materials
Research Assistant	Mr. Muneshwar Nandeshwar	PhD	Chemistry/IIT Hyderabad	Assisting mater students & data analysis
Research Assistant	Mr. Kalaivanan Subramaniyam	PhD	Chemistry/IIT Hyderabad	Assisting mater students & data analysis
Co-PI	Dr. Osamu Tsutsumi	Professor	Dept. of Applied Chemistry/Ritsumeikan University	Collaboration with PI/Co-supervising students
Co-researcher	Dr. Kyohei Hisano	Ass Prof	Dept. of Applied Chemistry/Ritsumeikan University	Collaboration with PI/Co-supervising students
Research Assistant	Tamon Nakao	M1	Dept. of Applied Chemistry/Ritsumeikan University	Synthesis of Au complexes
Research Assistant	Tomoki Shigeyama	D2	Dept. of Applied Chemistry/Ritsumeikan University	Application of Au complexes to luminescent devices
Research Assistant	Tomohiro Azumaya	M1	Dept. of Applied Chemistry/Ritsumeikan University	Application of Au complexes to luminescent devices

1-2 Summary of Research (Research Question and Findings)

1) Research Question

[1] Target of the project is to isolate the single source material to emit blue light or even direct white light using organo gold precursor or equivalent materials.

[2] Our target was to identify the correct single source materials to fill the requirements.

[3] Our most challenging task was to identify the blue or white emitting system without chromophore contribution.

[4] The target of this project was on the right track and no deviation from the proposed target.

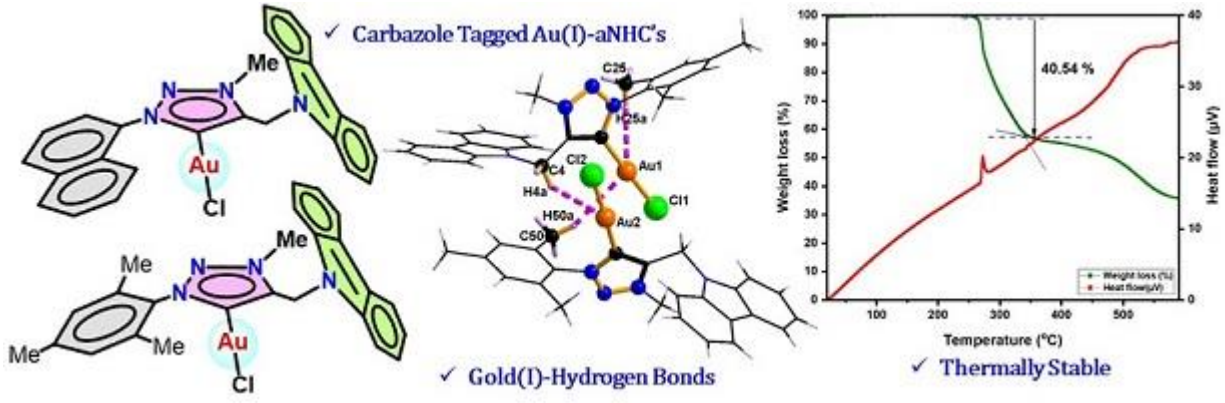
2) Research Findings (Do NOT disclose details of findings; it might impede applying for a patent)

Summary of Research Findings

- We have identified the system with blue or close-to-white light-emitting properties without chromophore contribution. This is the first ever reported finding.
- Developed the blue and yellow light-emitting materials with high Quantum Yield using metals such as Cu(I) and Au(I) for the first time.
- Publications: published eleven papers through JICA-IITH collaboration, while seven manuscripts are under preparation.

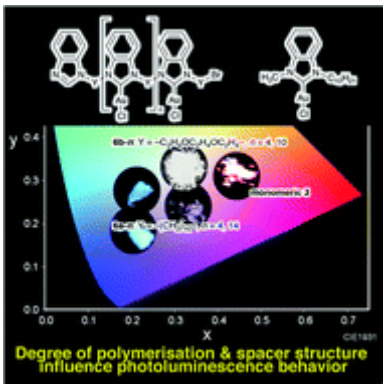
Details

The carbazole-substituted *N*-heterocyclic carbene (NHC) gold molecules have demonstrated diverse structural features and interesting thermal properties. The role of the remotely linked carbazole group to mesoionic carbene in gold(I)-NHC complexes has been addressed in this paper. Thus, we have synthesized and characterized the neutral gold-mesoionic carbene monomers tagged with the carbazole group. The mononuclear gold(I) carbene molecules [(**L**^{1})AuCl] (**1**) and [(**L**^{2})AuCl] (**2**), where **L**^{1}**.HI** = 1-(naphth-1-yl)-3-methyl-4-(carbazolylmethyl)-1,2,3-triazolium iodide and **L**^{2}**.HI** = 1-(mesityl)-3-methyl-4-(carbazolylmethyl)-1,2,3-triazolium iodide, have been synthesized and characterized. The new class of complexes depicted interesting gold-hydrogen bonding. In addition, the thermal properties of **1** and **2** were investigated. The Density Functional Theory (DFT) calculation and natural bond orbital analysis (NBO) was accomplished on a model system [(L')AuCl] (**1A**), L'=1-phenyl-4-methyl-carbazole-1,2,3-triazol-ylidene to realize the bonding situations. The calculated metrics agreed reasonably well with the experimental observations.

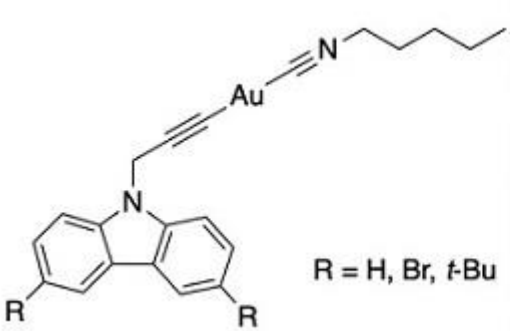


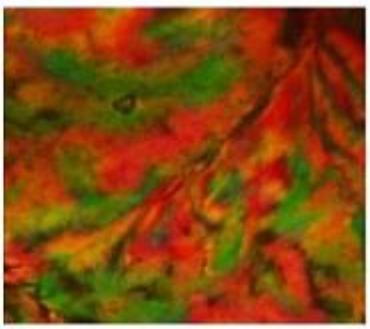
Gold(I) N-heterocyclic carbene (Au(I) NHC) polymers were successfully synthesized with alkyl and alkoxy spacers, wherein polymers with different degrees of polymerisation were isolated for the first

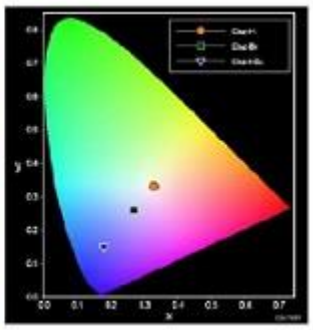
time by varying the reaction time. The structure–property relationships of the newly synthesised luminescent Au(I) NHC polymeric complexes were examined from the viewpoint of material applications. In particular, we investigated the effect of controlling the Au–Au interactions by varying the degree of polymerisation and introducing spacers into the complexes. An emission study of the polymers suggested that increasing the degree of polymerisation decreases the number of Au–Au interactions. The structures of the molecular aggregates were affected by the degree of polymerisation as well as the spacer between the two carbenes, and all complexes exhibited a high thermal stability (>300 °C). Moreover, we found that the polymer bearing an alkoxy spacer and with a low degree of polymerisation exhibited white room-temperature phosphorescence, thereby indicating that the luminescence behaviour depends mainly on the molecular aggregate structure. These results suggest that various material properties, such as the luminescence colour and thermal stability, can be controlled independently by tuning the structures of molecules and molecular aggregates using alkyl/alkoxy spacers with different degrees of polymerisation.



Organometallic materials that exhibit white luminescence in condensed phases are of considerable interest for lighting and display applications. Herein, new carbazole-based Au(I) complexes containing an isocyanide group and a long pentyl chain were synthesized. The complex with an unsubstituted carbazole moiety exhibited a white emission at room temperature as well as nematic liquid crystalline behavior. Color tunability from white to blue was achieved when bulkier substituents were introduced at the 3 and 6 positions of the carbazole moiety. Furthermore, all complexes possessed long phosphorescence lifetimes in the crystal state. The proposed design framework provides new opportunities for practical applications using luminescent organometallic molecules.







1-3 Research Outputs to Date

Summary

- *Human resource training: 2 master students from IITH and 1 PhD student from RU. 1 master student from IITH has been recruited to do PhD in Co-PIs lab from PI Lab.*
- *Publications from April 2022-November 2022: 3 and 7 more publications under preparation. Total publications with Co-PI: 11 published.*
- *Lectures: 2 lectures were delivered & 4 lectures will be delivered within November 2022.*
- *PI and two students will attend and present ongoing work in the international conference, Dec 2022.*

1) Publications (Underline the authors from the Co-PI team)

- International Journals (Author, Year, "Title," *Journal*, Vol., pp.)

