give

Impact Assessment Report

Mphasis F1 Foundation | **Ashoka University**

CONTENTS

LIST OF ACRONYMS

TOC	Theory of Change
LFA	Log Frame Analysis
SDG	Sustainable Development Goal
AI	Artificial Intelligence
ML	Machine Learning
ML2CT	Machine Learning and Computational Thinking
CSR	Corporate Social Responsibility
AMR	Anti-microbial Resistance
HPC	High Performing Computers
OJT	On-the-job training
KII	Key Informant Interviews
ISM	Independent Study Module
CHART	Center for Health Analytics, Research & Trends

LIST OF FIGURES

1 Executive Summary

Increasing computational capacity is of utmost importance for Indian universities to stay relevant and competitive in the global arena of research and innovation. With the exponential growth of data and the increasing complexity of research questions, the ability to process and analyze vast amounts of data has become critical. In today's world, success in research and innovation is heavily dependent on computational capabilities, and universities need to adapt to this reality by investing in high performance computing (HPC) infrastructure and resources. The availability of HPC infrastructure enables universities to attract and retain top talent, drive innovation, and create new knowledge. It allows researchers to carry out complex simulations and analysis that were previously impossible, leading to significant advancements in various fields. Moreover, it provides students with the opportunity to develop skills in cutting-edge technologies, preparing them for future career opportunities.

To encourage HPC driven interdisciplinary research, Mphasis F1 Foundation supported Ashoka University, a liberal arts and sciences university, to augment its computational capability by setting up the 'Mphasis Lab for Machine Learning & Computational Thinking (ML2CT)'. The project is in alignment with Mphasis F1 Foundation's CSR policy, which emphasizes on technology-driven community development as one of its key verticals. Mphasis F1 Foundation disbursed a grant amount of Rs. 10 Cr to Ashoka University in FY 2020-22. The intervention contributes to SDG 4 (quality education) of the agenda 2030 of the UN Sustainable Development Goals directly and to multiple other SDGs such as SDG 16 and SDG 13 through the research projects being conducted in the lab. Nationally, it is in alignment with the activity (ii) of Schedule VII of the Companies Act, 2013.

The impact assessment study included the development of a logical framework analysis against the expected theory of change to understand the parameters, indicators, output, outcome, and overall impact of this project. A qualitative approach was deployed to collect and analyse textual data. The total sample size covered during the assessment was 40. FGDs were conducted though physical visit to the University Lab in Sonipat and virtual interactions with student and researcher scholars, University professors, co-founder of the University and the administrative staff of the Lab. In-depth KIIs were conducted with the professors, researchers, scholars and the ones who have used the ML2CT lab as part of their collaborative research.

Give found that this project has greatly augmented the computational capabilities of the University which has enabled its stakeholders to work on socially relevant novel projects. The lab has enabled the university to conduct research in the field of genomics and bioinformatics, which involves analyzing large amounts of biological data. This research aims to curb the rising incidence of antimicrobial resistance in the country by identifying new treatments and solutions. In addition, the lab has supported research projects centered around data security and AI. One such project involves the development of an 'explainable AI' model, which can translate AI predictions into human language. This model aims to bridge the trust gap between humans and AI systems and improve the understanding of AI predictions, thus making it easier for organizations to integrate AI powered systems in their work. Another project focuses on future-proofing cryptographic standards, ensuring that personal, institutional, and financial data remains secure, even in the face of potential hacking threat by quantum computers.

The lab has also enabled a project that has been aiding in policy decisions related to the COVID-19 pandemic. This project involves simulating the pandemic on synthetic populations, which can provide valuable insights into the effectiveness of lockdowns and vaccinations. Such research is crucial in the ongoing fight against the pandemic and can inform policy decisions aimed at minimizing the impact of future surges.

The project has also resulted in the development of a makerspace in the university premises. The makerspace is a collaborative workspace that provides the university students and faculty access to tools, equipment, and resources to bring their ideas to life. It fosters creativity, innovation, and hands-on learning amongst students, which are crucial skills for the modern workforce. Give found that students from varied disciplines (STEM and non-STEM) are using the makerspace to collaborate on projects, promoting interdisciplinary learning and problem-solving. Additionally, start-up founders and entrepreneurs in residence at Ashoka University were also levering the makerspace for prototyping and testing their business ideas, thus indicating that the makerspace can also serve as a hub for entrepreneurship.

The Give team is of an opinion that the establishment of more academia-industry partnerships can significantly enhance the impact of the program. This would allow for the collaboration of different resources, expertise and knowledge that would accelerate the progress and impact of the research projects.

During the assessment, the team found that professors engaged in research expressed concerns about obtaining travel grants for academic conferences to present their research findings. They emphasized that this would increase the visibility of their research and provide an opportunity to network with potential collaborators from academia and industry. Ashoka University and Mphasis can consider reserving a portion of the grant for academic travel purposes.

Moreover, Give also observed a lack of women as research project lead. To address this issue, Ashoka University and Mphasis can collaborate to proactively seek out research proposals from female researchers and encourage their participation in research projects. This initiative would not only contribute to gender diversity and inclusivity but also increase the pool of talent in the research field.

2 Introduction

In a fast-paced and technology-driven society, the need to rely on Artificial Intelligence and Machine Learning (AI/ML) is felt today than ever before. AI's role is to mimic the cognitive abilities of humans' minds to solve problems. Such human cognitive functions are based on computer science, mathematics, psychology and neuroscience. The role of AI/ML and computational thinking can be in an array of fields like healthcare, media, education, banking, maintenance, operations and so on. Mphasis Ltd, as part of its CSR Policy, through Mphasis F1 Foundation is supporting projects in the domains of 1) creating opportunities for the disadvantaged with emphasis on persons with disabilities, and 2) technology-driven community development. Mphasis F1 Foundation disbursed the Ashoka University a grant amount of Rs. 10 Cr. for FY 2020-22. The intervention addresses SDG 'quality education' (4) of the UN Sustainable Development Goals. Nationally, it is in alignment with the activity (ii) of schedule VII, the Companies Act, 2013.

