SUPPORTED BY:

Office of the Principal Scientific Adviser to the Government of India

SCIENCE & TECHNOLOGY CLUSTER

IUCAA

# PUNE KNOWLEDGE CLUSTER

CITY KNOWLEDGE INNOVATION CLUSTER PKC

# IMPACT REPORT
# 2020 - 2022

**Compiling and Editing**
Dr. Preeti Nema
Dr. Priya Nagaraj
Valuable contributions by The PKC Team.

**Design**
Ms. Mitheila Mujumdar

Copyright © 2022

No part of this report to be reproduced without prior permission.

All rights reserved.

# CONTENT

**Vision & Mission** ..... 3
**Leadership** ..... 4
**Advisory Committee** ..... 5
**Leadership Perspectives** ..... 8
**PKC at a glance** ..... 13
**Executive Summary** ..... 15
**Partner Perspectives** ..... 18
**Verticals**
- Health ..... 31
- Sustainability & Environment ..... 42
- Sustainable Mobility ..... 53
- Big Data and AI ..... 56
- Capacity Building ..... 65

**Partners** ..... 86
**PKC in News** ..... 89

# VISION & MISSION

Pune Knowledge Cluster is established by the Office of the Principal Scientific Adviser, GoI (PSA) and hosted by Inter - University Centre for Astronomy and Astrophysics, Pune (IUCAA).

The O/o PSA aims to provide pragmatic and objective advice to the Prime Minister and cabinet on matters related to science, technology and innovation with a focus on application of Science and technology in critical infrastructure, economic and social sectors in partnership with Government departments, institutions and industry.

IUCAA is an autonomous institution set up by the University Grants Commission (UGC) of India to promote the nucleation and growth of active groups in astronomy and astrophysics at Indian universities. IUCAA aims to be a centre of excellence within the university sector for teaching, research and development in astronomy and astrophysics.

## Vision

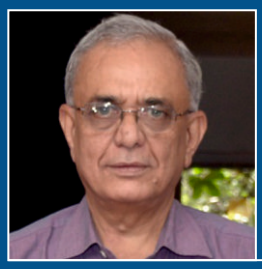
The Pune Knowledge Cluster (PKC) aims to bring together academia, R & D institutions and the Industry of Pune and its surrounding areas, to address challenging problems of the region through innovative means, using scientific knowledge and engaging highly skilled human resources.

## Mission

To act as a catalyst to bring together the large talent pool present in Industry, Academia, Government and non-Governmental organizations of Pune to brainstorm, discuss and identify projects of importance and of value to the region and to execute them through collaborative efforts.