1) Arruri Sathyanarayanaa, Kumar Siddhanta, Masaya Yamanea, Kyohei Hisanoa, Ganesan Prabusankar and Osamu Tsutsumi, 2022Tuning the Au–Au interactions by varying the degree of polymerisation in linear polymeric Au(I) N-heterocyclic carbene complexes, *Journal of Materials Chemistry C*, 10, 6050-6060.
2) Kumar Siddhant, Ganesan Prabusankar and Osamu Tsutsumi, 2022, Luminescent Behavior of Liquid–Crystalline Gold(I) Complexes Bearing a Carbazole Moiety: Effects of Substituent Bulkiness, *Crystals* 12(6), 810, 1-10.
3) Subramaniyam Kalaivanan, Moulali Vaddamanu, Kumar Siddhant, Kavitha Velappan, Osamu Tsutsumi, and Ganesan Prabusankar, 2022, Carbazole Tagged Au(I)- Abnormal N-Heterocyclic Carbene Complexes with Diverse Gold-Hydrogen Bonds: Synthesis, Photophysical and Thermal Properties, *New Journal of Chemistry, Accepted.*

- Conference Proceedings (Author, Year, "Title," *Proceedings*, Vol., pp.)

  NIL
- Others

  NIL

2) Patent Applications Not Applied

Filing Number	Date	Name of Invention	Inventors

1-4 Future Challenges

1) Next Goal/Plan of Research

✓ To facilitate more PhD student exchanges.
✓ To train at least 3 master students to utilize the JICA-IITH program for the higher studies.
✓ To publishing the seven pending papers, in addition to ongoing work.

- ✓ To establish the contact suitable research group to investigate the theoretical aspects of light emitting properties.
- ✓ To investigate the
    - Emitting properties of Au(I) clusters
    - Emitting properties of mixed Au(I) and Au(III) NHC derivatives
    - Methodologies to replace blue or white emitting Au(I) by less expensive metal derivatives such as Cu(I) without losing the emitting nature.
    - Fabricating the working model of LEDs/OLEDs using high QY Cu-NHCs & Au-NHCs.

2) Next Financial Resources/Research Grants (Obtained/Applied for/Drafting)

- At the end of the research period, the collaboration will be continued through student exchange as well as research samples exchange.
- 2) Ongoing DST-JSPS project will be completed.
- 3) The joint research proposal will be submitted to India-Japan Joint Research Laboratory Programme to DST-JST.
- 4) The proposal will be submitted to the JASSO internship fellowship, the Ritsumeikan University to exchange the master students and Ph.D. scholars to carry out the research work.
- 5) As PI and Co-PI are AVH fellows, the joint application will be submitted to continue the existing collaboration to conduct the workshop/seminar/research work.
- 6) The Ph.D. scholar from the PI lab will apply for a JSPS post-doc fellowship to work in the Co-PI lab.

2 Input to Research

2-1 Research Equipment

Item	Place of Installation	Date of Installation	Current Status
Hot Air Oven	Organometallics Lab, R. No 32, Chemistry Building	07.07.2022	Working
Temp Controlled stirres	Organometallics Lab, R. No 32, Chemistry Building	28.09.2022	Working
Fumehood	Organometallics Lab, R. No 32, Chemistry Building	10.11.2022	Working

2-2 Visits to Japan

Visitor	Period	Activities (Academic/Research)	Outputs
Ganesan Prabusankar	11.09.2022-15.09.2022	1) Delivered lecture. 2) SCXRD, SS-FS, QY, LT & TGA studies. 3) Manuscript preparation 4) Intern was invited and the travel plan was finalized with the Co-PI lab. 5) Travel plan of Co-PI was finalized.	1) Delivered lecture. 2) SCXRD, SS-FS, QY, LT & TGA studies. 3) Manuscript preparation 4) Intern was invited and the travel plan was finalized with the Co-PI lab. 5) Travel plan of Co-PI was finalized.

2-3 Visits by Japanese Research Team Members

Visitor	Period	Activities (Academic/Research)	Outputs
Osamu Tsutsumi	21st to 23rd November 2022	Lecture & Project discussion	Will be reported

2-4 Solutions Taken under the COIVD-19 Pandemic

- The institute has taken several stringent measures to combat Covid spread.
- IITH/GoI guidelines
- Mandatory use of Aarogya Setu.

- Must wear a face mask at all times.
- All students have to undergo a self-quarantine for the first 14 days after arrival in Hyderabad as per Govt guidelines.
- Only double-vaccinated students have been invited to the IITH campus.
- Everyone must sanitize their hands often by washing with soap or hand sanitizers.
- Social distancing norm of 6 feet between two individuals is to be maintained at all times
- Everyone entering the campus will be thermally scanned for their body temperature.
- Sanitization/Disinfection of isolation facility/washrooms are being carried out at regular intervals

2-5 International Conferences

1) Trips

Conference	Visitor	Period	Outputs
MTIC-XIX	Ganesan Prabusankar	15.12.2022-17.12.2022	Invited talk In addition, two students will be presenting the posters
MTIC-XIX	Kalaivanan Subramaniyam	15.12.2022-17.12.2022	Poster Presentation
MTIC-XIX	Nandeshwar Muneshwar Giridhar	15.12.2022-17.12.2022	Poster Presentation

2) Registration (including online conferences)

Conference	Speaker	Date	Country	Outputs
MTIC-XIX	Ganesan Prabusankar	15.12.2022-17.12.2022	India	Invited talk
MTIC-XIX	Kalaivanan Subramaniyam	15.12.2022-17.12.2022	India	Poster Presentation
MTIC-XIX	Nandeshwar Muneshwar Giridhar	15.12.2022-17.12.2022	India	Poster Presentation

2-6 Execution Status of Budget

Item Category	Consumption (amount spent in INR)	Budget (as listed in the research plan, INR)	Consumption % (Consumption / Budget x 100)
Research equipment	4,25,653	NIL	Yes
Consumables	2,44,347	NIL	Yes

Item Category	Consumption (amount spent in INR)	Budget (as listed in the research plan, INR)	Consumption % (Consumption / Budget x 100)
Registration fees	0	-	-
Travel	130000	NIL	Yes

3 Collaboration with Japanese Partner

3-1 Academic Development through Collaboration

1) Record of Collaborative Academic Activities (including online activities; except co-supervision of 'I's master's students)

Date	Collaborative Academic Activity (Topic of Lecture/Open Seminar)	Speaker	Outputs
12/10/2022	Open Seminar: Luminescent Gold-Carbenes with Elusive Gold-Hydrogen Bond	Prof. Ganesan Prabusankar	Lecture was delivered and discussed in details about the possibilities of the future research collaboration.
22/11/2022	Open Seminar: Liquid Crystalline Polymers	Prof. Dr. Osamu Tsutsumi	Lecture will be delivered and discussed in details about the possibilities of the future research collaboration.
21/07/2022	Open Seminar: Photophysical and Thermodynamic Behaviour of Au(I) Complexes Bearing Nitrogen Based Aromatic Ligands	Mr. Kumar Siddhant	PhD degree was awarded.
23/11/2022	Lecture: High QY Cu(I) Dinuclear carbenes	Mr. Kalaivanan Subramaniyam	Manuscript preparation will be completed.
23/11/2022	Lecture: High QY Cu(I) mononuclear carbenes	Mr. Sabari Veerapathiran	Manuscript preparation will be completed.
23/11/2022	Lecture: Extended Pi-conjugated metal-carbenes for OLEDs and LEDs	Mr. Gopendra Muduli	Manuscript preparation will be completed.

2) Plan of collaborative education programs (Double/Joint degree)

- Under the joint master thesis program, two master students, Mr. Abhilash Sahu and Mr. Sarthak Mohanty were trained. The suitable master's student will apply for the PhD program through JICA Friendship.
- PI and Co-PI are in constant touch with IITH/RU to actively participate in the double/joint degree progrems.

3) Plan of collaborative lectures in 2023 or later

- Joint workshop will be conducted in March 2023 by PI at IITH

- Joint workshop will be conducted in January 2024 by Co-PI at RU
- Joint seminar will be conducted in July 2023 by PI at IITH
- Joint seminar will be conducted in July 2024 by Co-PI at RU

3-2 Co-supervision of Master's Students

1) Record of Co-supervision

Student: Mr. Abhilash Sahu

Co-supervisor: Prof. Dr. Osamu Tsutsumi

(If two or more students have been co-supervised, use one table for each student)

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs
28.11.2022 to 19.12.2022	Mr Tomoki Shigeyama	A visit from RU will be arranged with external funding. Part of the thesis work will be carried out at IITH.

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs
01.04.2022 to 30.11.2022	Mr. Abhilash Sahu	Master's thesis is under preparation. The 1st stage presentation will be conducted in the last week of November 2022. Subsequently, he will continue his project un the proposed topic.

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs
01.04.2022 to 30.06.2022	Mr. Preetam Dash	Worked briefly on the proposed research topic. However, he scored less CGPA in his course work to continue his project.

