

IMPACT ASSESSMENT REPORT

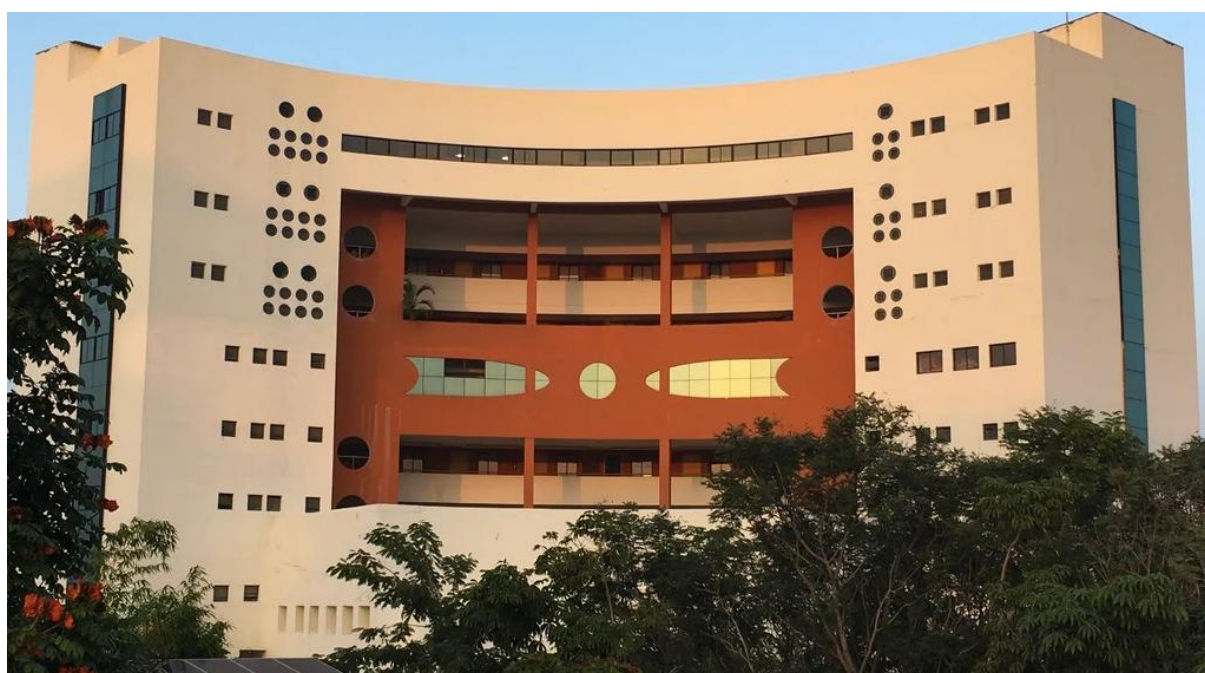
Shriram Finance Limited

(Formerly known as Shriram Transport Finance Limited)

CSR Support to

**EXPANDING RESEARCH AND TEACHING IN
MATHEMATICS, PHYSICS, COMPUTER SCIENCES**

1st April 2018 – 31st March 2021



CHENNAI MATHEMATICAL INSTITUTE

AUGUST 2024

Submitted to

Shriram Finance Limited (SFL)

Submitted by

EQUALITY EMPOWERMENT FOUNDATION

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Abbreviations

CMI	Chennai Mathematical Institute	CSR	Corporate Social Responsibility
BSc	Bachelor of Science	MSc	Master of Science
OECD	Organization for Economic Cooperation and Development		
PhD	Doctor of Philosophy	PDF	Post Doctoral Fellow
SFL	Shriram Finance Limited		
UN	United Nation	SDG	Sustainable Development Goal

1 Executive Summary

Chennai Mathematical Institute is a centre of excellence for teaching and research in the mathematical sciences. CMI takes up activities pertaining to quality education and advancement in knowledge for basic science of Mathematics, Physics, Computer Science, and Data science. To fulfil the objective of improved access to quality technological education in the field of basic science CMI provide opportunities to underprivileged community. During the project period 2018 to 2021, CMI implemented a project on expanding research and teaching with CSR support from Shriram Finance Limited. The project included support for additional faculties both regular and adjunct, post-doctoral and doctoral research seminars, workshops, leading to building processes and effective learning environment for youth dedicated to basic sciences.

To comply with the need of third-party impact assessment of projects under CSR, Shriram Finance Limited planned for impact assessment of its support to CMI. Equality Empowerment Foundation (EEF) team developed survey tools and shared them with CMI team, faculty, and post-doctoral research fellows. The performance has been analysed in terms of **Relevance, Coherence, Effectiveness, Efficiency, Impact, and Sustainability**. The report shares the process followed by the project sanction, description of interventions, outputs and outcomes generated, impact created over the life of the education community. The results are derived from the responses received and the data available through primary interactions and study and analysis of CMI reports and secondary sources. It resulted in some of the very positive impacts for the students.

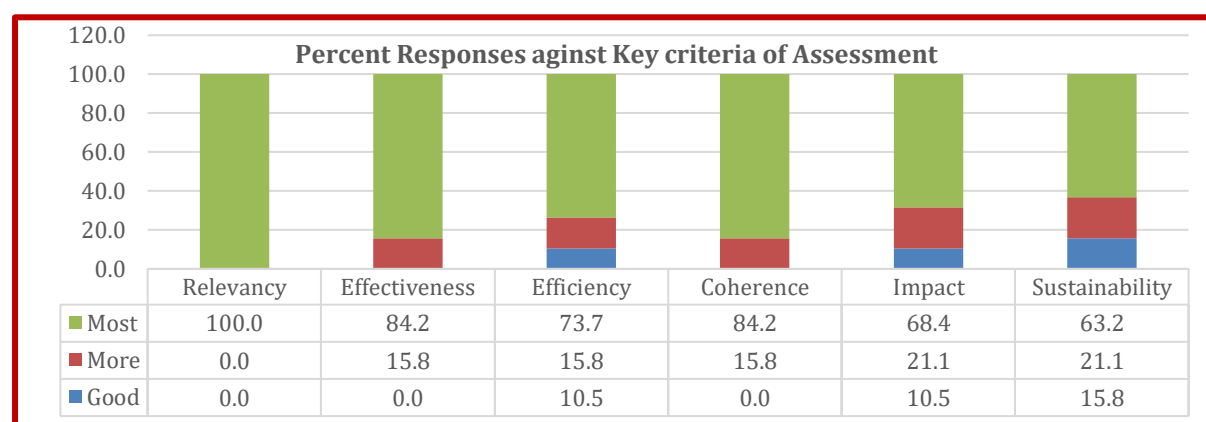


FIGURE 1 OECD IMPACT ASSESSMENT SUMMARY

- It provided affordable learning opportunities for more than 600 students in different classes of which 244 students completed education at Chennai Mathematical Institute (CMI), which is not one more educational institute in basic science, but it is the educational institution with co-creation of knowledge with its students, researchers, faculty and adjunct faculty.
- Of these 244 Altogether 85 students completed their undergraduate, 128 completed graduates and 21 could earn PhD and moved to further career building actions.
- Research scholars, Post-Doctoral Fellows, faculty and adjunct faculties have provided opportunities for 251 publications, 182 journal papers and 69 conference papers.

2 Introduction

Chennai Mathematical Institute (CMI) is a Centre of excellence for teaching and research in the mathematical sciences. **Founded in 1989 as part of the SPIC Science Foundation, it has been an autonomous institute since 1996.** CMI is managed by a Governing Council consisting of eminent persons. Today, The research groups in Mathematics and Computer Science at CMI are among the best known in the country. The Institute has nurtured an impressive collection of PhD students. In 1998, CMI took the initiative to bridge the gap between teaching and research in India by starting BSc and MSc programs in Mathematics and allied subjects. Students who have graduated from CMI have gone on to join leading institutions throughout the world. CMI occupies a unique position in Indian academia, attracting substantial funding from both corporate and government sources.

CMI is a premier institution registered as a public charitable Trust engaged in teaching and research and is recognized as a deemed university wherein students, selected based on a nationwide test, are admitted and taught Mathematics, Computer Science and other areas by faculty and active researchers. CMI also holds a tax-exempt status under Section 12AA of the Income Tax Act, 1961. In 1998, CMI took the initiative to bridge the gap between teaching and research in India by starting BSc and MSc programmes in Mathematics and allied subjects. Students who have graduated from CMI have gone on to join leading institutions throughout the world.

CMI occupies a unique position in Indian academia, attracting substantial funding from both corporate and government sources. In December 2006, CMI was recognized by the Government of India as a University under Section 3 of the UGC Act, 1956. The research groups in Mathematics and Computer Science at CMI are among the best known in the country. CMI is a centre of excellence for teaching and research in the mathematical sciences. It was founded in 1989 as a part of the SPIC Science Foundation, funded by the SPIC group in Chennai. CMI is managed by a Governing Council consisting of eminent persons. Today, CMI is a rare example of public-private partnership in research and education in India. The Institute receives major private funding, side by side with substantial financial support from the Government of India. The main areas of research at CMI are Mathematics, Computer Science and Physics. In addition to a vibrant PhD programme, the Institute conducts BSc undergraduate in Mathematics and Computer Science and Graduate in Mathematics, Physics, Computer Science and Data Science.