To encourage application of technology in everyday use, Mphasis F1 Foundation has been supporting Ashoka University since 2019 to run an on-campus AI/ML 'Mphasis Lab for Machine Learning & Computational thinking'. The lab is currently catering to professors pursuing research with a streak of computational thinking and machine learning in their studies. These studies could be either from the core department of computer science in the university or a collaboration to have an interdisciplinary study which has aspects of AI/ML or computational thinking in them. The lab is open for students who wish to be part of it who hail from an array of disciplinarian background like Physics, Economics, Behavioral Sciences, etc. Currently, the grant is funding 10 research projects which largely fall under the umbrella of environment, healthcare, and cybersecurity, namely:

1. **Makerspace**: It is a space where creativity meets tinkering and possesses infrastructural support of 3D printer
2. **World Food Atlas** platform tracks impact of food on aspects of health and wellness
3. **Triple Negative Breast Cancer** is AI-aided research on cancer on the basis of data science
4. **Rational Drug Design**: Drug design aided by generative models
5. **Post-Quantum Cryptography**: Protecting privacy from new age computers
6. **Privacy Preserving Machine Learning**: Cybersecurity to preserve and secure data
7. **Covalent Magnetic Tweezers** is AI enabled automation of the data collection on movement of protein molecule
8. **BharatSim**: It is ultra-large-scale simulation on Indian demographic
9. **Explainable AI**: Algorithms to make AI more reliant, trust-worthy and just
10. **Anti-Microbial Research**: Microbial genomic research on public health

The activity flow at the ML2CT Lab at Ashoka University is represented in the diagram below:

2019
Ashoka University and Mphasis begin talks in 2019

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2020
MoU gets signed in September 2020 during the pandemic

→

2021
Actual work and research in physical space as a lab on campus premises begins in 2021

→

2022
Infrastructural support like image scanner, HPC and 3D printer are purchased in 2022 to help support 10 research projects

→

2023
MoU in pipelines for renewal for April 2023

Figure 1: Activity Flow at ML2CT Lab

The lab has been operating with three core principles:

- Apply machine learning and design thinking to produce world-class papers and compelling proof-of-concepts of systems with the potential for large societal impact

- Produce experiential pedagogy-based modules that are virtually offered and designed to be broadly accessible by all students of various disciplines. Each module is based on a sequence of hands-on activities that allow a student to reconstruct proof-of-concepts produced in the laboratory.

- Conduct workshops, webinars and hackathons that create opportunities for collaboration between academicians, practitioners, and policy makers

An impact assessment was carried out by the team of Give to understand the overall effectiveness of the Mphasis Lab for Machine Learning & Computational Thinking (ML2CT).

3 Objectives and Scope of Study

The study aims to understand the implementation pathways of Mphasis Lab for Machine Learning & Computational Thinking (ML2CT), Makerspace and AMR. The assessment captures the change the program has brought in the STEM education domain. It intends to showcase direct and indirect impact of the program.

3.1 Objectives of The Study

The major objectives of the study are as follows:
- **Assess the relevance and efficiency** of the lab ensuring that the beneficiaries' challenges are addressed by the project and to review the implementation pathways.
- **Understand the effectiveness** of the intervention: How each project under the banner of Mphasis Lab has led to creating the ripple effect in the respective domain of research.
- **Understand the major success factors** and challenges in the intervention.
- **Find the areas of improvement** across all the factors from program design to implementation.
- **Provide an assessment framework** to be able to capture impacts in a manner that is effective recommendation.
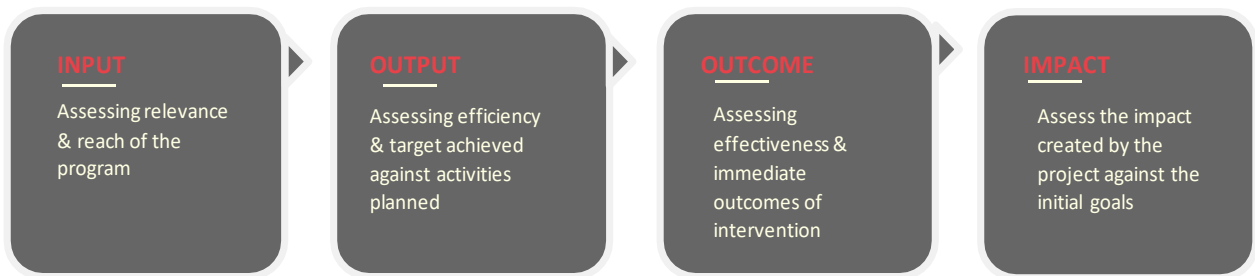
3.2 Limitations of The Study

- The participation of the students in the assessment remained laidback. One of the reasons for insufficient participation was attributed that assessment period overlapped with their end-semester evaluations.

4 Assessment Framework

To create an overall framework for the impact assessment, following activities were undertaken. We began by establishing the scope of the assessment in terms of type of stakeholders to be engaged and topics to be discussed with them. Based on this and the understanding of the project activities, we developed stakeholder-wise detailed questionnaires to ascertain factors including rationale for supporting the ML2CT lab, Makerspace and AMR, the implementation process, roadblocks in operations and beneficiary feedback about the efficacy of the program. The findings and recommendations arising out of this process are mentioned in the subsequent sections of the report.

4.1 Theory of Change

The THEORY OF CHANGE FRAMEWORK (ToC) for the given program is illustrated below:

INPUT
Assessing relevance & reach of the program

OUTPUT
Assessing efficiency & target achieved against activities planned

OUTCOME
Assessing effectiveness & immediate outcomes of intervention

IMPACT
Assess the impact created by the project against the initial goals

Theory of Change (TOC)				
Need	**Input**	**Output**	**Outcome**	**Impact**
• Develop skills and concept among the students to drive the skill-based/technology based solutions • Foster use of ML and AI in developing proof of concepts for various domains • Encourage students to have access to tinkering	• Identifying need for lab infrastructure • Selection of projects to enable the use of lab • Develop experiential pedagogy-based learning module • Identify and develop hands-on-activities enabling project design/proof of concept • Providing infrastructural support and academic guidance for students and researchers to showcase interdisciplinarity and creativity at a university-level • Develop workshop module and execution plan	• Procurement of lab equipment for advanced research • Students, researchers utilizing lab infrastructure for running project algorithms • Number of workshops conducted for academicians, practitioners, and policy makers,	• Proof of concepts having societal impact developed • To run simulations on societal demographic for implementing healthcare policies	• Enable applications of Machine Learning and Computational Thinking for societal good.