2) Candidates of FRIENDSHIP 2.0 Scholarship 2023

Name	Prospective Supervisor	Research Plan
Mr. Sarthak Mohanty	Dr. Osamu Tsutsumi	Liquid Crystalline Organo Gold Polymers

Name	Prospective Supervisor	Research Plan
Mr. Sarthak Mohanty	Dr. Osamu Tsutsumi	Liquid Crystalline Organo Gold

		Polymers

3) Master's Thesis (as outputs of the FRIENDSHIP 2.0 research; by students of India and Japan)

Author	Thesis Title	Status
Mr. Abhilash Sahu	Luminescent Gold-N-Heterocyclic Carbene with Tunable Light Emission	Ongoing

Author	Thesis Title	Status
Ms. Arushi Rawat	Selenium and Sulphur doped rGO application in wastewater treatment	Completed and took admission in RU, Japan

4) Dissertations (as outputs of the FRIENDSHIP 2.0; by students of both India and Japan)

Author	Dissertation Title	Status
Mr. Kalaivanan Subramaniyam	Gold(I)-N-Heterocyclic Carbenes with Hydrogen Bonds	On going at IITH
Mr. Nandeshwar Muneshwar Giridhar	Bulky Organo Sb(III) Complexes with unusual structural and Bonding Aspects	On going at IITH
Mr. Sabari Veerapathiran	Luminescent Organ Copper Derivatives	On going at IITH
Mr. Gopendra Muduli	Gold(I)-N-Heterocyclic Carbenes Materials for Light Emitting Applications	On going at IITH
Mr. Kumar Siddhant	Photophysical and Thermodynamic Behaviour of Au(I) Complexes Bearing Nitrogen Based Aromatic Ligands	Completed on 21/07/2022
Ms. Arushi Rawat	Liquid Crystalline Polymers	On going at RU
Mr Tomoki Shigeyama	Liquid Crystalline Polymers	On going at RU

5) Next Plan of Co-supervision

Name	Status (Master/Doctor)	Prospective Co-supervisor	Research Topic
Mr. Abhilash Sahu	Master (M2)	PI: GP & Co-PI: OT	Synthesis & characterization of NHC -Au materials
Ms. Sandhya B	Master (M1)	PI: GP & Co-PI: OT	Synthesis & characterization of NHC -Au materials

Mr. Adnan Banatwala	Master (M1)	PI: GP & Co-PI: OT	Synthesis & characterization of NHC ligands
Ms. Shimoni Patel	Master (M1)	PI: GP & Co-PI: OT	Synthesis & characterization of NHC -Cu materials
Mr. Kalaivanan Subramaniyam	Doctor	PI: GP & Co-PI: OT	Assisting master students & data analysis
Mr. Sabari Veerapathiran	Doctor	PI: GP & Co-PI: OT	Assisting master students & data analysis
Mr. Gopendra Muduli	Doctor	PI: GP & Co-PI: OT	Assisting master students & data analysis
Ms Andriani Furoida	Doctor	PI: OT & Co-PI: GP	Application of Au complexes to luminescent devices
Ms. Arushi Rawat	Doctor	PI: OT & Co-PI: GP	Application of Au complexes to luminescent devices
Mr Tomoki Shigeyama	Doctor	PI: OT & Co-PI: GP	Application of Au complexes to luminescent devices
Mr Tamon Nakao	Master (M1)	PI: OT & Co-PI: GP	Synthesis of Au complexes

3-3 Action Plans for Further Collaboration

1) Financial Resources/Research Grants (Obtained/Applied for/Planned)

- As the current JICA Friendship 2.0 project is over, the collaboration will be continued through student exchange as well as research samples exchange.
- The Co-PI Ph.D. student has applied for the travel fund and received the grant to visit the PI lab at IITH in November-December 2022.
- Ongoing DST-JSPS project will be completed.
- The joint research proposal will be submitted to India-Japan Joint Research Laboratory Program to DST-JST.
- The proposal will be submitted to the JASSO internship fellowship, the Ritsumeikan University to exchange the master students and Ph.D. scholars to carry out the research work.
- As PI and Co-PI are AVH fellows, the joint application will be submitted to continue the existing collaboration to conduct the workshop/seminar/research work.
- The Ph.D. scholar from the PI lab will apply for a JSPS post-doc fellowship to work in the Co-PI lab.

2) Potential Industrial/Social Application of Research Outputs

- At present we found a suitable collaborator to fabricate the working model of LED & OLED

using our high QY materials.

- In addition, the possible industrial collaboration will be established through the coworkers of Co-PIs as the former coworkers of Co-PIs are associated with the electronic industries to develop the display materials.

3-4 Lessons Learnt and Challenges for Future Collaboration

1) Lessons learnt

Emitting nature of the material can be tuned with the help of molecular packing. The focus should also be paid to the solid-state packing of materials. Besides, the unexpected delay was experienced in the publication output due to poor access to the OLED fabrication and the theoretical work. To overcome this issue, a collaboration was established in November 2022 with Prof Shivakumar, while the initial stage of discussion was established with Prof Nocolas Ferre, Aix-Marseille University, France for the theoretical calculation. Therefore, the pending papers will be published in 2023.

2) Challenges for future collaboration and potential solutions

As PI and Co-PI have been working together since Dec 2015, the major academic-level challenges have been resolved to some extent. The next level of challenges will be to design the working model of OLED using our new materials. Besides understating the electronic structure of these new materials. Therefore, PI and CO-PI are working in this direction. So that the current research work can attract industrial attention and patent applications. Indeed, our collaborative research will continue in these directions.

FRIENDSHIP 2.0

Research Grant 2022

Final Report

ID: AC2022-4

Research Topic: Microalgae-microbial fuel cell (mMFC): an integrated process for removal of xenobiotics in sewage and simultaneous electricity generation

Name of PI: Dr. Pritha Chatterjee

Date: 12/11/2022

Table

1 Implementation of Research

1-1 Research Team Members

	Name	Position	Department / Organization	Responsibilities
PI	Dr. Pritha Chatterjee	Assistant Professor	Department of Civil Engineering, IIT Hyderabad	Overall responsibility for the project implementation
Research Assistant	Bharat Sreepada	Master's student	Department of Climate Change, IIT Hyderabad	Statistical analysis of removal of pharmaceuticals using microalgae
Research Assistant	Jesna Fathima	PhD Student	Department of Civil Engineering, IIT Hyderabad	Removal of pharmaceuticals using microalgae, Microalgae-Microbial fuel cell (m-MFC) for antibiotic degradation
Co-PI	Dr. Norihisa Matsuura	Associate Professor	Faculty of Geosciences and Civil Engineering, Kanazawa University	Collaboration with PI/Co-supervising students

1-2 Summary of Research (Research Question and Findings)

1) Research Question

- To study the removal of mix of pharmaceuticals using microalgae
- Microalgae-microbial Fuel cell for antibiotics degradation

2) Research Findings (Do NOT disclose details of findings; it might impede applying for a patent)

- By statistical analysis of literature, optimum conditions for obtaining maximum removal efficiency is found to be:
  (i) Temperature = 25 °C
  (ii) Light intensity of 60 μmol photon/m^2 s
  (iii) Photoperiod of 12:12 light dark
  (iv) Hydraulic retention time of 7 days
  (v) Phylogenetic diversity does not found to affect the removal efficiency
- Microalgae could remove the pharmaceutical azithromycin and Fluconazole with an efficiency of 80-90%. The initial concentration of pharmaceutical had an effect on removal efficiency of pharmaceutical using microalgae and the removal efficiency is found to be decreasing with high initial concentrations
- The COD removal and Nitrate removal in anodic and cathodic chambers of the microalgae-microbial fuel cell is found to be 60% and 100% respectively in 25 days and Fluconazole removal in anodic chamber of microalgae is found to be 76% in 7 days.

1-3 Research Outputs to Date

1) Publications (Underline the authors from the Co-PI team)

- International Journals (Author, Year, “Title,” *Journal*, Vol., pp.)

Nil

- Conference Proceedings (Author, Year, “Title,” *Proceedings*, Vol., pp.)