Shriram Finance Limited (SFL) supports work of various Civil Society Organizations as corporate social responsibility. CMI has prepared a project and approached Shriram Finance Limited (SFL) to financially support the project on expanding its academic and research actions during the period of 2018 to 2021 under its CSR project "**Expanding Research and Teaching in Basic Sciences of Mathematics, Physics, and Computer Sciences.**"

To comply with the provisions of the Act and Companies (Corporate Social Responsibility Policy) Rules, 2014 regarding impact assessment of projects supported under CSR interventions, both Shriram Finance Limited and Chennai Mathematical Institute

planned to take-up an exercise of impact assessment. The task assigned to Equality Empowerment Foundation (EEF), a registered section-8 not-for-profit company dedicated to bringing equality in community through studies, research, program design, and implementation guidance, participate in this assessment project. EQUALITY EMPOWERMENT FOUNDATION, applied a participatory process of review of literature available, visited social media sites of CMI, interacting with CSR team at Shriram Finance Limited, study of foundation website, and social-media reports. The EEF team tried to capture objectives of CMI and align interventions with them. The report shares the work done under the interventions, immediate outcomes, and impact in terms of creating a conducive learning environment, and quality. It also tries to establish linkages of interventions with CSR-Schedule-VII items and various UN-SDGs. The last section deals with the concluding remarks for further strengthening for enhancing its reach.

3 Impact Assessment Methodology

The CMI is a civil society-initiated institute of international level which is dedicated to promoting education and research in the basic science of Mathematics. It is supported by Shriram Finance Limited (SFL) under its CSR funded support. Under the compliance of provisions of the Companies Act, 2013 read with Companies (Corporate Social Responsibility Policy) Rules, 2014 (as amended), an impact assessment was undertaken. Report shares the findings of the assessment process carried out during August 2024.

3.1 Impact Assessment Objectives

The impact assessment was carried out with the following specific objectives.

- To understand project context, objectives, strategies, interventions, output, outcomes, and key-learnings.
- To assess the impact of the program in promotion of quality education in the peer science of mathematics and associated subjects.
- Impact over community in terms of relevance, coherence, effectiveness, impact on society, and sustainability.
- Data driven and evidence-based recommendations to further increase the coverage and approach plan.

3.2 Steps

The assessment covered reports against the CSR interventions conducted for the period 1st April 2018 to 31st March 2021. The report is based on study carried out using secondary data, project reports, visit to CMI, discussion with core team, Faculty, Post-doctoral Research Scholars, Adjunct Professors, and Students discussing about the outputs, outcomes, and impact caused in terms of expansion of basic science education (Mathematic, Physics, and Computer Science). The impact assessment included following objectives and tools.

- To understand the achievements in terms of community needs and priorities in the study field of education specific to basic science.
- To capture the vision and mission of Chennai Mathematical Institute within the larger purview of providing affordable education and research.
- To interact with team-CMI, and beneficiary students of the project.
- To recommend strengthening of CSR interventions and linkage with UN-SDG and pathways to take it forward.

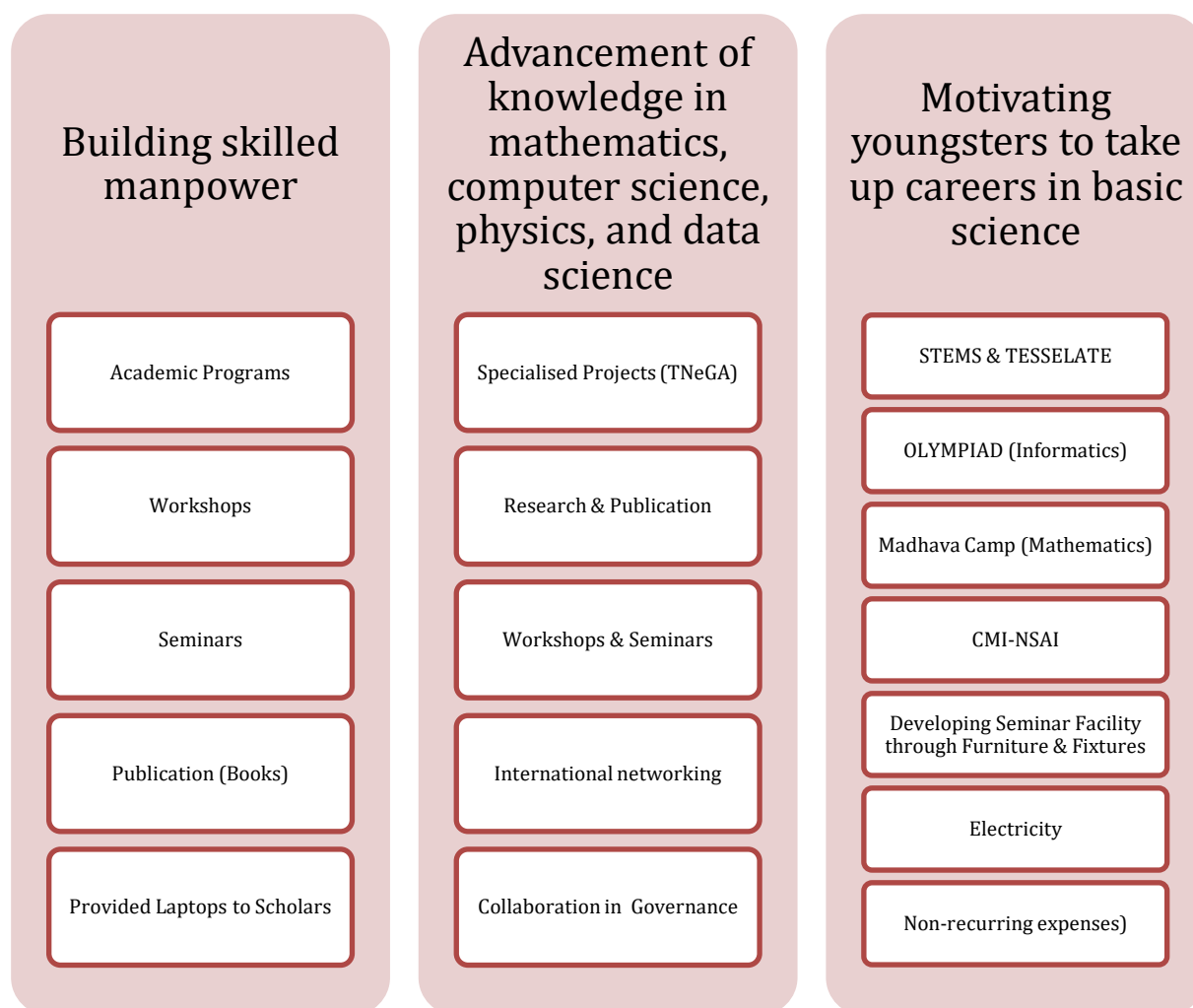


FIGURE 2 WITHIN ITS OBJECTIVES CMI HAS INCORPORATED ABOVE MAJOR INTERVENTIONS

4 Project background

CMI is a premier institution registered as a public charitable Trust engaged in teaching and research and is recognized as a deemed university wherein students, selected based on a nationwide test, are admitted and taught Mathematics, Computer Science and other areas by faculty and active researchers. CMI also holds a tax-exempt status under Section 12AA of the Income Tax Act, 1961. It is a rare example of public-private partnership in research and education in India. The Institute receives major private funding, side by side with substantial financial support from the Government of India. CMI occupies a unique position in indigenous academia, attracting substantial funding from both corporate and government sources. In October 2005, CMI moved to its new campus at Siruseri, and started providing a very conducive learning environment to its students and research scholars. CMI got the status of the University under Section 3 of the UGC Act, 1956, which made it possible to contribute directly to research and studies.

4.1 Building Skilled Manpower

Since 1998, CMI has also been undertaking **BSc and MSc programs** in Mathematics and Computer Science as well as Mathematics and Physics, along with MSc programmes in Mathematics, Applications of Mathematics and Computer Science. **Students who have graduated from CMI have gone on to join leading institutions throughout the world."** Being a responsible corporate, Shriram Finance Limited (SFL) tried to contribute to educational needs to fill up the gap.

TABLE 1 STUDENTS COMPLETED THEIR EDUCATION DURING THE PROJECT PERIOD

Education Level	2018-19	2019-20	2020-21	2018-21
B.Sc. (Undergraduate)	39	28	28	95
M.Sc. (Graduate)	41	26	61	128
PhD (Doctoral)	5	4	12	21
Total Students Completed	85	58	101	244

As reflected in the Figure-3 the support has helped altogether 244 students to complete their studies during the project period.

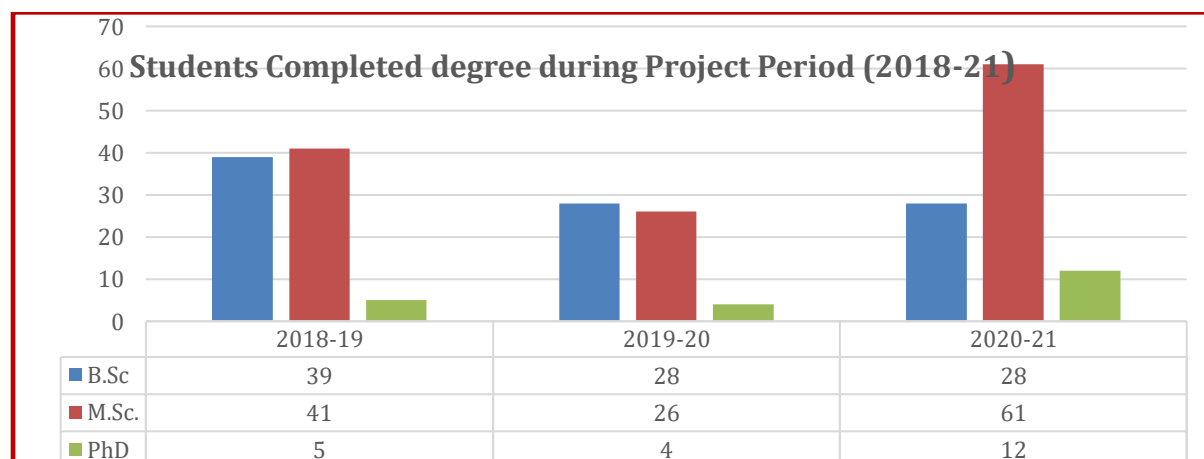


FIGURE 3 NUMBER OF STUDENTS COMPLETED DURING THE PROJECT PERIOD (2018-2021)

TABLE 2 LECTURE SERIES

	Subject	Dates
1	CMI-NASI Outreach Lectures for Schools, 2018	16-17 July, 2018
2	CMI-NASI Outreach Lectures for Schools, 2019	8-9 July, 2019
3	Berkovich Spaces	Jan-March, 2020
4	Lecture series on de Rham Complexes	Feb-March, 2020
5	CMI Webinars series on Recent Connections to GCT and Progress in GCT	April-July, 2020
6	CMI Online Seminar Series	May-July, 2020
7	CMI NASI Online Outreach Lectures for Schools, 2020	Sept-Nov, 2020
8	CMI Arts Initiatives, Online Talks and Readings, 2021	Feb-March, 2021

4.2 Advancement of knowledge in Mathematics, Computer Science, and Physics

The unique combination of research institute and academic programs is rarest among the Indian institutes particularly in the field of mathematics, computer sciences, and physics. CMI is unique amalgamation of two sides of the coin i.e. advancing in the knowledge and delivery of learning for quality human resource through academic programs.