4.2 Logical Framework Model

A LOGICAL FRAMEWORK MODEL is created against the identified ToC to reflect the identifiable indicators, means of verification, and assumptions, as given below:

| Log Frame Analysis (LFA)				
	Project Summary	**Indicators**	**Means of verification**	**Assumptions**
Impact ⇩	• Enable applications of Machine Learning and Computational Thinking for societal good.	• Proof of concepts put into action	• Qualitative and Quantitative interviews with stakeholders and beneficiaries • Physical visit to the university where the Mphasis Lab was located • MoU signed between Mphasis and Ashoka University	• Students and researchers are in close contact with the professors anchoring the research in the Lab • Professors are guiding the research
Outcome ⇩	**Specific Objective** • To pursue research which has real-time implications on the society • To provide opportunity to students to learn and get trained on state-of-the-art technology	• Increase in the student's participation, researchers, professors and collaborators using in the lab • Research infrastructure support such as 3D image scanners and High Performing Computers (HPCs) in place • Proof of concepts published		
Output ⇩	**Expected Results** • Build capacity of the researchers and students of the lab	• No. of trainings conducted • No. of workshops held • No. of hackathons hosted on campus		• Professors at the university are able to acquire grant once they pitch to Mphasis
Input ⇩	**Activities** • Having webinars, workshops and hackathons • Allowing students to take up ISMs • Providing a chance to work in the lab by offering stipends	• Identification and filtering out passionate students and researchers		

4.3 Three Point Assessment Framework

Based on the TOC and the LFA created, we examined the relevance of services, efficiency, and effectiveness of delivery of services as well as any innovations that may have been implemented on the ground.

The impact assessment findings are further anchored around Give's Three-point Assessment Framework as illustrated here.
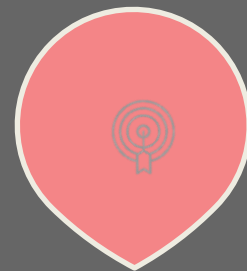
Program Design
- Relevance of the intervention
- Preparedness for the intervention
- Qualitative assessments
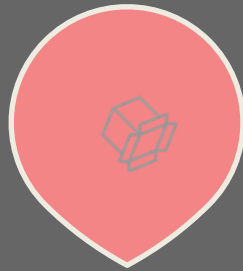
Program Delivery
- Efficiency of program implementation
- Effectiveness of program implementation

Impact & Sustainability
- Depth of impact
- Sustainability of impact

Program Design

We studied program design through program strategies, inputs and resources, assumptions, outreach mechanisms, and much more. We also consider if the program design attends to specific needs of the stakeholders, program locations, social categories, site, and situation, among other development needs. Give's Impact Assessment approach for program design is based on assessment criteria like Relevance and Preparedness using methodologies such as assessment of baseline survey.

Program Delivery

Give assesses the Program Delivery to understand the success of the program delivery mechanism in attaining the overall objectives such as cost effectiveness, resource efficiency, equity in service delivery, best practices and challenges, perception about the services among the relevant stakeholders, among other actors.
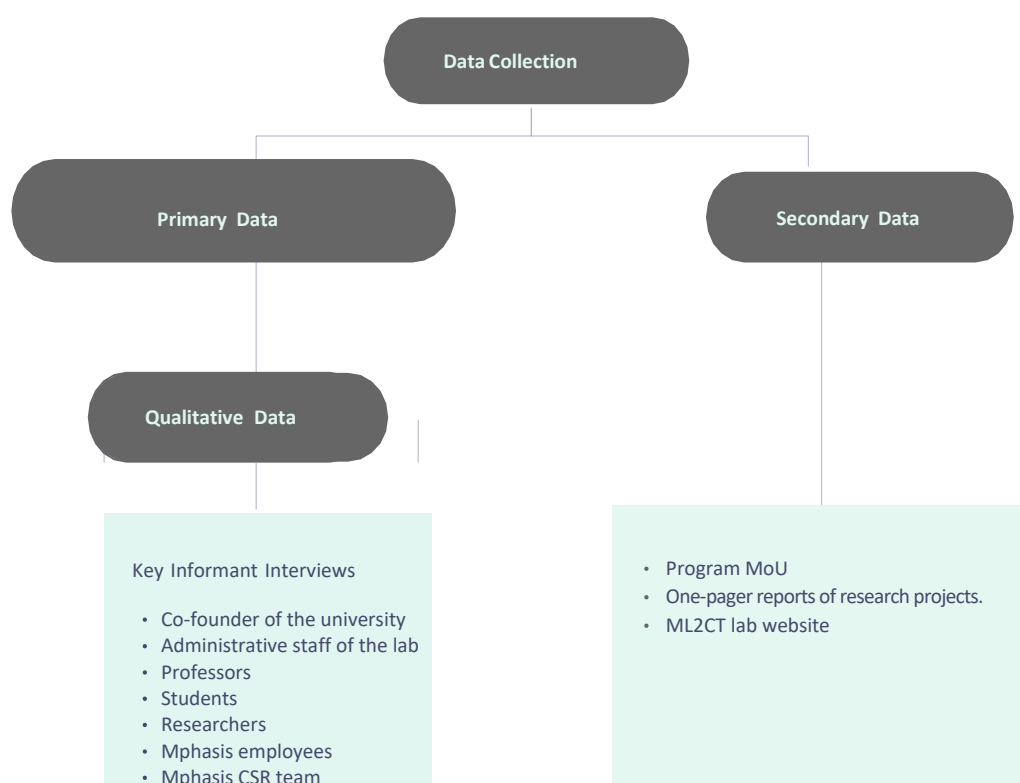
Impact

The program's impact potential was assessed to ascertain whether a change or the desired outcome can be attributed to the program intervention. Give uses criteria such as scale of Impact and impact sustainability to understand the impact potential of the project

5 Methodology Adopted

We initiated the impact assessment study by identifying the key stakeholders for the project. These stakeholders were ratified in consensus with the implementing partner. The data collection methods used in this study included semi-structured interviews which were designed to elicit rich and detailed accounts of participants' experiences and perspectives.

The data obtained from the interviews was analysed using thematic analysis, a flexible and iterative approach that involves identifying patterns and themes within the data. The process of analysis involved multiple stages of coding and theme development, which allowed for a deep exploration of the data and the emergence of new insights.