Nil

- Others

Nil

2) Patent Applications Nil

Filing Number	Date	Name of Invention	Inventors

1-4 Future Challenges

1) Next Goal/Plan of Research
   1) To study the degradation by products of pharmaceutical removal using microalgae and microalgae microbial fuel cell
   2) To study the removal of pharmaceuticals from real wastewater using microalgae-microbial fuel cell
   3) Scale up of the system

2) Next Financial Resources/Research Grants (Obtained/Applied for/Drafting)

Friendship 2.0

2 Input to Research

2-1 Research Equipment

Item	Place of Installation	Date of Installation	Current Status
Workstation	G02 Lab, Department of Civil Engineering, IIT Hyderabad	10 August 2022	Working good. In use for experiments
Conductivity meter	G02 Lab, Department of Civil Engineering, IIT Hyderabad	28 September, 2022	Working good. In use for experiments
Magnetic stirrer	Lab 323, Environmental Engineering laboratory, Department of Civil Engineering, IIT Hyderabad	28 September, 2022	Working good. In use for experimental setup
pH Electrode	G02 Lab, Department of Civil Engineering, IIT Hyderabad	9 November, 2022	Working good. In use for experiments

2-2 Visits to Japan

Nil

Visitor	Period	Activities (Academic/Research)	Outputs

2-3 Visits by Japanese Research Team Members

Nil

Visitor	Period	Activities (Academic/Research)	Outputs

2-4 Solutions Taken under the COIVD-19 Pandemic

NA

2-5 International Conferences Nil

1) Trips

Conference	Visitor	Period	Outputs

2) Registration (including online conferences) Nil

Conference	Speaker	Date	Country	Outputs

2-6 Execution Status of Budget

Item Category	Consumption (amount spent in INR)	Budget (as listed in the research plan, INR)	Consumption % (Consumption / Budget x 100)
Research equipment	1,21,000.00	1,21,000.00	100%
Consumables	159337.44	159337.44	100%
Registration fees	Nil		
Travel (Used for consumables)	129,931.33	130000	99%

3 Collaboration with Japanese Partner

3-1 Academic Development through Collaboration

NA

1) Record of Collaborative Academic Activities (including online activities; except co-supervision of 'I's master's students)

Date	Collaborative Academic Activity (Topic of Lecture/Open Seminar)	Speaker	Outputs

2) Plan of collaborative education programs (Double/Joint degree)

3) Plan of collaborative lectures in 2023 or later

3-2 Co-supervision of Master's Students

1) Record of Co-supervision

Student: Bharat Sreepada

Co-supervisor: Norihisa Matsuura

(If two or more students have been co-supervised, use one table for each student)

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs
	Reactor design for removal of pharmaceuticals	Partial fulfillment of thesis requirements

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs

2) Candidates of FRIENDSHIP 2.0 Scholarship 2023

Name	Prospective Supervisor	Research Plan
Akanksha Rajpurohit	Tomohiro Tobino	Optimize the operational conditions for removal of pharmaceutical products in MES
Pavithra	Tomohiro Tobino	Continuous MES reactor operation at optimal conditions to remove pharmaceuticals

3) Master's Thesis (as outputs of the FRIENDSHIP 2.0 research; by students of India and Japan)

Author	Thesis Title	Status
Bharat Sreepada	Reactor design for removal of pharmaceuticals	Done
Akanksha Rajpurohit	Synthesis of VFA in MES reactor	Continuing
Pavithra	Impact of imposed potential on chain elongation in MES reactor	Continuing

4) Dissertations (as outputs of the FRIENDSHIP 2.0; by students of both India and Japan)

NA

Author	Dissertation Title	Status

5) Next Plan of Co-supervision

Name	Status (Master/Doctor)	Prospective Co-supervisor	Research Topic
Akanksha Rajpurohit	Master	Tomohiro Tobino	Optimize the operational conditions for removal of pharmaceutical products in MES
Pavithra	Master	Tomohiro Tobino	Continuous MES reactor

			operation at optimal conditions to remove pharmaceuticals

3-3 Action Plans for Further Collaboration

1) Financial Resources/Research Grants (Obtained/Applied for/Planned)

NDIA-JAPAN FRIENDSHIP 2.0 Research Grant – applied for

2) Potential Industrial/Social Application of Research Outputs

NA

3-4 Lessons Learnt and Challenges for Future Collaboration

1) Lessons learnt

Regular communication helps in getting objectives done

2) Challenges for future collaboration and potential solutions

The only way of contacting the collaborator being through email, holidays and vacations are difficult to know. Sharing of deadlines and calendars will help with this.

FRIENDSHIP 2.0

Research Grant 2022

Final Report

ID: 8

Research Topic: Generating natural language descriptions/ summaries of data tables

Name of PI: Dr. Maunendra Sankar Desarkar

Date: 15-Nov-2022

Table

1 Implementation of Research

1-1 Research Team Members

	Name	Position	Department / Organization	Responsibilities
PI	Dr. Maunendra Sankar Desarkar	Associate Professor (CSE), Head, Department of AI	IIT Hyderabad	Mentoring, and handling the project
Co-PI	Prof. Akiko Aizawa	Professor, National Institute of Informatics	NII, Tokyo	Mentoring
Student	Darshan Dobariya	Student	IIT Hyderabad	Literature survey, model implementation and evaluation

1-2 Summary of Research (Research Question and Findings)

1) Research Question

Can NLP techniques be used to generate descriptions of tabular data?

2) Research Findings (Do NOT disclose details of findings; it might impede applying for a patent)

1. NLP techniques can be used to generate descriptions of rows from data tables
2. For tables that are “info boxes”, where attributes are presented in rows (or columns) and values for the attributes are presented in columns (or rows), and the entire table can be viewed as a description of an object/entity/topic, NLP techniques can be used to generate descriptions of the table.
3. Quality of the generated descriptions is not uniform, and there is huge variation in the acceptability of individual generations, which requires deeper investigations into the models.

1-3 Research Outputs to Date

1) Publications (Underline the authors from the Co-PI team)

- International Journals (Author, Year, “Title,” *Journal*, Vol., pp.)

- Conference Proceedings (Author, Year, “Title,” *Proceedings*, Vol., pp.)

- Others

2) Patent Applications

Filing Number	Date	Name of Invention	Inventors

1-4 Future Challenges

1) Next Goal/Plan of Research

- Development of a better algorithm for the task. The current approaches show lot of scope for improvement.

2) Next Financial Resources/Research Grants (Obtained/Applied for/Drafting)

- Planning to draft a proposal for submitting to funding agencies. Waiting for the current set of experiments to finish, to identify the required methodological changes.

2 Input to Research

2-1 Research Equipment

Item	Place of Installation	Date of Installation	Current Status
GPU Workstation	A-612	23-07-2022	Working

2-2 Visits to Japan

Visitor	Period	Activities (Academic/Research)	Outputs

2-3 Visits by Japanese Research Team Members

Visitor	Period	Activities (Academic/Research)	Outputs

2-4 Solutions Taken under the COIVD-19 Pandemic

2-5 International Conferences

1) Trips

Conference	Visitor	Period	Outputs

2) Registration (including online conferences)

Conference	Speaker	Date	Country	Outputs

2-6 Execution Status of Budget

Item Category	Consumption (amount spent in INR)	Budget (as listed in the research plan, INR)	Consumption % (Consumption / Budget x 100)
Research equipment	3,30,000	3,30,000	0%
Consumables	0	85,000	0%
Registration fees	0	40,000	0%
Travel	3,30,000	4,55,000	72.5%

Collaboration with Japanese Partner

2-7 Academic Development through Collaboration

1) Record of Collaborative Academic Activities (including online activities; except co-supervision of 'I's master's students)

Date	Collaborative Academic Activity (Topic of Lecture/Open Seminar)	Speaker	Outputs
11-Nov-2022	Measuring and Mitigating Shortcuts in Natural Language Understanding	Prof. Akiko Aizawa	Many members from the IITH community attended the interesting talk. Discussions on interesting open problems/future works
17-Nov-2022	Language Generation in low-resource languages: Concerns and Considerations	Dr. Maunendra Sankar Desarkar	Talk is yet to happen

2) Plan of collaborative education programs (Double/Joint degree)

We are drafting proposals for joint problem statements

3) Plan of collaborative lectures in 2023 or later

Nothing planned as of now.

2-8 Co-supervision of Master's Students

1) Record of Co-supervision

Student: Darshan Dobariya

Co-supervisor: Prof. Akiko Aizawa

(If two or more students have been co-supervised, use one table for each student)

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs
June 2023	Table to Text Generation	The student is currently working on this problem as his MTech Thesis

2) Candidates of FRIENDSHIP 2.0 Scholarship 2023

Name	Prospective Supervisor	Research Plan

3) Master's Thesis (as outputs of the FRIENDSHIP 2.0 research; by students of India and Japan)

Author	Thesis Title	Status
Darshan Dobariya	<To be decided>	<Ongoing>

4) Dissertations (as outputs of the FRIENDSHIP 2.0; by students of both India and Japan)

Author	Dissertation Title	Status

5) Next Plan of Co-supervision

Name	Status (Master/Doctor)	Prospective Co-supervisor	Research Topic

2-9 Action Plans for Further Collaboration

1) Financial Resources/Research Grants (Obtained/Applied for/Planned)
   - Planning to draft a proposal for submission to funding agencies. Waiting for the current set of experiments to finish, to identify the required methodological changes.

2) Potential Industrial/Social Application of Research Outputs
   - The current work has many industrial and social applications. In any situation where tables are used to store data, the table-to-text generation techniques could be helpful to get a meaningful explanation of the underlying data. However, a generic algorithm for all types of tables (values as textual/numeric/categorical/comparable-vs-non-comparable e. g. Marks vs zip codes etc.) may not be possible. That's where thorough research is needed to understand the broader context of the tabular data and develop the methods accordingly.