# PUNE KNOWLEDGE CLUSTER LEADERSHIP



**Prof. Ajit Kembhavi**
Principal Investigator



**Prof. L. S. Shashidhara**
Co-Principal Investigator



**Prof. Somak Raychaudhury**
Director, IUCAA



**Dr. Priya Nagaraj**
Chief Operating Officer



**Ms. Anita Kane**
Senior Advisor



**Ms. Rashmi Urdhwareshe**
Senior Advisor



**Prof. Ninan Sajeeth Philip**
Senior Advisor

# PUNE KNOWLEDGE CLUSTER ADVISORY COMMITTEE



**Prof. R. A. Mashelkar**, FRS
Chairman, Advisory Committee
Former Director - General, CSIR



**Prof. Somak Raychaudhuri**
Director,
IUCAA



**Dr. Hemant Darbari**
Mission Director,
National Supercomputing Mission



**Dr. Pramod Chaudhuri**
Chairman,
Praj Industries



**Dr. Anand Deshpande**
Chairman,
Persistent Systems Ltd



**Mr. Arun Firodia**
Chairman,
Kinetic Group



**Dr. Naushad Forbes**
Co - Chairman,
Forbes - Marshall

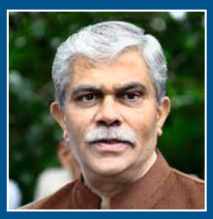


**Dr. Baba Kalyani**
Chairman,
Bharat Forge (PSA's Nominee)

# PUNE KNOWLEDGE CLUSTER ADVISORY COMMITTEE



**Lt. Gen. Dr. Madhuri Kanitkar** (Retd)
Vice Chancellor,
MUoHS



**Prof. Nitin Karmalkar**
Former - Vice Chancellor
SPPU



**Mr. Dinanath Kholkar**
Vice - President & Global Head
of Analytics and Insights, TCS



**Ms. Pratima Kirloskar**
Kirloskar Brothers



**Mr. Sudhir Mehta**
CMD, Pinnacle Industries,
President, MCCIA



**Dr. Arabinda Mitra**
Former Scientific Secretary,
Office of the PSA



**Mr. Ravi Pandit**
Chairman,
KPIT Technologies



**Ms. Lila Poonawala**
Chairperson, LPF
Former CMD Alfa Laval & Tetrapak

# PUNE KNOWLEDGE CLUSTER ADVISORY COMMITTEE



**Dr. V. Premnath**
Director,
Venture Centre



**Prof. Jayant Udgaonkar**
Director,
IISER Pune



**Prof. Ajit Kembhavi**
Principal Investigator - PKC,
Professor Emeritus, IUCAA
Ex-Director, IUCAA



**Prof. L. S. Shashidhara**
Co-Principal Investigator, PKC
Dean of Research, Prof. Biology,
Ashoka University
Prof. Biology, IISER Pune

# LEADERSHIP PERSPECTIVES

**Prof. Ajit Kembhavi**
**Principal Investigator, Pune Knowledge Cluster**

**Prof. L. S. Shashidhara**
**Co-Principal Investigator, Pune Knowledge Cluster**

**Dr. R. A. Mashelkar, FRS**
**Chairman, Advisory Committee, Pune Knowledge Cluster**

**Prof. Somak Raychaudhury**
**Director, IUCAA (Host Institution of PKC)**

**Dr. Priya Nagaraj**
**Chief Operating Officer, Pune Knowledge Cluster**



**Prof. Ajit Kembhavi**
**Principal Investigator,**
**Pune Knowledge Cluster**



**Prof. L. S. Shashidhara**
**Co-Principal Investigator,**
**Pune Knowledge Cluster**

The idea of setting up a knowledge cluster in the Pune region was conceived in late 2018; at that time the objective was simply to bring together various institutions in Pune to a common platform for inter-disciplinary projects and capacity building. But discussions with the then Principal Scientific Advisor (PSA) to the Government of India, Professor K. Vijayraghavan and his colleagues led to the idea of a knowledge cluster much broader in its scope with participation by institutions as well as other organisations. The first discussion meeting regarding the cluster was held in January 2019. That was followed by a few town hall meetings called by the PSA and the then Scientific Secretary at the PSA's Office Dr. Arabinda Mitra. From these meetings the idea emerged of a Pune Knowledge Cluster (PKC) of academic institutions, R&D organisations, industries, NGOs and civic and governmental bodies to work together to address some of the problems faced by the city and the surrounding regions, in a knowledge based and data driven manner. A proposal was made to the PSA's office for support for the PKC and approval was received in February 2020, just at the beginning of the pandemic.

The first problems to be addressed by the PKC, even before the formal beginning of the cluster in August 2020, were issues related to the pandemic, which are described in this impact report.

The verticals of interest to the PKC are health, sustainability & environment, sustainable mobility, Big data & AI, and capacity building. In these verticals our focus has always been on those projects which require multi-disciplinary and multi-institutional participation for providing long-term and sustainable solutions to the city's problems. To define projects and for their implementation, we initiate a series of brainstorming meetings with diverse sets of experts in each vertical and we seek funding for them from government agencies, foundations and CSR initiatives of the industry. Several projects have been initiated in this manner and others are in advanced stages of finalisation. We have already demonstrated our ability to manage city-wide and multi-institutional projects, as the stories in this impact report will show, thus fulfilling to some extent at least, an important mandate of our cluster. We have also contributed substantially to capacity building among the youth in city and a wider region.

In the two years of its existence the PKC has grown into a dynamic organisation with a staff of about 25 very talented, dedicated and hardworking people, who convert ideas to reality. We have received help from every organisation that we have approached, and funds from the PSA's office as well as a number of other sources. We have also been inspired and guided by a host of distinguished individuals in the city and beyond, and our Advisory Committee. Without all that support, our ideas would have still remained on paper. For the two of us this has been a wonderful journey, not easy and often out of our own comfort zones, but always immensely enriching and fulfilling.



**Dr. R. A. Mashelkar**
**FRS,**
**Chairman, Advisory Committee,**
**Pune Knowledge Cluster**

I have been the chairman of the Advisory Council of Pune Knowledge Cluster (PKC) for two years now. I would consider PKC as a highly successful S&T cluster, almost an exemplar. There are five reasons for my making this statement.