5.1 Data collection

Data Collection

Primary Data

Secondary Data

Qualitative Data

Key Informant Interviews

- Co-founder of the university
- Administrative staff of the lab
- Professors
- Students
- Researchers
- Mphasis employees
- Mphasis CSR team

- Program MoU
- One-pager reports of research projects.
- ML2CT lab website

- **Primary data:** Primary data is the key to collecting first-hand information as evidence from the beneficiaries and stakeholders on the interventions. It allows us to understand the benefits delivered, its effectiveness and key challenges to assess the impact created by the program and arrive at recommendations that enhance it.

- **Secondary data:** For secondary data collection, the program proposal, MoU, and one-pager reports were referred. These documents gave high level insights about the projects including the inception and implementation phase along with the processes followed.

5.2   Sampling strategy

The Give team carried out interactions with various important stakeholder groups involved in the project through Focus Group Discussions (FGDs) and in-depth Key Informant Interviews (KIIs). FGDs were conducted with students and research scholars while in-depth KIIs were conducted for the remaining stakeholders.

Sampling Plan for the students, research scholars and professors: The students, research scholars and professors to be interviewed were selected through purposive sampling.

Questionnaires were designed for each stakeholder interview. All relevant questions were asked to the respondents and duly captured. The assessment captured of 40 responses over a period from 13th March 2023 to 17th March 2023.

Following table elaborates the sample size and distribution as per the strategy.

Stakeholder Group	Sample Size Achieved
Mphasis Employees	03
Lab Manager	01
University co-founder	01
Research team	03
Ashoka university students, research scholars	28
Ashoka University professors	4
Total	**40**

6 Findings & Analysis

A mix of thematic analysis and content analysis (for qualitative data to interpret and analyze unstructured textual content into manageable data) were done to analyze and interpret the data collected. The findings for the program are organized as per the three-point assessment framework described earlier.

6.1. Program Design

The ML2CT Lab homes research projects which have an overarching thread of computational thinking. Mphasis Laboratory for Machine Learning and Computational Thinking has been established with the objective to make machine learning an obvious paradigm of choice for complex problem solving, ability to sense and handle enormous amount of data across domains.

The term 'lab' quintessentially would mean a physical space. However, the program about coming up with disruptive yet creative proof of concepts that drives some of the development, scientific or policy level solutions. In that sense, program is ever evolving in nature.

The goals of the laboratory are:

- Apply machine learning and design thinking to produce world-class papers and compelling proof-of-concepts of systems with the potential for large societal impact
- Produce experiential pedagogy-based modules that are virtually offered and designed to be broadly accessible by all students of various disciplines. Each module is based on a sequence of hands-on activities that allow a student to reconstruct proof-of-concepts produced in the laboratory.
- Conduct workshops that create opportunities for collaboration between academicians, practitioners, and policy makers

The Makerspace has 3 verticals under it- ISM, collaborative research and utilization of 3D printer where funding for consumables is part of the grant. The Makerspace is also supporting Independent Study Modules (ISMs) which encourages students to be self-taught on disciplines tethered to department of computer science. Makerspace has 9 ISMs and 2 interns, and other students which cumulatively add up to 32 people who actively engage with Makerspace on a daily basis. Makerspace holds the potential to have collaborative research between departments like Economics, Biosciences and Psychology.
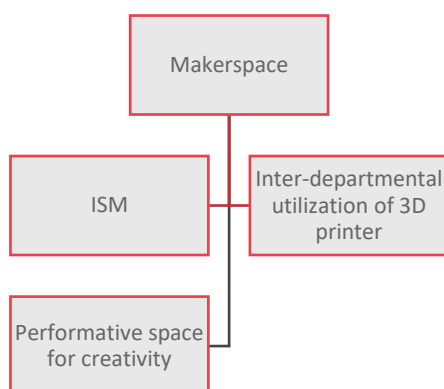
Figure 3: Structure of Makerspace

Figure 2: A 3-D printed remote

6.2. Program Delivery

The table below lists the ML2CT lab and makerspace usage statistics by different user groups:

User Group	#
Current students	57
Graduated students (University alumni)	11
Interns/Employees outside Ashoka University	15
PhD scholars	14
Students using makerspace	8
Professors using makerspace	12

Mphasis is funding the development of a Makerspace and research in Center for Health Analytics, Research & Trends (CHART). CHART is a center which carries out research predominantly in discipline of Biosciences but relies on Mphasis grant for computation of health analytics. Research on AMR is a typical example of collaborative nature of the study.

Having a HPC setup as part of the lab, the lab has facilitated research in projects such as 'BharatSim' which runs simulations on synthetic population and Antimicrobial Research (AMR). It is the application of the knowledge that students and researchers put primacy over.

The participation of students in the lab is encouraged by awarding stipends and giving a course credit for an independent study module.

The Give team found that most of the equipment existed before the students joined the lab, but there were additions like HPC setup (3 dual-monitor desktops with RAM of 512 GB) introduced to update the infrastructure of the lab to cater the high-quality research. 3D printers and 3D image scanners were procured for setting up the Makerspace.