2-10 Lessons Learnt and Challenges for Future Collaboration

1) Lessons learnt
   - The problem is challenging, and recently many research papers have started to come on this theme. This shows that there is a growing interest in the area. Also, as each paper aims to advance the state of the art, more effort is needed to understand the very recent literature and analyze them critically.
   - Implementation is a crucial part of this kind of projects. It is better to involve students who have prior experience of doing implementations involving Natural Language Generation tasks.
2) Challenges for future collaboration and potential solutions
   - A major part of the work involves implementation. The implementation also is not straight-forward. It is important to (a) either involve students who are knowledgeable about natural language generation implementation (b) or give them time and resources to come to pace with this level of implementation.
   - Dataset availability is a major challenge. Not many datasets are publicly available for the task

FRIENDSHIP 2.0

Research Grant 2022

Final Report

ID: AC2022-9

Research Topic: Experimental Investigation on Fracture Behavior of High-strength Steel Reinforced Concrete using Acoustic Emission

Name of PI: Suriya Prakash S

Date: 01/11/2022

Table

1 Implementation of Research

1-1 Research Team Members

Role	Name	Position	Department / Organization	Responsibilities
PI	Dr. Suriya Prakash S	Professor	Dept. of Civil Engineering	Overall responsibility for the project implementation
	Chetharajupalli Veerendar	PhD Candidate	Dept. of Civil Engineering	Help with experimental work
Co-PI	Dr. Yuma Kawasaki	Associate Professor	Dept. of Civil Engineering	Help with analytical work in the experiment,

1-2 Summary of Research (Research Question and Findings)

I. Research Question: The proposed research uses high-strength steel rebars of lesser diameter of high strength compared to the conventional rebars. Though there is a cost reduction in the consumption of steel by using high-strength steel, the outcome of the project is to find the performance of high-strength steel at the serviceability conditions and compare with conventional TMT rebars.

II. Research Findings

The experimental results shows that the proposed high-strength steel strands perform well under the serviceability condition and these stands can also be used in on-grade slab applications.

1-3 Research Outputs to Date

I. Publications (Underline the authors from the Co-PI team)

- International Journals (Author, Year, “Title,” *Journal*, Vol., pp.)

  Submitted the journal paper to construction and building materials journal titled “A study on the fracture behavior of concrete prisms reinforced with normal and high-strength steel rebars using acoustic emission” (authors: Krishnaa S, Chetharajupalli Veerendar, Suriya Prakash S, Yuma Kawasaki).

- Conference Proceedings (Author, Year, “Title,” *Proceedings*, Vol., pp.)

  Submitted the conference paper titled ‘Experimental investigation of fracture behavior of concrete

beams reinforced with high-strength steel rebars using acoustic emission' SICE 2022 by 'Indian Structural Integrity Society', December 18-20, Hyderabad. Authors: Krishnaa S, Chetharajupalli Veerendar, Suriya Prakash S, Yuma Kawasaki

II. Patent Applications

Filing Number	Date	Name of Invention	Inventors
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1-4 Future Challenges

I. Next Goal/Plan of Research:

The next plan of the research would be to explore the use of glass fiber reinforced polymer (GFRP) bars in concrete elements to understand the fracture behavior and compare the results with high-strength steel rebars and conventional TMT rebars.

II. Next Financial Resources/Research Grants (Obtained/Applied for/Drafting) Currently working on the draft for the JICA FRIENDSHIP 2.0 Research Grant 2023.

Applied for JICA FRIENDSHIP 2.0 Research Grant 2023 with the research title "Fracture behavior of glass fiber reinforced polymer (GFRP) bars reinforced concrete using acoustic emission technique with and without exposure to alkaline environment".

2 Input to Research

2-1 Research Equipment

Item	Place of Installation	Date of Installation	Current Status
AE Sensors	QC Lab, IITH	30-06-2022	Working
Strain Gauges	QC lab, IITH	15-06-2022	Working

2-2 Visits to Japan

Visitor	Period	Activities (Academic/Research)	Outputs
Krishnaa S Master Student of IITH	3 months	Research. Travel support was take care by Prof Suriya Prakash.	To learn AE analysis. Two papers have come out of this stay.

2-3 Visits by Japanese Research Team Members

Visitor	Period	Activities (Academic/Research)	Outputs

2-4 Solutions Taken under the COIVD-19 Pandemic

2-5 International Conferences

1) Trips

Conference	Visitor	Period	Outputs
India	Krishnaa S	4 days	Conference paper to be published

2) Registration (including online conferences)

Conference	Speaker	Date	Country	Outputs
Indian Structural Integrity Society	Krishnaa S	14/12/2022	India	Conference paper to be published

2-6 Execution Status of Budget

Item Category	Consumption (amount spent in INR)	Budget (as listed in the research plan, INR)	Consumption % (Consumption / Budget x 100)
Research equipment	3,36,300	3,36,300	100
Consumables	4,63,700	4,63,700	100
Registration fees	-	-	-
Travel	-	-	-

3 Collaboration with Japanese Partner

3-1 Academic Development through Collaboration

- Record of Collaborative Academic Activities (including online activities; except co-supervision of 'I's master's students)

Date	Collaborative Academic Activity (Topic of Lecture/Open Seminar)	Speaker	Outputs
NIL			

- Plan of collaborative education programs (Double/Joint degree)
  - Joint PhD guidance is planned. It will be discussed in the senate of IITH.

- Plan of collaborative lectures in 2023 or later

  Workshop on Non-Destructive techniques on concrete elements using acoustic emission techniques is planned in December 2023 at IIT Hyderabad.

3-2 Co-supervision of Master's Students

1) Record of Co-supervision

   Student: Krishnaa S

   Co-supervisor: Yuma Kawasaki

   (If two or more students have been co-supervised, use one table for each student)

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs
01/08/2022-present	Discussion on AE analysis	Conference paper and Journal paper to be published

2) Candidates of FRIENDSHIP 2.0 Scholarship 2023

Name	Prospective Supervisor	Research Plan
Krishnaa S	Dr. Suriya Prakash S	To understand the fracture behavior of GFRP rebars in concrete using acoustic emission technique.

3) Master's Thesis (as outputs of the FRIENDSHIP 2.0 research; by students of India and Japan)

Author	Thesis Title	Status
Krishnaa S	Experimental investigation of fracture behavior of concrete beams reinforced with high-strength steel rebars using acoustic emission	Paperwork in progress

4) Dissertations (as outputs of the FRIENDSHIP 2.0; by students of both India and Japan)

Author	Dissertation Title	Status

5) Next Plan of Co-supervision

Name	Status (Master/Doctor)	Prospective Co-supervisor	Research Topic
Krishnaa S	Master student	Dr. Yuma Kawasaki	Fracture behavior of glass fiber reinforced polymer (GFRP) bars reinforced concrete using acoustic emission technique with and without exposure to alkaline environment".

3-3 Action Plans for Further Collaboration

I. Financial Resources/Research Grants (Obtained/Applied for/Planned)

Applied for JICA FRIENDSHIP 2.0 Research Grant 2023 with the research title "Fracture behavior of glass fiber reinforced polymer (GFRP) bars reinforced concrete using acoustic emission technique with and without exposure to alkaline environment".

II. Potential Industrial/Social Application of Research Outputs

TATA steel, India has been collaborating with IITH to promote the widespread use of GFRP bars. It is expected that it will be a stepping stone towards building a sustainable infrastructure and promote use of GFRP rebars as an alternative for steel.

3-4 Lessons Learnt and Challenges for Future Collaboration

I. Lessons learnt

The use of high-strength steel has both advantages and disadvantages. Though the high-strength steel reinforced concrete beams perform well under serviceability and ultimate condition, these bars are prone to corrosion damage. This will be overcome by the use of GFRP rebars.

II. Challenges for future collaboration and potential solutions

One of the main challenges for the use of GFRP bars in industries will be their adaptability to different conditions. As the use of these materials in various applications are yet to be studied , implementation of proper codes is necessary.

FRIENDSHIP 2.0

Research Grant 2022

Final Report

ID:
Research Topic:
Application and Life Cycle Analysis of Waste-based Biochar for Water Treatment

Name of PI: Dr. Ambika S

Date: 14.11.2022

Table

1 Implementation of Research

1-1 Research Team Members

	Name	Position	Department / Organization	Responsibilities
PI	Dr. Ambika S	Assistant Professor	Assistant Professor, Civil Engineering Adjunct Faculty, Climate Change Faculty and Program coordinator, E-Waste Resources Engineering and Management IIT Hyderabad, India	Overall responsibility for the project implementation Task 1) Preparation and characterization of biochar Task 2) Application of biochar for the water treatment Task 3) Life cycle Impact assessment Task 4) arranging and giving lectures, joint workshops, manuscript preparation
Co-PI	Dr. Yoshikawa Naoki Co-PI	Lecturer	Department of Civil and Environmental Engineering, College of Science and Engineering, Ritsumeikan University	Collaboration with PI/Co-supervising students Task 1: Supervision, data analysis and interpretation in life cycle impact analysis of waste-based biochar for water treatment, manuscript preparation Task 2: arranging and giving lectures, joint workshops, manuscript preparation

1-2 Summary of Research (Research Question and Findings)

1) **Research Question:**

Is the application of waste-derived biochar in water treatment a step towards achieving sustainable development goals by 2030?

Objective

The objective of this proposal is to apply the crop residue and plastic waste-derived biochar for removing agricultural-based emerging pollutants from aqueous solution and assess the impacts based on life cycle analysis aspects.

2) Research Findings (Do NOT disclose details of findings; it might impede applying for a patent)

The following tasks are successfully demonstrated. The research findings are being converted to a manuscript.