First, it has done something that was much needed, but was not achieved in the city of Pune. That is to bring together not only Academia, R & D institutions and the industry, but also all other stakeholders, like NGOs, the civic bodies and so on, and like never before. The Office of the Principal Scientific Adviser, GoI deserves a loud applause for this initiative.

Second, Knowledge Clusters can't be just clustering knowledge, they must go beyond knowledge and facilitate converting knowledge into wealth and social good. It is not the power of ideas, but the power of execution that matters. That means action that brings together both generators of knowledge but also the users. PKC has followed an end to end approach, helping move from ideas to impact, in multiple activities that it has undertaken. Their partnering with civic bodies like Pune Municipal Corporation, Pune Zilla Parishad, R&D organizations, hospitals, etc is a case in point.

Third, PKC has focussed on problems that 'need' to be solved rather than those that 'can' be solved. In other words, focusing on the 'need' of the hour. For instance, during the pandemic PKC rose magnificently with great projects that aligned itself with Integrated Disease Surveillance Project and contributed through sero-survey, genomic and environmental surveillance, long term immunogenicity studies, etc.

Fourth, PKC has done the magic of MLM, meaning More from Less for More, a term that I had coined in 2008, while proposing the concept of Gandhian Engineering. This means getting 'more' output from 'less' resources for impact on the lives of 'more' and more people. PKC has spent just Rs 3 CR in two years, but managed to forge 60 national and international partnerships and raise Rs 5 CR plus of their own funding to support their projects. This is a brilliant example of the trust and confidence that PKC has been able to win.

Fifth is the visionary leadership, which has admirably leveraged talent, technology and trust. At present, 80% of the PKC team comprises women. The CEO and two of out of three Senior Advisors are women. This is inclusion of the highest order.

These are the five reasons that have given me the confidence to say that PKC is an exemplar. Some of the lessons learnt and models developed at PKC could be followed by other Knowledge Clusters.



**Prof. Somak Raychaudhury**
**Director, IUCAA**
**(Host Institution of PKC)**

I am very happy that the Pune Knowledge Cluster, in its first two years, has achieved its current form and extent, and has already established itself as an important operation, to bring together the skills and talent available in the academic and research institutions and in industry in the greater Pune area, in order to tackle the important ongoing and emerging problems of the region. I feel privileged that my institution, the Inter-University Centre for Astronomy and Astrophysics (IUCAA) was chosen, by the office of the Principal Scientific Advisor to the Government of India, to host this cluster at its inception.

It was very exciting to see the cluster take shape in its early days, with various participants and possible stakeholders coming together in various groups to explore how this novel concept might help enhance synergies inherent in their activities. IUCAA, with its long history of local collaborations between academia and industry and inter-disciplinary and international academic research, was a natural locus for these discussions.

These two years after the cluster was formally started have been dominated by the challenges posed by the COVID-19 pandemic and its associated exigencies. However, the adversities brought together the various partners in many unprecedented ways. PKC and IUCAA members played a very important role in these activities, working with industry and local government, enhancing and facilitating the various efforts which have now led to singular achievements far beyond the initially planned public health and disease related exercises.

At the two-year mark, the Pune Knowledge Cluster has actively collaborated with research groups and industry and raised external funding from national and international sources. Substantial work has commenced in all the focus areas of public health, environment, sustainable mobility, data analytics and capacity building, and I am very happy to see that academic institutions, including IUCAA, and industry are participating in equal measure. An underlying theme in all the research areas is the application of artificial intelligence-driven data handling initiatives, which is powered by one of the strong areas of activity and expertise in the Pune region. Our dream is to reinforce the skills training programmes, and to involve academia and industry in improving the long-term living conditions of the citizens of the region, in a way that the catalysis that the cluster offers adds up to much more than the sum of its parts.



**Dr. Priya Nagaraj**
**Chief Operating Officer,**
**Pune Knowledge Cluster**

The City Knowledge and Innovation Cluster initiative by the Office of Principal Scientific Adviser, GoI is a nascent project in India. While focused ecosystems have existed for many years, the idea that organized cluster thinking can significantly influence growth strategies and enhance quality of life in a city (going forward state and nation) is being explored for the first time at the national level through Knowledge and Innovation Clusters like the Pune Knowledge Cluster.

PKC, over the past 2 years has stayed true to its mandate by enabling meaningful and fruitful partnerships between diverse stakeholders, all working towards a common goal – leveraging S&T capabilities of institutions and individuals to work for the betterment of Pune city. Most of PKC's initiatives have been initiated and implemented through a participatory and consortium approach. Organizations that are part of these consortiums have achieved much more than what they could have achieved individually, by pooling their infrastructural and intellectual resources.