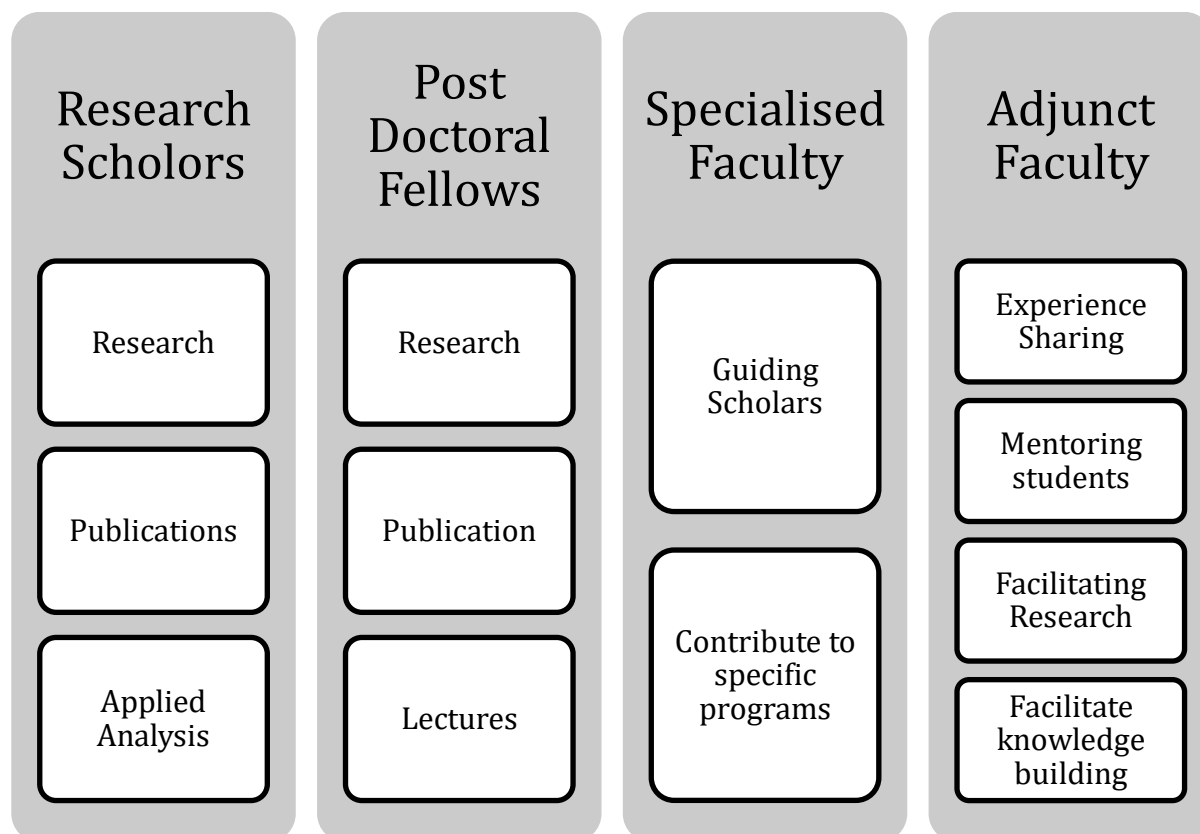


FIGURE 4 INTERVENTION AREAS AT CHENNAI MATHEMATICAL INSTITUTE

4.2.1 Workshop

In specialized and dynamic institutions workshops offer excellent learning opportunities for all the participants, be they students, research scholars, or organizers. During the reporting period CMI organized five specific events, but due to the outbreak of COVID more numbers could not be organized.

TABLE 3 KEY WORKSHOP SUMMARY DURING THE REPORTING PERIOD

Sl	Title	Period
1	International Olympiad in Informatics Training Camp & Workshop	30 th April-10 th May 2018
2	Mathematics and Finance Summer School 2018	May-June 2018
3	IOI 2019 Training Camp	30 April–9 May, 2019
4	IOI 2019 Workshop on Topics in Theoretical Computer Science	9–10 May, 2019
5	Mathematics and Finance Summer School 2019	20 May–21 Jun 2019
6	Statistical Methods in Finance 2019	16–21 Dec, 2019
7	Relax Workshop on Games	1–4 Feb, 2021

4.2.2 Research and Publication

The project supported research at large through faculty, research scholars, MSc Students, and Post Doctoral Fellows as prime activity. Under these interventions various sub-activities were undertaken, Annexure-02 shares a list of post-doctoral fellows and their existing association. Figure-5 shares subject wise number of publications undertaken by post-doctoral fellows and faculty.

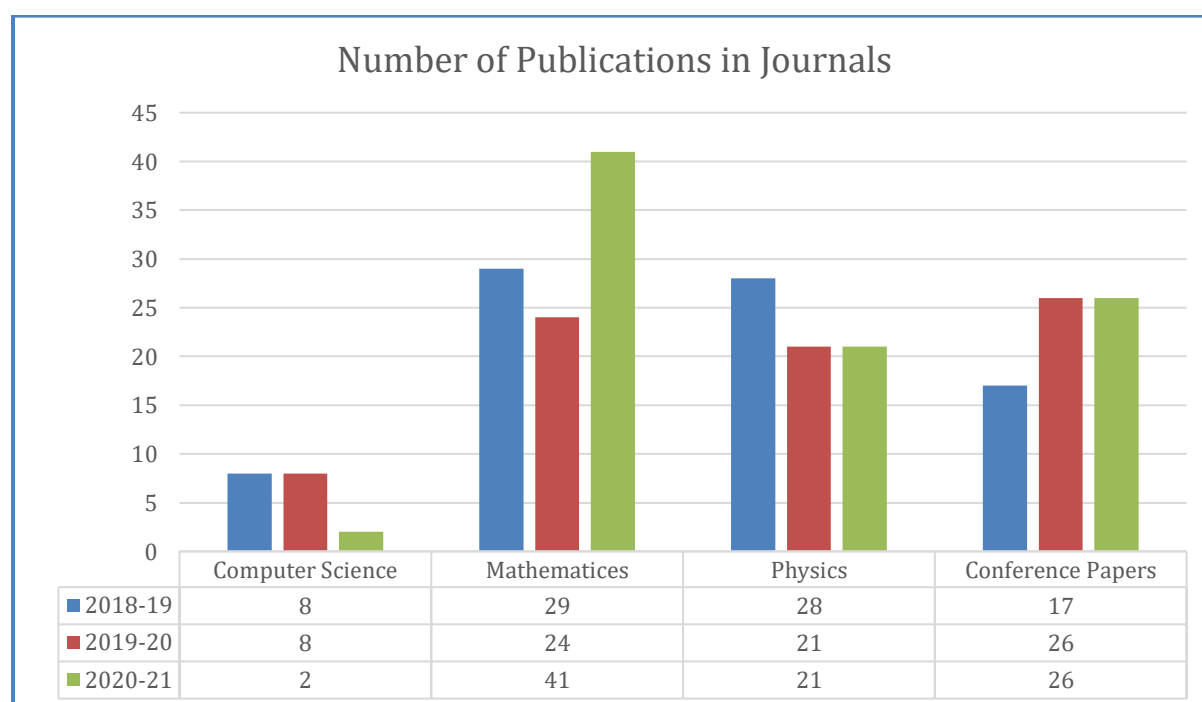


FIGURE 5 PUBLICATIONS AND CONFERENCE PAPERS BY FACULTY AND RESEARCH SCHOLARS

4.2.3 Seminars

Seminars provide scope for specialized deliberation which are listen and learn in a reflective-learning mode (one of the critical adult learning tools) During the reporting period altogether 208 such events were organized on different themes and subjects.