When there is a need for small parts, the requirement is flagged through a hierarchy in place- students reach out to the researchers and professors. The professors, then, sign off on the requirement and finally the administrative team of the lab fills out the inventory and the 'procurement team' of the university gets it delivered to the lab after its purchase. The need to overhaul the equipment has not been felt yet, for they are fairly new and were mostly purchased in or after 2021.
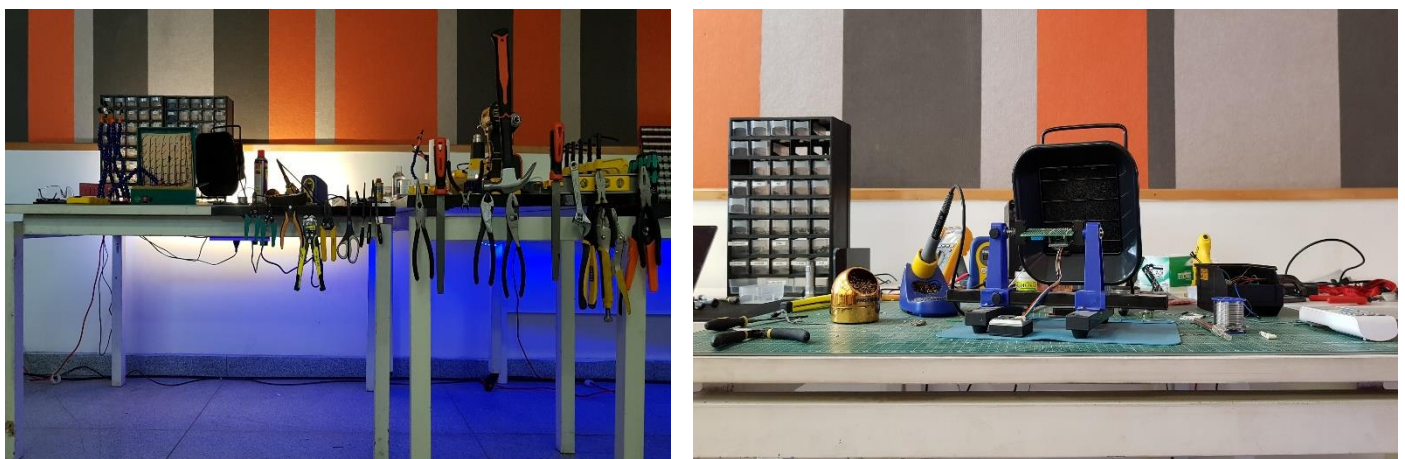

Figure 4: Tools available at the makerspace

Students claimed that they were able to apply classroom knowledge at the lab. The lab provided a conducive environment for them to flourish and pursue research. They were able to acquire academic skills like reviewing literature as well as management skills through organizing events like hackathons and all the aspects related to such an event like booking venues, negotiating with the vendors for merchandise.

The periodic updates on the research happen at team level and the professors heading the research are kept in loop. Mphasis is also given periodic updates through one-page reports. Ownership of any software developed as part of the research projects lies with the university, but the research papers published in journals is among those who work on them. The lab collaborates with other departments of the university such as Economics and Biosciences. What makes this lab unique in its own right is that it goes beyond theoretical knowledge.

Currently, external users who have an MoU with the university can visit the makerspace and use 3D printer which is typically available for internal use only.
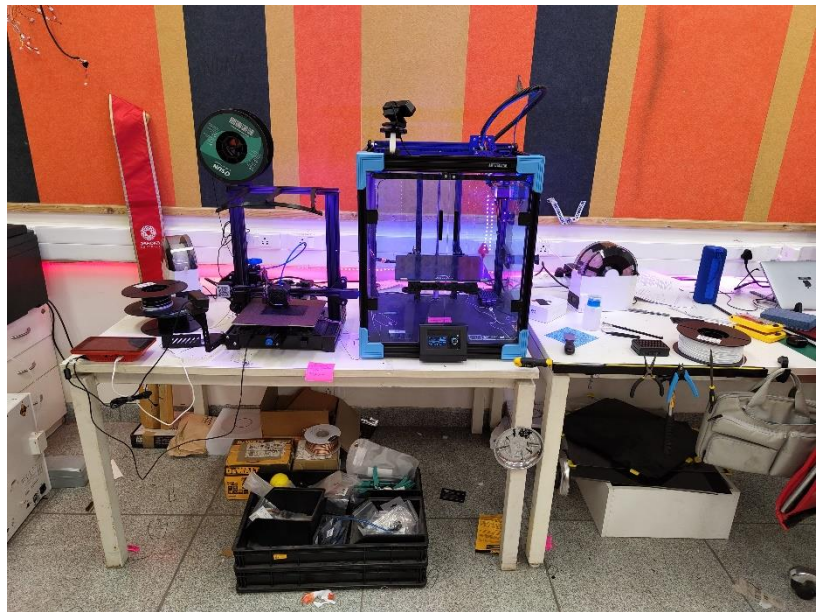

Figure 5: A 3D printer in makerspace

Figure 6: Hackathon conducted as part of the project

6.3. Impact & Sustainability

Case Study: Generative Art: An Interdisciplinary Project Developed in the Makerspace

The Ashoka University makerspace has played a pivotal role in promoting innovative interdisciplinary initiatives among its students, aimed at nurturing a research-oriented and inquisitive mindset. This project involves designing a sizeable transparent visual display system, enabling immersive and interactive contemporary performances, crafted and directed by student researchers. Upon completion, this installation is envisioned as an interactive exhibit, open to visitors at the India Habitat Centre in Delhi. The aim of the project is to foster a deeper understanding of the intricate processes that govern the creation and evolution of human ideas. The following project summary can provide an insight into the kind of inventive and interdisciplinary student research that the makerspace caters to.

Project Summary:

This project is a unique fusion of different types of art and technology, including generative art, live performance, and audience engagement. The aim is to explore the complex processes underlying the birth, evolution, and dissemination of ideas, which is something that can be hard to understand just by thinking about it. The use of visual patterns and live performance makes it easier for people to see how ideas form and how they can grow and change over time.

The transparent glass box serves as a canvas for the visually stunning patterns that are created using complex algorithms. These patterns are inspired by different fields such as philosophy, cognitive science, and conceptual art. They represent the intricate cognitive processes that drive idea formation and development, such as how ideas start as small sparks and build up from our experiences and interactions with the world around us.

During the live performance, dancers and actors move around the glass box, and their movements are tracked by sensors. This creates a feedback loop that shows how our thoughts and ideas are inextricably linked to our actions and experiences. The performance is a way of highlighting the connection between our thoughts and our physical movements and how they shape each other.

After the performance, the audience is invited to interact with the installation and engage with the artwork directly. By touching the patterns and moving around the box, they can shape the ever-evolving digital patterns and see how their actions affect the artwork. This highlights the idea that human thoughts are continually moulded by their interactions with others and the world around them, and humans can all contribute to the growth and spread of ideas.

The give team found that the ML2CT lab has successfully achieved the intended impact by having top-notch research in multiple domains ranging from environment to healthcare to cryptography.

The lab and the Makerspace provide students with the opportunity of experiential learning by applying textbook concepts in practical projects. All the students that we interacted with stated that they apply classroom knowledge at the lab. The lab provides a conducive environment for them to flourish and pursue research. They were able to acquire skills such as literature review or organizing tech-based events like hackathons negotiating with the vendors for merchandise etc.