- Preparation of biochar from crop residue using various methods and characterization
- Preparation of biochar from plastic waste and characterization
- Application of the obtained biochar for the removal of target agri-based pollutant
- Life cycle impact assessment considering the ecological damage, climate change aspects, health-risks, impact on life above land and below water to assess the status and achieve the targeted SDGs

1-3 Research Outputs to Date

1) **Publications (Underline the authors from the Co-PI team)**

- **International Journals (Author, Year, "Title," *Journal*, Vol., pp.)**
  1. Conference paper: Parvathy AS, Nitya C, Naoki Y, Ambika S., 3rd International Conference on Advanced Technologies for Industrial Pollution Control (ATIPC-2022), December 21-23, 2022 (accepted)
  2. Journal paper: Parvathy AS, Naoki Y, Ambika S., Conversion of Agro-based Waste to Biochar and its Application in the Removal of Pesticides from Agricultural Run off (under preparation)
  3. Journal paper: Parvathy AS, Nitya C, Naoki Y, Ambika S., Application and Life Cycle Sustainability Assessment of Plastic Waste based Biochar in Treating Emerging Pollutants (under preparation)

2) **Patent Applications:** NA

1-4 Future Challenges

1) Next Goal/Plan of Research

This research provided us with the proof of concept and required data to apply for a S&T research proposal. The team aims to submit the proposal to Indo-Japan Bilateral Research Call from DST.

2) Next Financial Resources/Research Grants (Obtained/Applied for/Drafting)

The team is drafting the proposal for its submission to DST-Bilateral call.

2 Input to Research

2-1 Research Equipment

Item	Place of Installation	Date of Installation	Current Status
Workstation	IITH	23.8.2022	Working
UV Visible spectroscopy	IITH	15.8.2022	Working
Laptop	IITH	23.8.2022	Working

2-2 Visits to Japan

Visitor	Period	Activities (Academic/Research)	Outputs
Nil			

2-3 Visits by Japanese Research Team Members

Visitor	Period	Activities (Academic/Research)	Outputs
Nil			

2-4 Solutions Taken under the COIVD-19 Pandemic

To apply for the next phase JICA project (2023) to take the travel to Japan and to visit PI's laboratory and to meet the group of researchers to formulate a research proposal aiming good funding

2-5 International Conferences

1) Trips

Conference	Visitor	Period	Outputs
Nil			

2) Registration (including online conferences)

Conference	Speaker	Date	Country	Outputs
Nil				

2-6 Execution Status of Budget

Item Category	Consumption (amount spent in INR)	Budget (as listed in the research plan, INR)	Consumption % (Consumption / Budget x 100)
Research equipment	5,00,000	5,00,000	100%
Consumables	3,00,000	3,00,000	100%
Registration fees	0	0	-
Travel	0	0	-

3 Collaboration with Japanese Partner

3-1 Academic Development through Collaboration

1) Record of Collaborative Academic Activities (including online activities; except co-supervision of 'I's master's students)

Date	Collaborative Academic Activity (Topic of Lecture/Open Seminar)	Speaker	Outputs
13.9.2022	Dr. Naoki Yoshikawa from the University of Shiga Prefecture has given a talk on "Waste Management and Life Cycle Analysis (LCA)" to the BTech, MTech, and Ph.D. students of IIT Hyderabad from 4.00 pm to 5.00 pm IST.	Dr. Naoki Yoshikawa	1) The students of IITH has learned the basic aspects of Life Cycle analysis in solid and liquid waste management 2) The students of IITH have interacted with Dr. Naoki on his on-going projects, and research opportunities.
14.10.2022	Webinar talk on "Opportunities and Challenges in Life Cycle Sustainability Analysis in Waste Management and Resource Recovery " during 7.30-8.30 am to the students of University of Shiga Prefecture. Prof. Soda from University of Ritzumeikan also attended the talk and interacted.	Dr. Ambika S	3) The students of University of Shiga Prefecture has learned the opportunities and challenges in LCA and sustainability analysis in waste management 4) There was a interaction between Dr. Ambika and the students have happened in which the students asked questions on the presentation and Dr. Ambika's on-going projects 5) Prof. Soda from Ritzumeikan university has interacted with Dr. Ambika regrading on-going and future projects.

2) Plan of collaborative education programs (Double/Joint degree)

Ms. Parvathy – the MTech student is interested in PhD opportunities at Japan universities.

3) Plan of collaborative lectures in 2023 or later

Prof. Soda has expressed delivering a lecture at IITH. May be, it will be organized during 2023.

Dr. Ambika got introduced to Prof. Kondo and Dr. Koichi from College of Pharmaceutical Sciences, at Ritzumeikan university with whom she has submitted the JICA Friendship 2023 proposal.

3-2 Co-supervision of Master's Students

1) Record of Co-supervision : Student: Ms. Parvathy, Co-supervisor: Dr. Naoki

Date	Topic of Co-supervision (Discussion/Seminar/Reports etc.)	Outputs
1.4.2022	Introduction meeting with the student Ms. Parvathy	The student was introduced formally and the works were planned
6.5.2022	Discussion on the framework of LCA	The LCA framework was finalized
3.6.2022	Discussion on inventory analysis of biochar	The input and output data were discussed
12.8.2022	Thesis Review 1 of Parvathy	The thesis review -1 was completed
13.9.2022	Dr. Naoki's talk and interaction	The IITH students got enlightened on the LCA related studies
14.10.2022	Dr. Ambika's talk and interaction	The USEP students got enlightened on the LCA related studies
4.11.2022	Discussion on interpretation of LCA	The results were interpreted for further reporting

2) Candidates of FRIENDSHIP 2.0 Scholarship 2023

Name	Prospective Supervisor	Research Plan
Mr. Venkateshwaran G	Dr. Ambika S	Removal of PFAS from Environment
To be fixed MTech student	Dr. Ambika & Prof. Koichi	PFAS in Environment
To be fixed MTech student	Dr. Ambika & Prof. Koichi	Electrochemical removal of PFAS

3) Master's Thesis (as outputs of the FRIENDSHIP 2.0 research; by students of India and Japan)

Author	Thesis Title	Status
Ms. Parvathy	Application and Life Cycle Analysis of Waste based Biochar for Water Treatment (Part of her thesis will be from this project)	Submitted at May 2023

4) Dissertations (as outputs of the FRIENDSHIP 2.0; by students of both India and Japan)

Author	Dissertation Title	Status
Nil		

5) Next Plan of Co-supervision

Name	Status (Master/Doctor)	Prospective Co-supervisor	Research Topic
Ms. Parvathy	Master	Dr. Naoki	Application and Life Cycle Analysis of Waste based Biochar for Water Treatment (will be continued)
To be fixed MTech student	Master (through JICA 2023 project)	Prof. Koichi	Removal of PFAS from Environment
To be fixed MTech student	Master (through JICA 2023 project)	Prof. Koichi	Analysis of PFAs in Environment

3-3 Action Plans for Further Collaboration

1) Financial Resources/Research Grants (Obtained/Applied for/Planned)

- Applied for JICA 2023 Friendship proposal call
- Planned to apply Indo-Japan bilateral proposal call

2) Potential Industrial/Social Application of Research Outputs

In the preliminary discussion with Fruit Research Institute, Sangareddy Hyderabad, the institute showed interest in converting the fruit-based waste to biochar. It needs to be tested for further progress.

3-4 Lessons Learnt and Challenges for Future Collaboration

1) Lessons learnt

- JICA projects offer a good platform for Japan collaboration which can be the stepstone for bigger future projects
- JICA supported the lab development in terms of funding to buy equipment and consumables which helps in progressing with the research
- Well ahead of time, the PI should be ready with the collaborator and proposal, so if the JICA call comes, the proposal can be submitted effectively.

2) Challenges for future collaboration and potential solutions

- Looking for academic collaborator in the research area of physicochemical treatment of water and wastewater such as
    - Membrane treatment
    - Disinfection
    - Electrochemical techniques
    - Catalysis and photocatalysis
- How to find an industrial collaborator in the field of waste management and treatment?