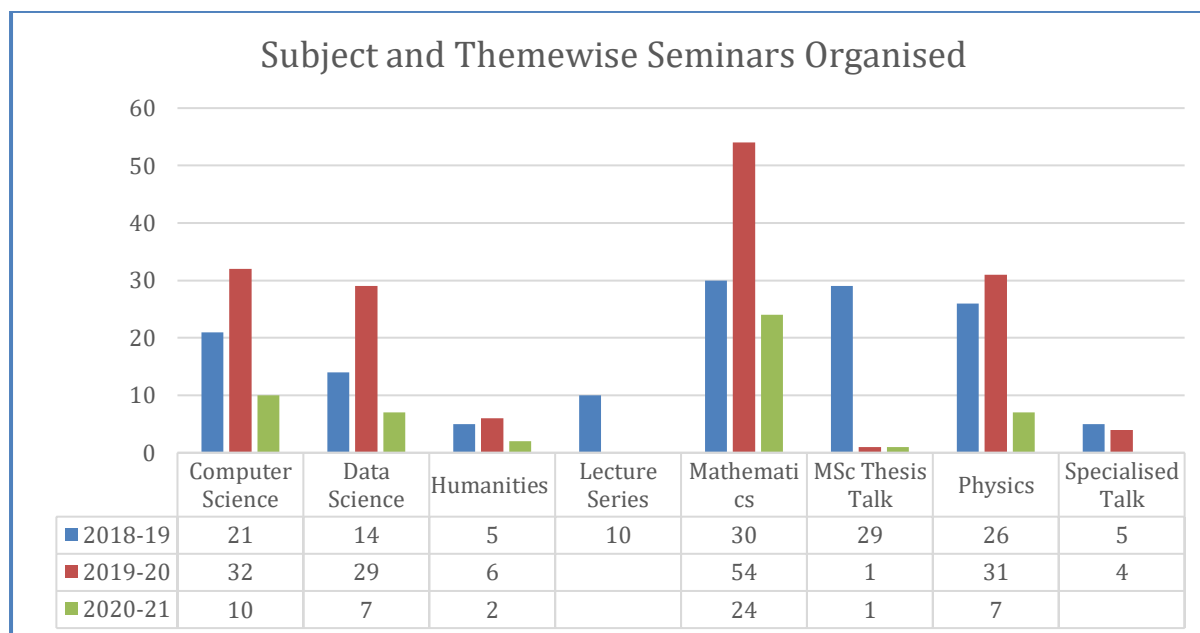


FIGURE 6 SUBJECTWISE SEMINARS ORGANISED BY CMI DURING APRIL 2018 TO MARCH 2021

Figure-6 gives a summary of various seminars and their subjects. It also indicates effect of pandemic in organizing seminars by monthly events average we find that during 2018-19 and 2019-20 monthly average was 12 and 13 respectively, while in case of COVID time it reduced to almost half that too in hybrid mode 2020-21 average four events.

4.3 Motivating Youngsters to study Mathematics and Physics

CMI is actively engaged in reaching out to students at school level to convey the excitement of studying and working in the fields of Mathematics, and Physics. It creates awareness about opportunities outside academia after pursuing higher studies in the mathematical sciences. Toward this, CMI organizes popular lectures, hosts training programmes for talented students, mentors students for summer internships and prepares students for national and international competitions.

- Mathematics and Finance Summer School 2018 (May - June 2018)
- NCM IST Mathematics for Computer Science (June 2018)
- AURA 2018 (October 2018)
- CMI-IISA Winter School in Data Science (December 2018)
- Lecture Programme for students of class XI and XII, in association with National Academy of Sciences, Allahabad (July 2018)

- Lecture Programme for students of class XI and XII, in association with National Academy of Sciences, Allahabad (July 2019)
- Workshop on Hochschild Homology, 2019 (July 2019)
- Statistical Methods in Finance 2019 (December 2019)
- Informatics Olympiad: CMI faculty coordinate the training and selection of students to represent India at the International Olympiad.
- Olympiad in Informatics through the Indian Association for Research in Computer Science (IARCS). From September 2004, a monthly online programming competition has been conducted by the CMI faculty via the IARCS website.

4.3.1 CMI NASI Online Outreach Lectures for Schools, September-November 2020

- Dr. K Viswanathan: The Periodic Table | A Masterpiece in Systematization.
- Prof. Rama S Verma, Department of Biotechnology, IIT Madras: Clean Water.
- Dr. C Aiswarya, Logical Reasoning through Puzzles.
- Dr. Shailesh Shirali, Director, Sahyadri School (KFI), Pune: Euler's Polyhedron Theorem and Some Applications.
- Prof Jim Libby: Searching for Beauty: Finding one in a Billion with the CMS Experiment at the Large Hadron Collider.
- Dr. Sushan Konar, Former Scientist, NCRA Pune: The Sound of Music.
- Prof. Rama S Verma, Department of Biotechnology, IIT Madras: Bioplastics.
- Relax Workshop on Games (February 2021) (Online)

4.3.2 CMI Arts Initiative

The objective of the CMI Arts Initiative is to provide a space for students, professionals and anybody else keenly interested in the humanities and arts to interact and learn from experts in these areas. The CMI Arts Initiative is coordinated by K. Srilata, K.V. Subrahmanyam, and Madhavan Mukund. Writers in residence CMI is proud to host a writers residency programme in cooperation with Sangam House. Under this programme, CMI supports two international writers each year for a residency of 46 weeks. TM Krishna, a Chennai based Musician and Writer. Writer in residence in October 2019. He also gave a talk titled Sebastian and Sons on his forthcoming book. CMI is proud to host a writers' residency programme in cooperation with Sangam House. Under this programme, CMI supports (2018-19) was provided to two writers namely: Francesca Marciano, Italy and Mindy Gill, Australia.

4.3.3 SWAYAM (NAPTEL)

CMI as an institution is regularly participating in propagating learning of basic science of Mathematics through **SWAYAM-NAPTEL** (National Programme on Technology Enhanced Learning) for Engineering. It is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The portal takes the best teaching learning resources to all, including the most disadvantaged. Figure-7 shares photo of the course developed by Dr. Madhvan Mukund, Director CMI as part of undergraduate and graduate education.

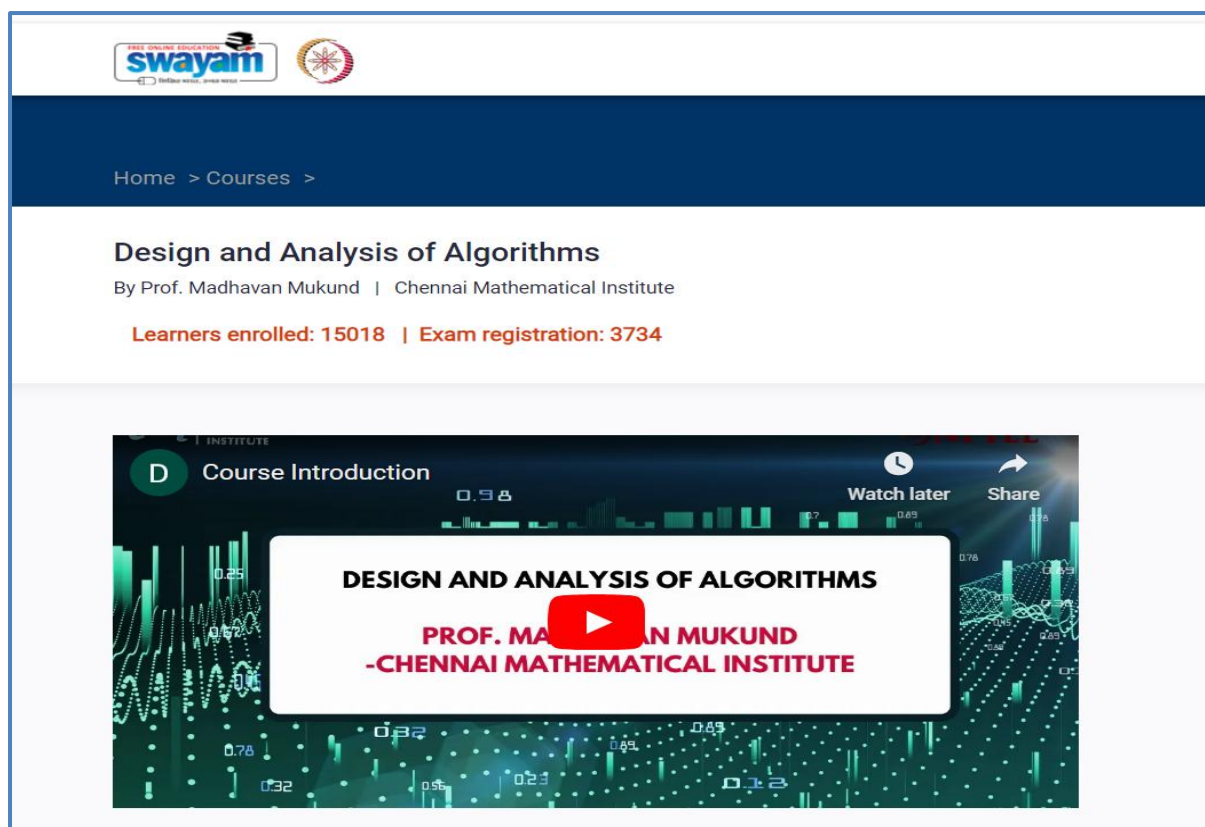


FIGURE 7 SCREEN SHOT OF COURSE DEVELOPED BY DIRECOTR CMI ON SWAYAM (NAPTEL)

4.4 Cross-Cutting (Non-Recurring) activities

During the project period CMI procured and issued Laptops, to faculty members, research fellows and established a computer lab (Photo-3) with support of 50 Desk-tops; 140 can-chairs were procured for Seminar halls (Photo-4). Seminar halls were also renovated using acoustic wall paneling (Photo-5). Annexure-3 shares details of the non-recurring support of the project.