The reason why many join this lab is because of the hands-on experience that they are privy to. It facilitates in solving real-life complex problems. It aids in accurate and easier treatment of common people, and also aids in flagging issues related to privacy; automation helps in saving time. Diversification of skills seems to be another reason why students work in projects which are funded by Mphasis F1 Foundation. Although these are the issues the research at the lab will soon be resolving, the projects are still at the nascent stages and might take a while to have a direct and evident

implication on the lives of common people.

The way pedagogy was seen has evolved greatly- now it is seen as AI/ML and computational thinking helping solve complex human problems.

An urge to have more equipment and collaborative activities between Mphasis and Ashoka University were expressed. Student body of the University seems to be unaware of what the capability of the lab is, hence having mixers at university level where interaction among those working on different research projects happen is something which may yield mutual benefit to those from an array of disciplinary background. Incentivizing those who work in the research should entail semester credits, or some form of stipend as a remuneration.

The team at the lab along with the university are attempting to draft a policy about receiving payments from outsiders (like researchers who pursue independent research) and insiders (like professors from other departments who are not actively involved in the project but want to use the infrastructure) who visit the makerspace to utilize resources like the 3D printer.

The lab would be highly recommended to those in the field because of the innovative and interdisciplinary nature of the lab which provides a platform to be open to trying new research ideas. Mphasis employees who attended webinars hosted by Ashoka University professors want academia to take up roadblocks that IT firms like theirs cannot solve. Having a fellowship from the Mphasis Foundation for either passionate part-time or female researchers in STEM would be something for Mphasis Foundation to consider.

7 SWOT Analysis

A SWOT analysis is conducted to understand the program's strengths, weaknesses, opportunities, and threats. It was conducted from the responses received from the program team and other implementation-level stakeholders, at the same time considering the beneficiary feedback.

STRENGTH	WEAKNESS
- The research projects under the ML2CT lab are addressing some of the most challenging problems in healthcare, data privacy, and the environment, thus contributing directly to SDG 3, SDG 16 and SDG 13 respectively. - The makerspace fosters collaborative research among students from diverse backgrounds, facilitating the exchange of ideas and leading to the creation of unique interdisciplinary projects.	- There is a notable lack of female participation in the research projects at the ML2CT lab. - There is potential for increased collaboration between academia and industry.
OPPORTUNITIES	THREAT
- The academic conferences of the researchers and academics can be funded by the university/Mphasis to present to enable them to share their research findings with the larger research community. - With its high computational capacity, the ML2CT lab can facilitate research in data-intensive fields such as astrophysics and climate science, contributing to the development of India's research ecosystem.	No perceived threat

8 Conclusion and Recommendations

Funds granted by Mphasis F1 Foundation were duly utilized by Ashoka University in pursuing research addressing pressing societal issues and contributing directly to multiple UN Sustainable Development Goals (SDGs). It was noted that the interdisciplinary nature of the research studies at Ml2CT lab was highly attractive to all working in the lab.

The Give team noticed that due to a lack of space, the ML2CT lab is currently spread out over multiple areas, which is causing difficulties for researchers. However, the lab manager reported that a larger campus is currently under construction and that by the end of 2023, both the ML2CT lab and makerspace will be relocated there.

The ML2CT lab and Makerspace have positively affected students and researchers of Ashoka University by expanding their knowledge-base and exponentially improving their chances of not just better employability but also their admission into prestigious universities for a doctoral program.

Recommendations

The recommendations have stemmed from on-ground observations, interactions with the beneficiaries and visit to the university; whereas after having analyzed program from the third-party perspective the strategic set of recommendations are made for the foundation to consider as way forward.

Category	Recommendations
Training	The makerspace team is working on an automated screening framework and a training module to make sure that users have the necessary knowledge to work with equipment like 3D printers. However, it may be wise to consider having a few permanent lab assistants as an extra precaution. These assistants would supervise the work to ensure that no mishaps occur that could cause damage to the equipment.
Equipment Purchase	Give discovered that university students were required to visit the city on occasion to purchase equipment parts. Assigning a dedicated team to oversee all equipment procurement for the lab would allow students to maximize their time on research work.
Travel grants	It is just as crucial to present research findings as it is to conduct the research itself. Mphasis and Ashoka University could consider allocating a portion of their funds as travel grants for professors and students to attend conferences and other relevant events.
Research grants	Give discovered that there was very little participation of women researchers in the research projects. Ashoka University and Mphasis could consider establishing a fellowship program to encourage women's participation in HPC driven research studies, which could help attract more women to the field.
Collaborative research	There is an opportunity to enhance partnerships between academia and industry by increasing the number of collaborations. Mphasis could also explore collaborating with academics at Ashoka University on projects that are of interest to both parties.

Annexure I: Survey Questionnaire

<u>Stakeholder group: Founder and co-founder</u>

Basic profile

1. Name
2. Designation
3. When was the lab founded?
4. Were you involved in the establishment of the lab, if yes, in what capacity?

Program design: Relevance

5. What kind of projects has the lab enabled the professors and students to take up?
6. How do the projects in the lab align with Ashoka University's vision?
7. To what extent does the Mphasis's contribution amount for a fully operational lab?

Program delivery: Efficiency/Effectiveness

8. What kind of projects get maximum traction in the lab?
9. Who is responsible for maintenance of the lab equipment? (number of lab staff present; what is the internal structure of the staff)
10. How is the work and research done in this lab different from research done in other AI/ML labs across the country?
11. How do you think the lab is contributing to the current STEM research scenario nationally and internationally?
12. What impact do you envision the lab to make? (societal, policy-level, etc.) How?
13. Are the projects at the lab aligned with any SDGs? If yes, which ones and how? (good health and well being, education, affordable and clean energy, work and economic growth, industry, innovation and infrastructure, etc.)

Impact and Sustainability

14. What impact do you envision the lab to make? (societal, policy-level, etc.) How?
15. When the lab rolls out a project, what do you desire its orientation to be like- academic or industrial or a collaborative one?
16. Are the projects at the lab aligned with any SDGs? If yes, which ones and how?
17. Do you have any recommendations or suggestions to give to Mphasis in support of the lab?
    a. (Testimony) (verbatim!) Would you like to give a testimonial about the lab/the sponsor of the lab?