Attachment 3-4:
Presentation Materials for
Interdisciplinary Research Seminar

Challenging the paradigm

Activating T-type calcium channel isoform Cav3.1 for breast cancer therapeutics

BC subtype specific expression

Gene isoforms (T-type)	BREAST CANCER SUBTYPE		
	Luminal	HER2+	Triple-Negative
(Cav3.1) CACNA1G	↓	↓	↓
CACNA1H	↑	↔	↔
CACNA1I	↑	↔	↑

Hypothesis: Selective Cav3.1 activation in luminal type breast cancer may lead to therapeutic benefits

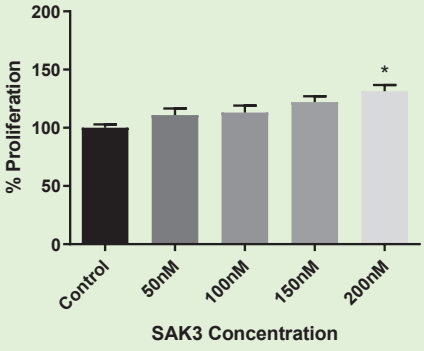
FRIENDSHIP 2.0 Interdisciplinary Research Seminar

PI: Anamika Bhargava
Associate Professor
Dept. of Biotechnology,
IITH

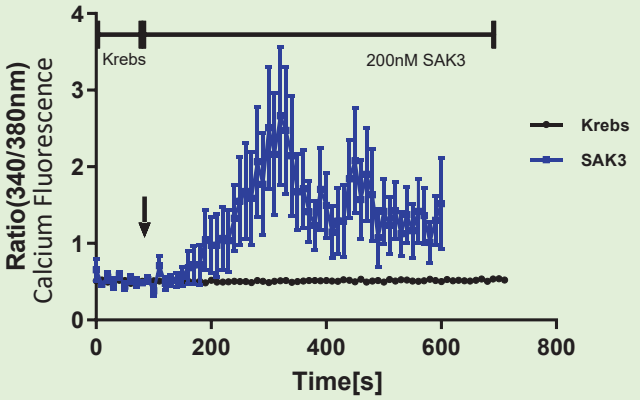
Co-PI: Andres D Maturana
Associate Professor
Graduate School of Bioagricultural Science,
Nagoya University,

Revelations

Experimental Model: T-47D, mammalian cancer cell line, luminal type



- Significant increase in proliferation of T-47D cells observed at 200 nM SAK3 concentration.



SAK3 perfusion led to a transient rise in cytosolic calcium in T-47D cells

- SAK3 acts on T-type calcium channels isoforms and significantly increases cytosolic calcium levels in T-47D cells.
- Treatment with SAK3 is resulting in an increase in cell proliferation due to the increase in intracellular calcium through activation of T-type Calcium channels not in line with our hypothesis.

Significance, Novelty and National/International Impact

- Novel drug targets for Luminal type breast cancer
- If proven successfully then existing drugs can be repurposed since channel modulators exist as drugs.

Future Plans: Indo-JAPAN Collaboration

1) **Sakura Academic Exchange:** PhD Student Ankush Sharma is visiting the lab of Dr Andre D Maturana, Nagoya University from Jan 12th to Jan 31^{st,} doing collaborative experiments.

2) **DST mobility grant applied:** Opportunity to travel for 3-6 months every year for 2 years for both sides. Result is awaited tentative March 2023.

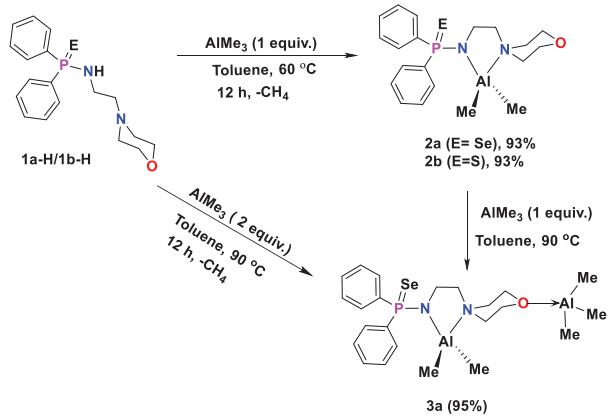
3) **MTech student Ms Tharunika will finish her thesis with Dr Andres Maturana as co-guide.**

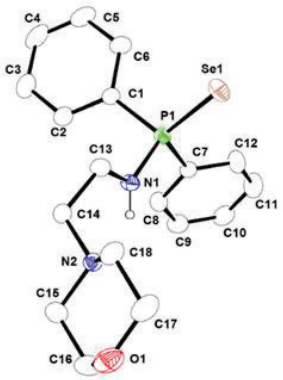
4) **Looking for grants to apply: both mobility and research expenses. Technical compatibility:** cellular electrophysiology and **Technique exchange:** Zebrafish animal model expertise (provide by Indian team) FRET (Provided by JAPAN team)

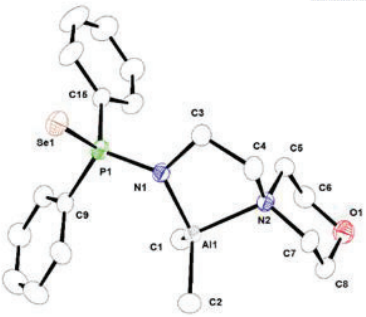
Atom Economic Hydroboration of C-X Unsaturated Bonds as Green Method for Organic Synthesis

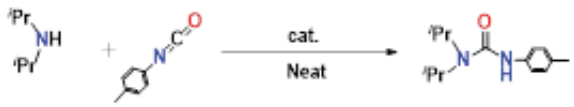
Implementation of Research

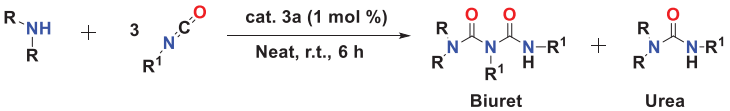
	Name	Position	Department / Organization	Responsibilities
PI	Tarun Kanti Panda	Professor	Chemistry	Overall responsibility for the project implementation
	Priyankar Mandal	Master student	Chemistry	Synthesis of Ligand and Metal complexes suitable for Al metal complexes.
	Ravi Kumar	PhD student	Chemistry	Synthesis of Al complexes and selective hydroboration with alkynes.
	Kulsum Bano	PhD student	Chemistry	Synthesis of Al complexes and selective hydroelementation.
Co-PI	Dr. Hayato Tsurugi	Associate Professor	*Graduate School of Engineering Science, Osaka University*	*Monitoring the project periodically through online/vedioconferencing, optimization and super-vising the master students and giving inputs to improprove the process.*

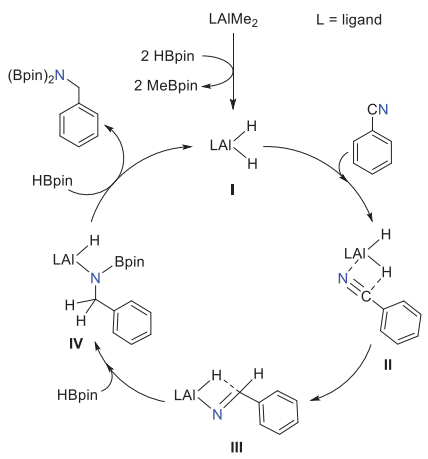


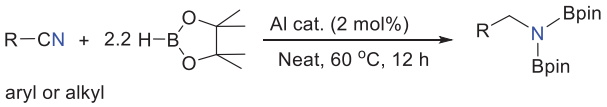




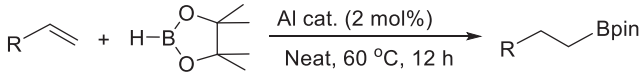




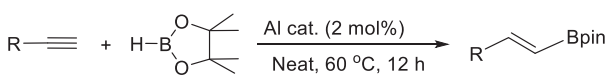




R = aryl or alkyl



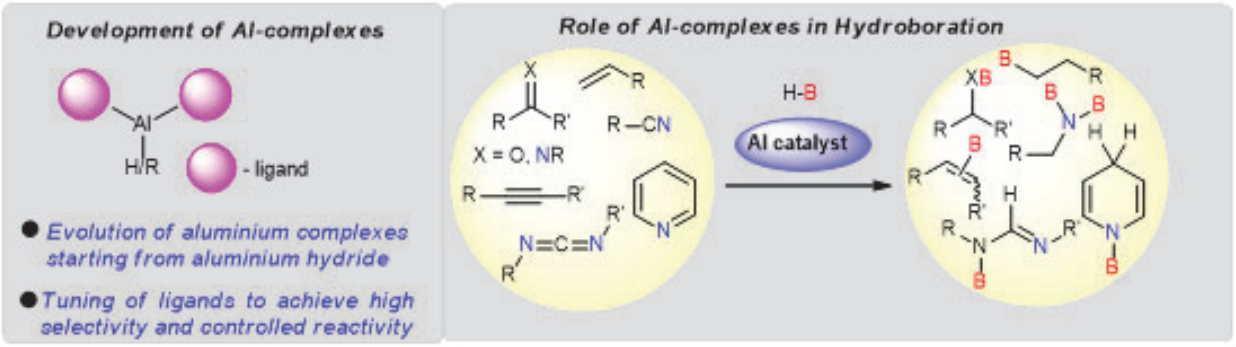
R = aryl or alkyl

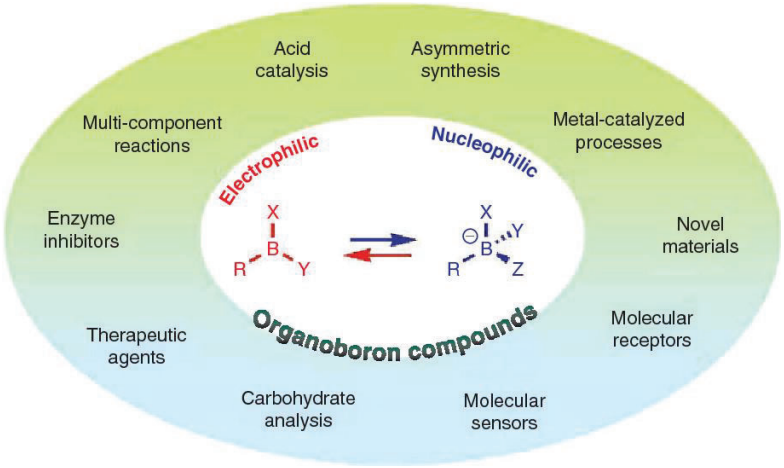


R = aryl or alkyl

Impact on Indian/global society

Development the Al-catalyst for hydroboration reaction of alkene and alkynes





In this greener approach, the organoboron compounds are vital tools for synthetic chemistry, particularly in asymmetric synthesis, metal-catalyzed processes, acid catalysis, and multicomponent reactions. As a result, boronic acids and related molecules have now evolved as major players in synthetic and medicinal chemistry.