PHOTO 3 COMPUTER LAB

PHOTO 4 RENOVATED SEMINAR-HALL

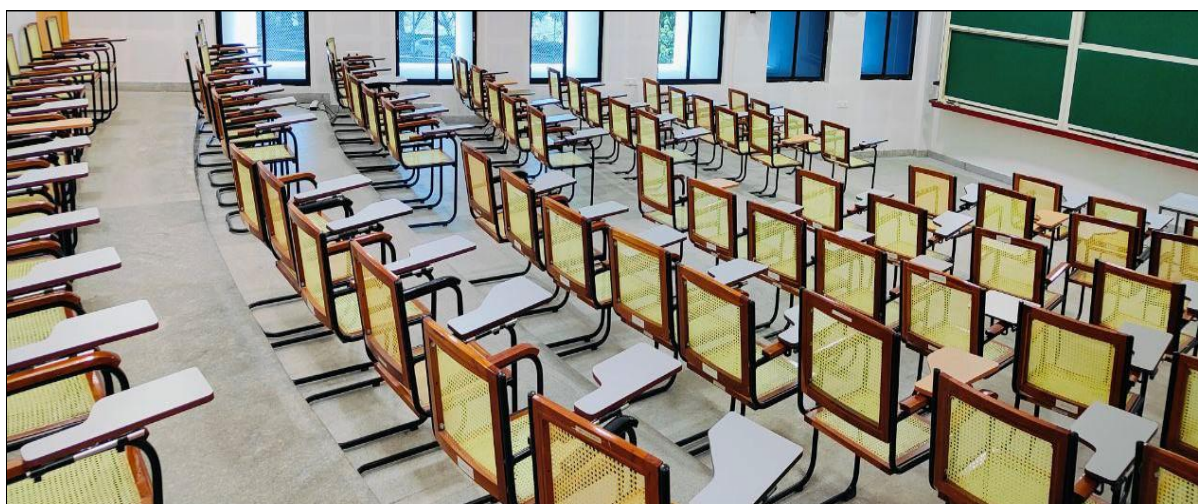


PHOTO 5 CHAIRS AND RENOVATED HALL 202

5 Outcomes and Impact: Key Insights

International institution called “The Organisation for Economic Co-operation and Development (OECD) is a specific organization dedicated towards economic and development partnership, and cooperation among member and partner countries. *It has* established six evaluation criteria – relevance, coherence, effectiveness, efficiency, impact and sustainability – to support consistent, high-quality evaluation. These criteria provide a normative framework used to determine the merit or worth of a project. The criteria can be thought of as a set of lenses, providing complementary perspectives that together give a holistic picture.

5.1 Relevance

In the present era students studying applied science is more common, very few students plan to join undergraduate and graduate level studies in peer sciences like mathematics and physics. Studying post-graduates and undertake doctoral and postdoctoral research works is further limited. This is such because of intensive faculty, researcher, students interaction necessary, high cost of courses offered at other institutions etc. One hardly finds institutions those offer accessible and affordable quality education in the field of basic sciences and related subjects, so that students with good education record from moderate and weaker socio-economic background will join these streams can also get opportunity to study at quality institute. The present CSR project makes CMI as an institute which offers such courses at affordable costs and provide learning environment to students. Hence project is helping CMI to respond to weaker community’s educational needs and achieve its objectives of quality education in the field of peer sciences. The project is also aligned to technological education need at national and international priorities (SDG Indicator-04). To capture beneficiaries perception with regards to relevancy, a digital samples survey was undertaken involving post-doctoral fellows and faculty members of CMI. As shown in Figure-1, all the respondent (100%) have reflected project as most relevant.

5.2 Coherence

Coherence includes concepts of complementarity, harmonisation and co-ordination, and the extent to which the intervention is adding value to international level. On one hand it is important to understand to what extent the project has helped Shriram Finance Limited to fulfil its commitment to CSR policies and purpose of focusing on betterment of wider community. While on other hand it is also critical to capture coherence to CMI's objectives as given in the Annexure-1. The achievements as reflected by different stakeholders are compatible and very-well aligned with the three objectives of advancing knowledge, training human resources and motivating youth. As per sample survey with postdoctoral fellows and faculty of CMI, 84.2% respondents indicated the project impact as most coherent while 15.8% reflected that support is more coherent to the vision of CMI and the commitment of Government of India towards SDG-04. The interventions of providing quality education at affordable cost goes hand-in hand with SDG-04 **Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all led by UNESCO.**

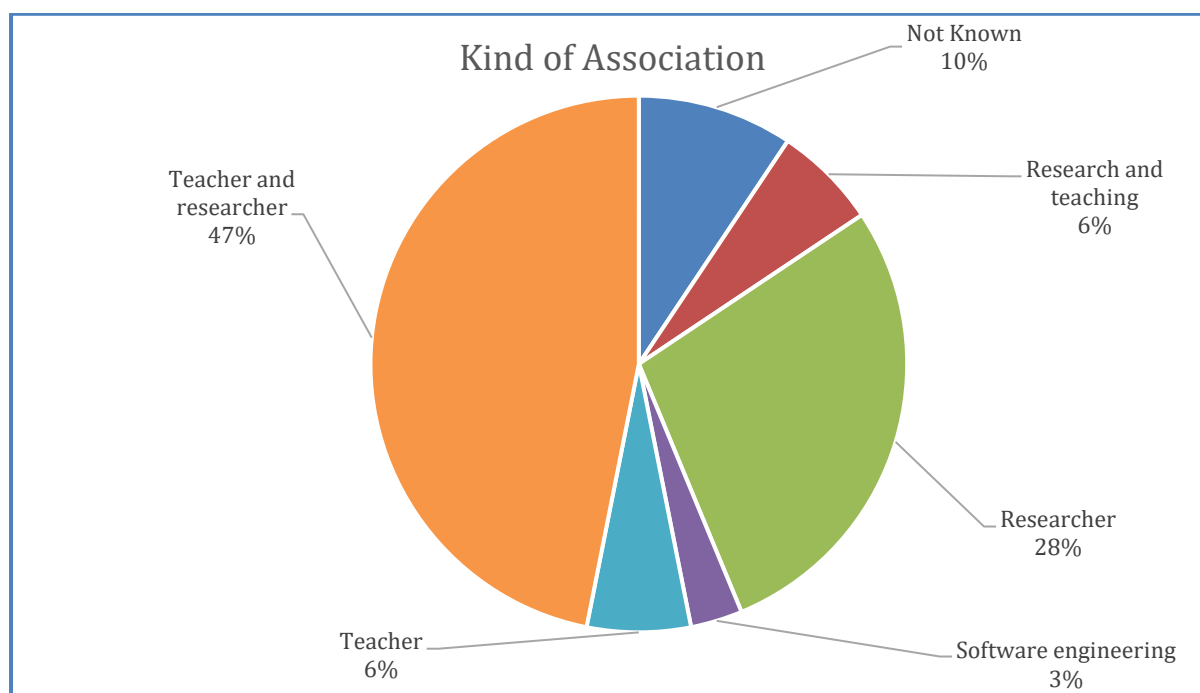


FIGURE 8 KIND OF ASSOCIATION OF BENEFICIARIES OF POST-DOCTORAL FELLOW COMPONENT

The project Intervention helps in creating this opportunity for more and more people, providing access to undergraduate, graduate, post-doctoral research, and knowledge building at various levels in the field of basic science and creating amalgamation between research and academic. Figure-8 shares that almost 87% of Post-Doctoral Fellows are associated with research and teaching related to basic sciences, only 3% have gone to software jobs, while 10% students have not shared about their association. It indicates that majority are in coherence with the CMI educational intervention supported under Shriram Finance Limited can be commended as high in the coherence parameter. Similarly, it is also part of the Schedule-VII of CSR themes shown in figure-9.

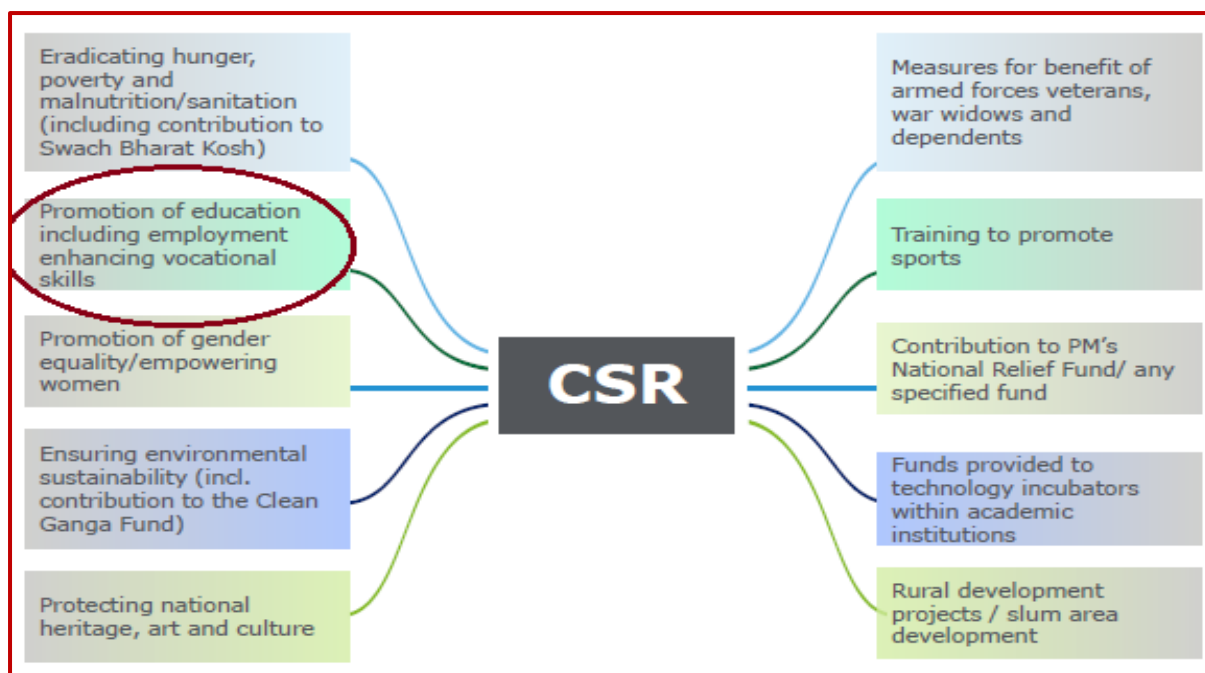


FIGURE 9 SUPPORT TO CMI BY SFL AND ITS CSR LINKAGES

5.3 Effectiveness

Present time is an era of job-oriented studies, most of the parents and youth opt for job-preparedness courses instead of studying basic sciences subjects. On another hand, there are only few institutions involved in applied research and offering study programs in the basic sciences, and CMI is one such institution. It has mandated to the objectives of **advancing knowledge, training human resources and motivating young students.**