Stakeholder group: Professors

Basic profile
1. Name
2. Designation
3. Area of expertise
4. Were you involved in the establishment of the lab,
    a. Yes
        i. If yes, in what capacity?
    b. No
5. Since when have you been working in the lab?
    a. How did you go about being associated with it? (did you have to submit a proposal, who approved it)
    b. How many projects are you anchoring in the current lab?
6. Are you also working in any other lab apart from this?
    a. Yes
        i. Name of the lab
        ii. Is it on campus?
            1. Yes
            2. No
        iii. What is the nature/theme of the lab?
        iv. Since when are you working there
    b. No

Program Design: Relevance

7. How did the need for 'Machine Learning & Computational Thinking' arise?
8. What does it mean for Ashoka University? What does it intend to achieve through setting this lab?
9. What type of the projects get designed/addressed most through this lab?
10. To whom does this lab maximum cater to? Or What type of individuals frequent this lab?
    a. Bachelor's
    b. Post Graduates
    c. PhD Scholars
    d. Research Scholars
    e. Others, _____
11. What do Ashoka professors use this lab for? Is it an independent research or a scientific project which is worked in the team?
12. Were you able to take up any new projects because of the introduction of this new lab on campus?
    a. Yes
        i. If yes, which one? How many students/scholars work on it?
13. No
14. Prior to the establishment of the Mphasis lab, were you working in a third-party lab with similar research agenda?
    a. Yes
    b. No
    c. Are you simultaneously working in other labs? If yes, in what capacity? (different projects? Or different equipment? Or collaboration with other researcher from another lab?)
15. Equipment:

a. Who owns the equipment- University or Mphasis?
　　　b. Were you involved in deciding the specifications of the equipment?
　　　　　i. Yes
　　　　　ii. No
　　　　　　　1. If not, who determines the infrastructural requirements of the lab?
　　　c. Is the current equipment enough for the project needs?
　　　d. Do you feel the need to update the equipment?

Program delivery: Efficiency/Effectiveness

16. According to you, on what aspects/topics a scholar use this lab for?
17. According to you, how does this lab help in bridging academia and industry requirements?
18. What are the challenges that you experience in a hassle-free functioning of the lab?
19. How do you overcome it? What activities are conducted by the lab? (webinars, hackathons- year 2021 to 22)
　　　a. Who are its participants? (do Mphasis employees participate in it?)
　　　b. How many webinars conducted in the academic year?
　　　c. What were the themes of these webinars?
　　　d. How many hackathons have been conducted in the academic year?
　　　e. What kind of outreach activities did they undertake to garner maximum participation in these activities?
20. Intellectual property:
　　　a. Who owns the papers, articles, and other software produced at the lab?
21. Would you say that the lab is fulfilling the objective it set out to achieve? How?
22. How is the work and research done in this lab different from research done in other AI/ML labs across the country?
23. Have you collaborated with other research labs (intra-University, nationally or internationally)?
24. Do you need to work with experts from other areas and other labs as well?
25. Do you need to hire non-Ashoka research assistants/associates for the research projects undertaken at the lab?
　　　a. Or, are you able to suffice with just students and research scholars?
26. How often do you update the infrastructure/gadgets/equipment in the lab?
27. Makerspace: (ask all profs., but esp. Prof. Debayan)
　　　a. What happens in it?
　　　b. Is it ready?
　　　c. In what capacity do you encourage it among students?

Impact and Sustainability

28. What does Ashoka University intend to achieve in the coming years through this lab?
29. Apart from Mphasis do any other companies fund this lab?
　　　a. Yes
　　　　　i. If yes, what is the % attribution of Mphasis?
　　　b. No
30. Does the lab plan to be self-sustaining?
　　　a. Yes
　　　b. No
　　　c. If yes, what approach or process has it envisaged?

d. If not, what would it do when Mphasis intends to exit the project?

31. What aspect of societal problems does the lab intend to address?
32. Future plans in the lab and new projects?
33. What happens to the equipment once the MoU with Mphasis ends?
34. Recommendations for improvement in the lab (for University administration or Mphasis as sponsors)

Stakeholder Group: SP/ Research Scholar

Basic profile

1. Name
2. Degree pursuing
3. Topic of research and name of the professor working under
4. Year of enrollment, current year of study
5. Since when are you working in the lab?

Program Design: Relevance

6. Which areas/domains of research does the lab cater to?
7. What does Machine Learning and Computational Lab mean to you?
8. Do you work in other labs with different research objective as well?
    a. How is the work done in this lab different from the work done in other labs?
9. Would working in the lab yield additional credits or recognition (which other labs on campus may not have)?
    a. Yes
    b. No
10. Equipment:
    a. Do you have all the equipment that you need?
    b. Were you provided with any special equipment as part of the lab to function smoothly?
    c. Do you flag unavailable equipment to the professors or the research team?
    d. Have you been asked to do its routine maintenance? If yes, what is the process like?
    e. If yes, do they bring it in to fulfil your requirement?
    f. Do you feel the need to update the equipment?
11. Know-how of the equipment:
    a. Were you given some training to run the equipment?
    b. Are you able to use the equipment independently?
    c. How long was the training?
    d. Do you have refresher trainings from time to time? If yes, how often are they?

Program Delivery: Efficiency/Effectiveness

12. Would you say that the lab is facilitating your research mettle?
    a. Yes
        i. If yes, how?
    b. No
        i. If no, why?
13. Who monitors your progress made in the domain of research?

      a. Are you asked to periodically update and present your progress to the concerned personnel?

14. Have you faced any challenges while working in this lab?

15. Have you taken part in activities conducted by the lab? (webinars, hackathons- year 2021 to 22)
      a. What were the themes of these webinars?
      b. How many hackathons have been conducted in the academic year?
      c. Did you have to partake in the outreach activities?

16. Intellectual property:
      a. Who owns the papers, articles, other software produced at the lab?

17. How is the work and research done in this lab different from research done in other AI/ML labs across the country?

18. Have you collaborated with other research labs (intra-University, nationally or internationally)?
      a. Yes
            i. If yes, which department/scholar/lab/university?
      b. No
            i. If no, why?

19. Do you need to work with experts from other areas and other labs as well?
      a. Yes
            i. If yes, in what capacity?
      b. No

Impact and Sustainability

20. What is your research objective to be working in this lab?
      a. What does it aim to address/achieve? (impact)
      b. In what way is the lab aiding your research agenda?
      c. How much have you achieved?