Future plan (especially for students and collaboration)

- **Master's thesis/dissertation of member students by co-supervision with Co-PI**
- **Study plan in Japan (for master's students)**
- **Application for another External funding (SERB, JSPS etc)**
- **Plan of cooperation with industries (such as internship, joint research)**
- **Plan of a joint application for research grants after the FRIENDSHIP 2 grant**
- **Dissemination of results, management of intellectual property: patents, publications, conferences.**

* K. Bano, J. Sharma, A. Jain,* H. Tsurugi* and T. K. Panda*, *RSC Advances*, **2023**, *in press*.

Thank you!

Generating Natural Language Descriptions/ Summaries Of Data Tables

Dr. Maunendra Sankar Desarkar

Prof. Akiko Aizawa

Problem Statement

- Input: A Table
- Output: A description of
  - One row
  - Multiple rows
  - One row, select columns
  - Multiple rows, select columns
- Possible usage scenarios
  - Ecommerce products
  - Weather data
  - Medical report generation

Slot type	Slot value
Name_ID	1 Aaron Miller
Member of sports team	2 Colorado Avalanche
Member of sports team	3 Quebec Nordiques
Date of birth	4 August 11 1971
Place of birth	5 Buffalo, New York
Country of citizenship	6 United States
Participant of	7 2006 Winter Olympics
Participant of	8 2002 Winter Olympics
Sport	9 Ice hockey
Position played on team / speciality	10 Defenceman

Aaron Miller (born August 11 1971 in Buffalo, New York) is an United States former professional Ice hockey Defenceman who played in the National Hockey League (NHL) for the Quebec Nordiques and Colorado Avalanche. he was a member of the United States men's national Ice hockey team at the 2002 Winter Olympics and 2006 Winter Olympics.

Progress made

- A thorough literature survey
- Reproducing some of the results to understand the quality of generations

- References:
  - Table-to-text Generation by Structure-aware Seq2seq Learning (AAAI 2018)
  - Table-to-Text Generation with Effective Hierarchical Encoder on Three Dimensions (Row, Column and Time) (EMNLP 2019)
  - Towards Faithful Neural Table-to-Text Generation with Content-Matching Constraints (ACL 2020)
  - TableGPT: Few-shot Table-to-Text Generation with Table Structure Reconstruction and Content Matching (ICCL 2020)
  - TABLEFORMER: Robust Transformer Modeling for Table-Text Encoding (ACL 2022)

Lessons Learned

- Different setups
  - Table talks about one object
  - Each row talks about one object
  - The values are numeric and the method understands it
- Evaluation
  - All the papers typically report absolute dataset-level performance
  - Each model generates some good captions, and some bad captions
  - The quality of generated captions is not uniform

Lessons Learned

- Seq2Seq models for the generation
- Input to the model: a linearized version of the cell(s) under consideration
- How the models are different from each other:
  - How the model generates the token sequence
  - The loss function
    - MLE Loss
    - Optimal transport loss
    - Latent feature matching disagreement loss
  - Implementation will be a crucial part of the work

Impact on Indian/Global Society

- In any situation where tables are used to store data, the table-to-text generation techniques could be helpful to get a meaningful explanation of the underlying data.
- However, a generic algorithm for all types of tables (values as textual/numeric/categorical/comparable-vs-non-comparable e. g. Marks vs zip codes etc.) may not be possible.
- That's where thorough research is needed to understand the broader context of the tabular data and develop the methods accordingly.
- Proper datasets will be needed

Future plan

- Identified a few next-level problem setups to work on
  - Proper formulation of the problems
- Planning to draft a joint proposal for submission
- Joint supervision of students
- Collaboration with industry on related problems

JICA Friendship Phase I Project 2022 Presentation on

Application and Life Cycle Analysis of Waste-based Biochar for the Removal of Emerging Contaminants

Dr. Ambika S
Assistant Professor,
Department of Civil Engineering,
IIT Hyderabad, India

Dr. Yoshikawa Naoki
School of Environmental Science,
University of Shiga Prefecture
Japan

Outline

- Research Question: Is the application of waste-derived biochar in water treatment a step towards achieving sustainable development goals by 2030?
- Objective: The objective of this proposal is to apply the crop residue and plastic waste-derived biochar for removing agricultural-based emerging pollutants from aqueous solution and assess the impacts based on life cycle analysis aspects.

New findings and Exciting Part

- Preparation of biochar from crop residue using a unique thermochemical methods and characterization
- Preparation of biochar from plastic waste – found another exciting application
- Application of the obtained biochar for the removal of target agri-based pollutants
- Life cycle impact assessment considering the
  - ecological damage,
  - climate change aspects,
  - health risks,
  - impact on life above land and below water
- Impacts on Sustainability aspects
- **2 webinar talks**

Impact on society when fully achieved

- Crop residue & Plastic waste management – Opportunities &Challenges
- Emerging pollutants - primary and secondary aqueous pollutants
- Looking for academic collaborator in the research area of physicochemical treatment of water and wastewater such as
  - Membrane treatment
  - Disinfection
  - Electrochemical techniques
  - Catalysis and photocatalysis
- How to find an industrial collaborator in the field of waste management and treatment?

Future plan

- **Next Goal/Plan of Research**
  - This research provided us with the proof of concept and required data to apply for a S&T research proposal.
  - The team aims to submit the proposal to Indo-Japan Bilateral Research Call from DST
- **Next Financial Resources/Research Grants (Obtained/Applied for/Drafting)**
  - The team is drafting the proposal for its submission to DST-Bilateral call
- **Students Collaboration**
  - The MTech student is interested in doing PhD in Japan

Attachment 3-5: Outlines of the FRIENDSHIP 2.0 Research Grant Program 2023 (As of 14th February, 2023)

ID	PI			Research Topic	Co-PI		
	Name	Sex	Department		Name	Organization	Deparment
AC2023-1	Panda Tarun Kanti	M	Chemistry	Production of Polycarbonates as an alternative to engineering plastic employing bio-based monomers towards a sustainable world	Tsurugi Hayato	Osaka University	Graduate School of Engineering Science
AC2023-2	Mehta Gunjan Deepakkumar	M	Biotechnology	Role of chromatin remodelers in meiotic recombination and transcriptional switch during yeast meiosis, with emphasis on genetic disorders, infertility, and cancers.	Shinohara Akira	Osaka University	Institute for Protein Research
AC2023-3	Rajagopal Amirtham	M	Civil Engineering	Sustainable and Resilient Strengthening Solutions for Unreinforced Masonry structures in Rural India	Maddegedara Lalith	The University of Tokyo	Earthquake Research Institute/ Department of Civil Engineering
AC2023-4	Ganapathy Nagarajan	M	Biomedical Engineering	SMART-BEING: Smart Multimodal Enabled Affective Computing to Promote Wellbeing	Igasaki Tomohiko	Kumamoto University	Faculty of Advanced Science and Technology
AC2023-5	Kanagaraj Nithayanandan	M	Physics	Design and DEvelopment of a multifuNctional all-fiber laser system for The “On-demand” generation of structured laser light (DENTO)	Omatsu Takashige	Chiba University	Department of Materials Science
AC2023-6	Duraiswamy Suhanya	F	Chemical Engineering	Label-free molecular spectroscopic studies for accurate and rapid detection of pathogens in urinary tract infection	Noothalapati Hemanth	Shimane University	Department of Life Sciences, Faculty of Life and Environmental Sciences
AC2023-7	Murapaka Chandrasekhar	M	Materials Science and Metallurgical Engineering	Development of novel spin Hall materials for spin-orbit torque based memory and logic devices	Mitani Seiji	National Institute of Materials Science (NIMS)	Research Center for Magnetic and Spintronic Materials
AC2023-8	Pati Falguni	M	Biomedical Engineering	A novel bioprinted vascularized bone-on-chip micro-physiological model	Hojo Hironori	The University of Tokyo	Department of Bioengineering
AC2023-9	Prabhakaran Nair Kusumam Srijith	M	Computer Science and Engineering	Advancing Machine Learning through Bayesian Causal Learning	Khan Emtiyaz	RIKEN	RIKEN center for Advanced Intelligence Project (AIP)
IC2023-1	Bhattacharyya Debraj	M	Civil Engineering	Improving the Nutrient and Micropollutant Removal Efficiency of Johkasou under Indian Conditions	Tiwari Kamal	Daiki Axis India Pvt Ltd.	

<Note>
AC: Academic Collaboration
IC: Industrial Collaboration