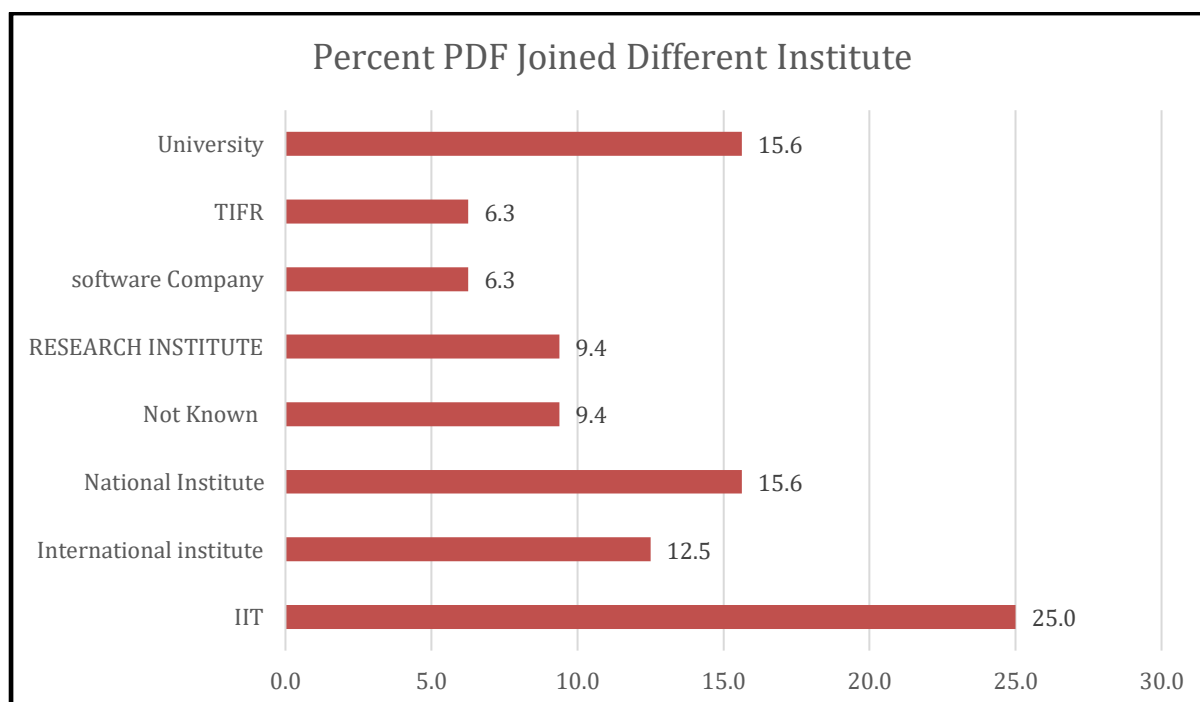


FIGURE 10 INSTITUTIONS POSTDOCTORAL FELLOWS FROM CMI DURING THE PERIOD HAVE JOINED

The figure-10 indicates the kind of institutions where postdoctoral fellows from CMI during the project period have joined as faculty, research faculty, etc. The effectiveness can also be seen from the present involvement of CMI students in further studies, doctoral and post-doctoral research, and working as faculty at various institutes and even at CMI itself. Participation in learning through lecture series, online courses, outreach programs, workshop seminars, learning-exchange leading to integrated outcome. With project support CMI have provided opportunity for youth from less privileged families to join such renowned institutions and doing excellence, thus giving multiplier effect of the project. The program has reached its objective of making quality education in basic sciences accessible to the brilliant students from socio-economically moderate families. In a google form-based survey 84.2% respondents indicated the project impact as most effective while 15.8% reflected as more effective.

5.4 Efficiency

The provision of quality education at the minimal cost to the brilliant students from middle and lower middle families has resulted in both developing a cadre of human resources in the field of basic science, with practical approach of conservation. At the same time, just because the opportunities are available through fellow-ships, moderate fee, stipend retention in the field of basic science for these students has been motivating. Multiple interaction helps in efficiency in terms of the output generated as against the expenses. CMI has a tremendous impact in knowledge building in critical areas of Mathematics, Computer Science, Data Science and Physics. CMI alumni are faculty members in nearly every top-level university and research institute in India such as IITs, TIFR, IISc, IISER, NITs etc. CMI alumni are also faculty members and researchers at top universities in US, Europe and worldwide. CMI's faculty members are some of the bests in the country and have received many prestigious awards and research grants. All this becomes even more remarkable when we consider that CMI is a small institution that runs minuscule budget, as compared to any other institute. In a google form-based survey with faculty and postdoctoral fellows, 73.7% respondents indicated the project impact as most efficient while 15.8% reflected as more efficient while 10.5% indicated good-efficiency.

The efficiency in terms of resource utilization can also be seen in terms of the day to day working and overall behaviour of students of institution, the faculty, the research fellows. Though, there are financial and accounting calculations for assessing efficiencies but assessing socio-economic behaviours are beyond measurements. Open Air classrooms, energy-efficient rooms, approach of Adjunct-Professors (involving senior brains to their utmost capacities) are some of the remarkable examples. At CMI, learning environment is traditional a 24x7 library, protected premises, open learning and discussion arenas, open classrooms, are some of the students demanded aspects included at the CMI. **It is an institution which believes that no one should be deprived of learning just because of costs. The institute is operating in a gurukul mode, costs are very nominal students study in a home environment.**

5.5 Impact

As discussed in above sections work of CMI has resulted in promoting students participation in studying peer science of Mathematics. Since 2013 when the CSR act came into existence various principles and SOPs are framed by Government such as what can be included within the package of CSR. The impact mapping is considered across the areas stakeholders. The beneficiaries i.e. brilliant young students, from families with moderate economy, can have better learning opportunities in basic science than before. In a google form-based survey 68.4% respondents indicated the project as most-impactful while 21.1% reflected as more-impactful while 10.5 indicated good impact over community in terms of livelihoods. **Annexure-4 shares a response from a student of CMI who is presently working with a research organization. Annexure-5 shares about the feelings shared by post-doctoral fellows (beneficiaries of scholarship under the project) about the impact it has caused to their life.**

Figure-3 indicated that 244 students received affordable learning from CMI are the direct beneficiaries who completed their education during the project period. Of these as

shown in figure-11, 76% (185) are continuing in the field of education and research in the stream of basic sciences, while 16% (40) students are working in the applied sciences particularly data management and computer science field. Employment information about the 8%(19) could not be traced.

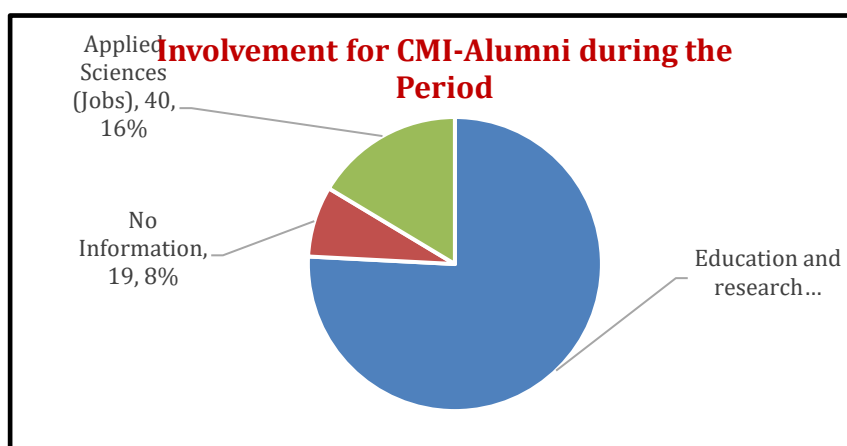


FIGURE 11 WORK FIELDS OF CMI-ALUMNI

Figure-12 indicates that alumni of CMI after degree have joined CMI, other national and international level renowned institutes for further study, and research. Some of them are even giving their services to these institutions as faculty or researchers. **The data is indicative of very high level of project impact to benefit overall human development with regards to socio-economic growth of community.**

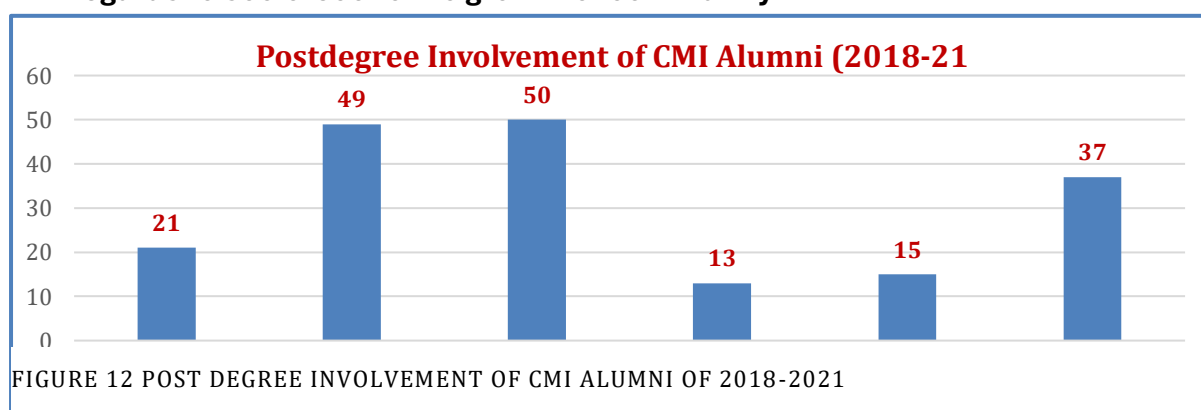


FIGURE 12 POST DEGREE INVOLVEMENT OF CMI ALUMNI OF 2018-2021

Besides it is also observed that CMI has been collaborating with the state Government on other data management fronts and impacting governance positively at state level. CMI team indicated that they worked with Tamil Nadu E Governance Agency (TNeGA) during the project period to work out a tool to identify duplication of data collected by various departments (RTO, EB, PDS) and suggest approach to rectify them. CMI- AlgoLabs team brought out an approach of algorithm for TNeGA and applied to sample databases. The individual's records were tested against individuals whose AADHAR details were available with more than 85% accuracy. The approach was shared with various departments to avoid duplication, this was CMI's work is also impacting for effective governance.