21. How is the work and research done in this lab different from research done in other AI/ML labs across the country?

22. Would this research touch the lives of the common people?
      a. Yes
            i. If yes, how
      b. No
    (What kind of impact (social, environmental, economic) does your research create? Do you also make policy recommendations to either the state or the central government?)

23. Has your understanding of pedagogy changed since you joined this lab?
      a. Yes
            i. How?
      b. No
            i. Why not?

24. What recommendations/suggestions do you have to improve the efficacy of the lab?

25. Would you recommend this lab to the scientific fraternity/peers/friends?
      a. Yes
            i. Why
      b. No
            i. Why

Stakeholder group: Research staff

Basic Profile

1. Name
2. Since when are you working in this lab?
3. What is your role in the lab?
4. Is Mphasis the only funder for this lab?
    a. Yes
    b. No
        i. Which organization funds it

Program Design: Relevance

5. How many researchers/students are currently using this lab?
6. How many students used this lab before they graduated?
7. What domains of projects do students engage in? (biomed, autosec, etc.)
8. Do you have to also see the appropriate allocation of funds to the lab?
    a. Yes
        i. Which budget head gets allocated the most?
    b. No
9. Have you worked in other such labs before? If yes, what was your role there?
    a. Do you simultaneously work in other labs?
10. Do you involve yourself in projects in the lab?
    a. If yes, what is your role?
    b. How many projects are you involved in/oversee?
11. Do you know the reason for the establishment of this lab?

Program Delivery: Efficiency/Effectiveness

12. Who uses the lab besides Ashoka professors, researchers and students (like ASP)?
13. Who is responsible for maintenance of the lab? (number of lab staff present; how often maintenance activities carried out; what is the internal structure of the staff; or third party looks after the maintenance)
14. Would you say that the lab is fulfilling the objective it set out to achieve?
    a. Yes
        i. How?
    b. No
        i. What do you think its goal was? How did its objective get lost in the way?
15. Do you need to collaborate and coordinate with other labs- both inter/intra University?

Impact and Sustainability

16. What are the challenges in functioning of the lab?
17. What measures can be taken to overcome them?
18. Recommendations for improvement in the lab (for University administration or Mphasis as sponsors)

Stakeholder group: Mphasis employees

Basic Profile

1. Name
2. Designation
3. No of years with Mphasis

Program Design: Relevance

4. Are you aware about Machine Learning and Computational Thinking Lab that Mphasis supports?
   a. Yes
   b. No
5. What was the rationale for supporting this lab?
6. What type of projects have you observed that are undertaken by the students, scholars, academics?
7. Do you engage in the lab in any capacity?
   a. Yes
   b. No
   c. If yes, in what way?
8. Webinars:
   a. Are you aware of any webinars that the lab has conducted?
      i. Yes
      ii. No
      iii. If yes, on which topic?
   b. Were you a part of it?
      i. Yes
      ii. No
   c. Are such webinars mandatory?
   d. When did you attend these webinar/s?

Program Delivery: Efficiency/Effectiveness

9. According to you, what is the best part of the lab or USP of the lab?
10. Do you believe the lab provides adequate research infrastructure for the students to work?
    a. Yes
    b. No
    c. If not, what according to you should be done to address this?

11. Have you attended any courses/webinars on Ashoka University campus?
    a. Yes
       i. which ones and
       ii. what was the duration of the visit?
    b. No

Impact and Sustainability

12. According to you, what is the lab's contribution in bringing the change? (Scientific, social, Policy level, etc...)

13. Going forward, what would you like to see (what areas, projects, themes etc..) in the lab?
14. Do you have any recommendations or suggestions for the scholars working in the lab?

Annexure II: Papers Published and Workshops Organised

Following papers have been published in reputed journals as a result of the establishment of the lab.

N. Chandra Shekar, A. Srinivas Reddy, P. Krishna Reddy, Anirban Mondal, Girish Agrawal (2022). Air Quality Data Collection in Hyderabad Using Low-Cost Sensors: Initial Experiences. DASFAA 2022 International Workshops. DASFAA 2022. Lecture Notes in Computer Science, vol 13248, pp. 402-416, Springer.

G Agrawal, H Rahman, A Mondal, P.Krishna Reddy: (2022). Visualizing Spatio-temporal Variation of Ambient Air Pollution in Four Small Towns in India. In: Rage, U.K., Goyal, V., Reddy, P.K. (eds) Database Systems for Advanced Applications. DASFAA 2022 International Workshops. DASFAA 2022. Lecture Notes in Computer Science, vol 13248: pp. 417-436, Springer.

Neekhra B, Kapoor K, Gupta D. Generating Synthetic Population. arXiv preprint arXiv:2209.09961 (2022).

Paper Publication Links:

https://openreview.net/pd?id=SqTLQ5LjQWp

https://arxiv.org/pdf/1908.09557v6.pdf

https://arxiv.org/pdf/2210.14833.pdf

https://www.biorxiv.org/content/10.1101/2023.03.16.532907v1

Workshops conducted as part of the research projects:

Workshop Title: "Data Challenges in Assessing Air Quality (DACAAQ 2021)" organized in conjunction with The Ninth International Big Data Analytics Conference (BDA-2021), organized by IIIT Allahabad (online conference), (URL: https://ml2ct.ashoka.edu.in/en/events/bda-dacaaq/). Attended by about 50 participants.

Workshop title: "Managing Air Quality Through Data Science (MAQTDS 2022)" in conjunction with The Twenty Seventh International Conference on Database Systems for Advanced Applications (DASFAA-2022), organized by IIIT Hyderabad (online conference), (URL: https://cs.ashoka.edu.in/maqtds/). Attended by about 50 participants.

Workshop title: "Data Challenges in Assessing Air Quality (DACAAQ 2022)", organized in conjunction with The Tenth International Big Data Analytics Conference (BDA-2022), organized by IIIT Hyderabad (physical conference), (URL: https://dacaaq.github.io/dacaaq2022/). Attended by about 60 participants.

Other media publications:

Parsons R, Chandrasekaran P (Hosts), Kshirsagar J, Menon G I (Guests). (Aug 19, 2022). Agent-based modelling for epidemiology: EpiRust and BharatSim. In Thoughtworks Technology Podcast.

The Print, India. New computer model can help assess Covid impact, progression in detail. (May 12, 2022)