Apart from this, enhanced number of quality researchers also helped other stakeholders and governance to apply mathematical tools in solving issues pertaining to COVID modelling, etc. The tools of epidemiological SIR were very helpful to estimate the basic reproduction number R_0 at national and state level. CMI developed the statistical machine learning model to predict the cases ahead of time, which able to forecast daily number of (i) new cases, (ii) R_0 and (iii) Mortality at district level. Clear spatial patterns were discovered which helped local TN State Govt to take necessary policy measurements at the time of pandemic and thus effectively contribute to save thousands of lives within the wider community.

5.6 Sustainability

Sustainability is the extent to which the net benefits of the intervention continue or are likely to continue. The program has reached its objective of making quality education accessible and create skilled human resources in the field of basic sciences (mathematics, physics, computer science, and data science) benefitting students passed out. In a google form-based survey with postdoctoral fellows and faculty members, 63.2% respondents indicated the project impact as most-sustainable and 21.1% indicated as more-sustainable, and 15.8% reflected as sustainable. The program is effective in addressing the quality education needs of the economically weak communities with diligent children by offering it at substantially lower cost. Conducive environment with regular interaction, participating in seminars, workshops, help in building further knowledge and enhancing the retention of quality human resources in the basic science.

- A book - Introduction to Stochastic Calculus has been published (jointly authored Prof RL Karandikar and Prof B V Rao). (October 2018)
- The election commission (of India) consulted me (along with Prof Abhay Bhatt) about the issue of sampling of EVM/VVPAT machines for cross validation. Participated in experts group to give advice of sampling strategy for VVPAT verification of EVMs (June-August 2018)
- CMI team (Sreejata Bhattacharyya, Rajat De, Debjit Paria) [qualifies for ACM ICPC World Finals](#), May 2019.

- CMI announces [FC Kohli Centre of Excellence](#), December 2020.
- Saket Saurabh awarded [Shanti Swarup Bhatnagar Prize](#) for the year 2021.
- Textbook by G Venkatesh and Madhavan Mukund '[Computational Thinking: A Primer for Programmers and Data Scientists](#)' published in 2021.
- V Balaji elected [Fellow of National Academy of Sciences, India](#) in 2021.

Further, the project is part of SDG-04 i.e. “**Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all**” for which the Government of India is committed. The SFL supported CSR project implemented by CMI during financial year 2018-2021 has benefitted to SDG indicators as shown in table-3.

Table 4 Linkages with the indicator of SDG-04

Indicators of SDG-04	CMI's Contribution to SDG indicators
4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational, and tertiary education, including university	4.3 Ensure equal access for all women and men to affordable and quality technical, and tertiary education, in the field of basic science.
4.4 By 2030, increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship	4.4 By Increase the number of youth and adults who have relevant skills, including technical and research skills, for employment, decent jobs, and entrepreneurship in basic science
4.b By 2020, expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and ICT, technical, engineering, and scientific programs.	4.b Ensure the number of scholarships available to needy students for enrolment and retention in higher education in the subjects of basic sciences specifically Mathematics, Physics, Computer Science, and Data Science.
4.c By 2030, increase qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States	4.c Increase qualified human resources including teachers, including through international cooperation for teacher training, interactive learning, exchange in the field of basic science.

6 Conclusion and Way Forward

The CSR project during the period 2018-2021 has provides concrete foundation to CMI to expand its research and academic programs to strengthen basic science of mathematics, physics, computer science and data science, through various interventions. The project support is in coherence with the broader component of “promotion of education including employment” included in the Schedule-VII of CSR Act 2013. Under this project CMI is creating knowledge building community in the basic sciences and providing faculty and researchers in basic sciences at all levels. At the same time, it is also providing opportunity for wards of middle-class society to access world class faculty at affordable cost and participate in the foundation building science streams of mathematics, physics, computer-science and data-science. During focus group discussion various dimensions of the impact and sustainability were discussed with the stakeholders mainly faculties, research scholars, students of graduate and undergraduate students. All of them unanimously thanked Shriram Group for supporting CMI. A few members also reflected on regular training programs for Math Olympiad and creating facilities for sports and game activities. Students of project period 2018-2021 have joined renowned institutions for further studies and research opportunities. This contribution of CMI in terms of faculty and research fellows, in the field of peer-sciences, to leading national and international institutions is exclusive.

Assessment team of EEF suggest CMI to develop intensive linkages with its alumni who are at various locations as their ambassadors dedicated to the subject of basic science. They can be pinned on an interactive map of World and India. It is recommended to CMI team to bring out some approach to propagate study among women candidates for undergraduate, graduates, Research and even as faculty. Though, CMI is highly engaged in hard-core mathematical and other basic science think tank and research institute, but at the same time helping governance in soliciting solutions to complicated issues through data and statistics is unique, which can be further explored and applied so more and more employment opportunities can be created for basic science learners in different industries even in social sector. CMI has also actively engaged with industry and contributed to data-driven areas such as financial services and healthcare. Project also contributes positively to help commitment of Indian Government to UN-SDGs, directly to achievement of SDG-4 particularly target SDG-4.3 which is about access to technical educations, besides inclusion of some interventions can add on to SDG target 4.4.

Shriram Finance Limited (SFL)’s support to projects like this for foundation building in the field of basic sciences are important for development of Indian society and its education community. Further annual monitoring visits from SFL-CSR team can enrich project implementation and outcomes. Thus, EEF would recommend SFL-CSR team to make time to time monitoring visit to projects.

For EQUALITY EMPOWERMENT FOUNDATION



Deepak Sharma

ANNEXURE 1 CHENNAI MATHEMATICAL INSTITUTE – (CMI) OBJECTIVES

CMI's aim is **to excel in research and teaching mathematical sciences**. In more concrete terms, this can be broken down under three broad heads.

1. **Advancement of knowledge**

The primary goal of researchers at CMI is to expand the frontiers of knowledge, both in foundational topics like algebra, geometry, computational complexity and gravitation, as well as in related application areas such as understanding machine learning models, optimal pricing of financial instruments and calculating the best trajectory to launch a satellite.

Faculty, postdoctoral fellows and research scholars at CMI interact with like-minded researchers from leading institutions in India and abroad to work on such problems. The new knowledge that is created is typically disseminated through papers in peer-reviewed publications. In addition, faculty from CMI organize and participate in conferences where researchers meet to present their work and exchange ideas about unresolved open problems.

2. **Training skilled manpower**

The creation of knowledge is an unending process and requires a constant infusion of fresh minds contributing new insights. Training students to undertake research is thus an important focus area for any institution dedicated to research.

CMI has had a vibrant PhD programme since its inception. For over 25 years, CMI has run high-quality BSc and MSc programmes that have produced several outstanding researchers. Over 60 CMI alumni are now faculty members at premier academic institutions across India, such as IITs, IISc, IISERs, IMSc, ISI and TIFR, and an equal number have academic positions in leading universities across the world.

3. **Motivating youngsters to take up basic science**

Attracting good students to pursue studies in the mathematical sciences is a huge challenge in India. Societal pressure pushes talented students to disciplines such as engineering which are perceived to provide more financial security.

To counter this, CMI is actively engaged in reaching out to students at school level to convey the excitement of working in these fields and create awareness about opportunities outside academia after pursuing higher studies in the mathematical sciences. Toward this, CMI organizes popular lectures, hosts training programmes for talented students, mentors students for summer internships and prepares students for national and international competitions.

ANNEXURE 2 LIST OF POST DOCTORAL FELLOWS, EXPERTISE AREA, PARTICIPATION IN KNOWLEDGE BUILDING AND ASSOCIATION PERIOD WITH CMI IS SHOWN WITH BLUE COLOUR

Sl	Name	Basic Subject	Principle Guide	Research Papers Published	International Seminars	2018-19	2019-20	2020-21
1	A Manu - 2015							
2	Aashish Satyajit -2019	Biology	Mukund Thattai	2	2			
3	Abdullah Abdul Khadir	Computer Science	Madhavan Mukund	0	0			
4	Abhishek Bharadwaj	Number theory/ Mathematics	Purusottam Rath	3	0			
5	Aditya N K Subramaniam	Mathematics	Krishna Hanumanthu	2	0			
6	Adwitee Roy	Computer Science	B Srivathsan	2	1			
7	Aishik Chattopadhyay -2018	Mathematics		0	0			
8	Anbu Arjunan	Mathematics	Vasanth Srinivasan	2	0			
9	Aneesh P B - 2015	Physics	Amitabh Virmani	2	0			
10	Anish Mukherjee	Computer Science	Samir Datta	7	3			
11	Ankit Yadav -2019	Physics	Shreedhar V V	2	0			
12	Archit Chauhan -2018	Computer Science	Samir Datta	4	2			
13	Arkadev Ghosh -2020	Mathematics	Senthamarai Kannan	2	0			
14	Asif Khan -2020	Computer Science	Samir Datta	2	1			
15	Athira P V - 2015	Physics	Alok Laddha	5	0			
16	B Sadhanandh Vishwanath -2019	Mathematics	Upendra Kulkarni	0	1			

17	Chellapillai D -2019	Mathematics		0	0			
18	Cyril J Jacob -2019	Mathematics	Krishna Hanumanthu	0	0			
19	Debodirna Ghosh-2016	Physics	Amitavh Virmani	3	0			
20	Dharm Veer	Mathematics	Manoj Kummini	2	1			
21	Ghanwat Abhijeet Atmaram	Mathematics	Dishant Pancholi	2	0			
22	Govind R	Computer science	B Srivathsan	3	1			
23	Himalaya Senapati	Physics	Govind K	3	0			
24	Hitesh Saini -2020	Physics	K Narayan	2	0			
25	Jagadale Mrunmay Milind	Physics	Alok Laddha	2	0			
26	Jagadish Pine							
27	K Sandesh Kamath	Computer Science	K V Subrahmanyam	2	2			
28	Kaberi Goswami -2019	Physics	K Narayan	2	1			
29	Kolekar Kedar Shrikrishna	Physics	K Narayan	2	1			
30	Krishnendu N V	Physics	K G Arun	5	0			
31	Kush Grover	Computer Science	B Srivathsan	0	0			
32	Malay Mandal	Mathematics	B V Rao	2	1			
33	Muthuvelmurugan I	Computer Science	K V Subrahmanyam	2	1			
34	N Pachaiyappan	Mathematics	..	0	0			
35	Naveen Kumar	Mathematics		0	0			
36	Navnath Daundkar	Mathematics	Priyavrat Deshpande	4				
37	Nirmal Kotal -2018	Mathematics	Manoj Kummini	2	0			
38	Pankaj Saini -2019	Physics	K G Arun	3	0			
39	Parthapratim Mahapatra -2019	Physics	K G Arun	2	0			
40	Pinaki Nath Saha	Mathematics	S Senthamarai Kannan	2	0			
41	Pranjal Dutta-2018	Computer Science	Nitin Saxena	6	2			
42	Pratik Roy	Physics	Amitabh Virmani	2	0			
43	Praveen Kumar Roy	Mathematics	Krishna Hanumanthu	2	0			
44	Pritish Sinha	Physics	Alok Laddha	0	0			
45	Pritthijit Biswas - 2018	Mathematics	P sankaran	1	1			
46	R Keerthan - 2015	Computer Science	B Srivathsan	1	0			

47	Rajit Datta	Computer Science	Partha M	8	1			
48	Ramadas N - 2015	Physics	V V Shreedhar	1	0			
49	S Aravindhan -2019	Physics		1	0			
50	S P Murugan Paramasivam	Mathematics	Vasanth Srinivasan	1	0			
51	Sachin Pathak -2012	Physics	Govind K	1	0			
52	Sahil Kulshrestha - 2020	Computer Science		0	0			
53	Sahil Mhaskar -2018	Computer Science	Aiswarya C	0	0			
54	Samit Ghosh -2020	Mathematics	-	0	0			
55	Sanchari Sil -2020	Computer Science	B Srivathsan	0	0			
56	Sarjick Bakshi	Mathematics	S Senthamarai Kannan	2	0			
57	Sayan Mukherjee	Computer Science	B Srivathsan	3	1			
58	Sayantani Datta -2018	Physics	K G Arun	3	0			
59	Shanmugapriya P - 2017	Physics	Amitabh Virmani	2	1			
60	Sheikh Shakil Akhtar - 2020	Computer Science	Pranabendu Misra	0	0			
61	Shubham Ramesh Ovhal -2018	Mathematics		0	0			
62	Somnath Sudam Dake-2018	Computer Science	K V Subrahmanyam	1	0			
63	Sonakshi Sachdev	Physics	Govind K	1	1			
64	Soumik Ghosh -2020	Mathematics						
65	Sourav Das	Mathematics	V Balaji	2	0			
66	Sourav Roychowdhury-2016	Physics	Alok Laddha	2	0			
67	Srinidhi N -2020	Computer Science	Mandyam Srivas	1	0			
68	Uday Sureshbhai Patel -2019	Mathematics		0	0			
69	Utsab Ghosal -2020	Computer Science	Partha Mukhopadhyay	2	1			
70	Vishnu T R	Physics	Govind K	3	0			
71	Vishwa Prakash -2020	Computer Science	Prajakta Nimbhorkar	3	2			

ANNEXURE 3 NONRECURRING SUPPORT PROVIDED UNDER THE PROJECT PERIOD 2018-21

Sl No	Particulars	Nos	Allocation/Remarks
1	Lenovo Desktop	50	Computer Lab (Photo-01)
2	MacBook Air 13"	1	Prof. K Narayan
3	MacBook Air 1.1GHz	1	Prof Rajeeva L Karandikar
4	MYH42HN/A I-pad Air WF CL 256GB Silver -HIN	1	Prof Clare
5	MYFM2HN/A : 10.9-inch iPad Air Wi-Fi 64GB - Space Grey with MU8F2ZM/A: Apple Pencil 2nd Gen	9	Prof Sukhendu Mehrotra
			Prof M. Praveen
			Prof Partha Mukhopadhyay
			Prof Prajakta Nimbhorkar
			Prof Geevarghese Philip
			Prof V. V. Sreedhar,
			Prof P Sankaran
			Prof Sundari, Prof K Narayan
			Prof K Narayan
6	MGN64HN/A-13-Inch Macbook Air	2	Prof Sourish Das
			Prof Pramathanath Sastry
7	Dell Laptop	7	Research Scholar-Pathaparthim
			Research Scholar-D Chellapillai
			Research Scholar-Sadhanandh
			Research Scholar-Ankit Yadav
			Research Scholar-Pankaj Saini
			Research Scholar-Cyril Jacob
			Research Scholar-Asif Khan
8	Lenovo ThinkPad Laptop	25	Research Scholar-Arkadev Ghosh
			Post Doctoral Fellow-Amith S K
			Post Doctoral Fellow-Sudheshna Roy
			Post Doctoral Fellow-Suparjo Das
			Post Doctoral Fellow-Hitesh Kumar Saini
			Post Doctoral Fellow-Oorna Mitra
			Research Scholar-Vishwa Prakash
			Post Doctoral Fellow-Kamalesh Saha
			Research Scholar-Sheikh Shahil Akhtar
			Post Doctoral Fellow-Chaitanya Ambi
			Post Doctoral Fellow-Nabanita Ray

			Post Doctoral Fellow-Sajad Ahmad Bhat
			Post Doctoral Fellow-Amit Kumar Singh
			Post Doctoral Fellow-Vimalraj Sharma
			Post Doctoral Fellow-Animesh Lahiri
			Post Doctoral Fellow-Jyotirmoy Ganguly
			Post Doctoral Fellow-Jayakrishnan Madathil
			Research Scholar-Utsab Ghosal
			Post Doctoral Fellow-Sruthy Murali
			Post Doctoral Fellow-Jyothsna S
			Research Scholar-N Srinidhi
			Research Scholar-Sanchari Sil
			Research Scholar-Asif Khan
			Post Doctoral Fellow-Pratik Ghosal
			Post Doctoral Fellow-Soumya Dey
9	S Type Chair with Cane Seat and Back/Writing Pad	140	Lecture Hall 1, 2,4, 5,801 and 805, New Building Room Number 202
10	Gypsum-board false ceiling & supply, UPVC trap door, Acoustic wall panelling & Painting	NA	Renovation of NKN Hall (Photo-2)
		NA	New Building Room : 202 (Photo-3)

Dear Prof., K.V.,

Greetings

I am writing to express my sincere gratitude for the incredible opportunities through subsidized due to the generous support of **the Shriram Foundation during my CMI studies, that reduced my financial burden and allowed me to fully immerse myself in my studies, research, and personal growth without worrying about the costs.**

The support I received from these esteemed organizations was more than just financial assistance—it was an investment in my future. With this backing, I was able to pursue my passion for computer science, specifically in machine learning, and work towards my dream of becoming a CS scientist. Though I eventually decided to pivot my career into the hedge fund industry, the foundational skills and knowledge I gained at CMI were invaluable in making this transition successful. The scholarships played a pivotal role in covering the cost of tuition, enabling me to focus on my studies and career development.

Studying at CMI has had a profound impact on my career and personal development. The education and experiences I gained there have equipped me with the skills and confidence needed to excel in both computer science and the financial sector. These support not only eased my financial burden but also served as a powerful motivation for me to strive for excellence in my academic journey. I am truly honoured to be part of CMI to make my dream come true.

Looking forward to staying in touch, and if I find myself in Chennai, I'll certainly drop by.

Warm regards,

Debjit¹

(Ex Student, CMI)

Dated 20th August 2024

¹ A beneficiary of CSR project to CMI

ANNEXURE 5 REFLECTIONS FROM BENEFICIARIES POST DOCTORAL FELLOWS DURING ASSESSMENT

- Fellowship is much more than the monetary value, all the other opportunities CMI provides benefits more in career building.
- My fellowship is providing me with valuable research experience and networking opportunities, which are crucial for advancing my career in both academia and industry.
- Fellowships make us independent to continue our research and passion.
- It gives me much needed exposure to world class research happening at CMI and experience in teaching bright young undergraduate students while sustaining my livelihood.
- Makes us independent and free to continue research.
- I am only earning member of my family, if has given a good support.
- The CMI Postdoctoral fellowship helped me to continue my research and achieve my goal to contribute to the field I am currently studying. I am enthusiastic about teaching and training young students, and in this case, CMI also gave us the opportunity to teach. Moreover, CMI helped me to expand my collaboration with other researchers in the related fields.
- First, and mainly it helps financially. Also, as my fellowship has contingency , I can buy necessary gadget, important books. Any research demands an adequate time. My fellowship is for three years so it provides a psychological support that I have additional time to do work.
- My goal is to become a successful researcher and a teacher. The fellowship is supporting me to continue my efforts in teaching and research in more than one way, while I gain enough expertise to secure a long-term position.
- It is funding my research and giving me the opportunity to interact with people interested in topics related to my area of research.
- It is providing us the financial support so that we have the privilege to continue our research.
- CMI is providing me with exposure to dynamic and progressive research environment and collaborations.
- Postdoctoral fellowship is helping me to gain more expertise in research areas of my interest. I am also able to continue my passion for research. So that I can contribute significantly to the future.
- Postdoctoral fellowship is helping me continuing my research and providing me opportunity to teach mathematics.