PKC was incepted during the pandemic which dictated the way we worked for a good part of two years. The pandemic also proved that when organizations agree to collaborate and work together, their people find ways to reframe challenges as opportunities. PKC leveraged this to build strong knowledge and innovation networks in the city. In order for us to sustain these efforts, we require the support of various stakeholders who see value in contributing to building a robust cluster ecosystem.

I am grateful for the commitment and resilience shown by the founding team who pushed through tumultuous times to uphold PKC's mission and lay the foundation for our organization to achieve scaled outcomes. The impact and achievements highlighted in this report are a testament to their hard work. This report intends to give you a glimpse of PKC's journey so far.

# PKC AT A GLANCE



**29** National Collaborations
**3** International Collaborations



**73**
Workshops/ Webinars/ Training Programs



**5,733**
Beneficiaries



**INR 5+ Cr**
Funds Raised



**8**
Externally Funded Projects

# Executive Summary

The Office of the Principal Scientific Adviser (PSA) to the Government of India has established Science & Technology (S&T) clusters in various cities in India. Their purpose is to bring together academic institutions, research and development (R&D) laboratories, industry and local administration to address challenging problems of the city and region where the cluster is located. The clusters were set up on recommendation by the Prime Minister's Science, Technology and Innovation Advisory Council (PM-STIAC), and are guided by a Cluster Apex Committee, chaired by the Vice-Chairman, NITI Aayog. The first set of clusters has been established in six cities of India, namely Bengaluru, Bhubaneswar, Delhi, Hyderabad, Jodhpur, and Pune.

Pune Knowledge Cluster was established in August 2020. Pune was chosen for establishing a cluster because of the many academic institutions, R&D labs and knowledge-based industries present in the Pune Metropolitan Region (PMR, which is larger than the region covered by the Pune Municipal Corporation, PMC) and surrounding areas, which together constitute the Pune region.

The PKC is currently administered by the Inter-University Centre for Astronomy and Astrophysics (IUCAA) and is on its way to becoming a Section 8 Company. It has its office on the campus of S. P. Pune University. It has a small staff including a Chief Operating Officer, Senior Advisors, Program Managers, Assistant Program Managers and scientific and technical experts working on specific projects. The PKC has an Advisory Committee consisting of eminent scientists, technologists, industrialists and heads of institutions. Funds for the operation of the PKC and seed funding for projects are provided by the O/o PSA, while the main funds for projects are obtained from CSR programmes of companies, foundations and other funding agencies.

The objectives defined by O/o PSA for S&T clusters in India include the following
- Building of a shared ecosystem in the region
- Becoming a regional solution provider
- Becoming nationally and globally competitive




**Objectives of the S & T Clusters**
(Pic Credit : https://www.psa.gov.in/st-clusters)

Pune Knowledge Cluster has been systematically working towards these objectives since its inception under the following verticals:

- Health
- Sustainability and Environment
- Sustainable Mobility
- Big Data and AI
- Capacity Building

## Building of a shared ecosystem in the region

Pune city is a hub of premier national level research institutions and innovation driven industries working in frontier areas of IT, health, environment, manufacturing, automotive etc. PKC has built a conducive ecosystem for various types of organizations to engage and collaborate for projects that have and will continue to benefit the city. PKC has worked with 60 partner organizations and has MoUs/MoAs with 30 of them including research and academic institutions, industries, societies and associations, NGOs, civic bodies and incubation centers.

## Becoming a regional solution provider

PKC has remained focused on programs involving citizens and civic bodies to address problems which have local relevance. These include programs like city level surveillance of COVID-19 during the pandemic, programs for enhancing the tree cover in the city and introducing technology-based teaching and learning methods in government schools. PKC has developed and launched 2 platforms to encourage citizens to participate and contribute to scientific data collection and curation. PKC has also served as a knowledge partner for the Pune Zilla Parishad, where it has facilitated technology feasibility studies for community biogas plants, creation of water management plans for water stressed villages etc. and has conducted a large STEM program for teachers of Zilla Parishad schools.

## Becoming nationally and globally competitive

The work done by Pune Knowledge Cluster on various regional issues has been carefully mapped to the objectives of various National Missions to foster local and national capabilities. Moreover, the solutions for the local problems have been carefully designed so that they take India a few steps further towards achieving targets of the United Nations 2030 Agenda for Sustainable Development with the help of national and international collaborations. PKC's ongoing projects across verticals align with 8 UN Sustainable Development Goals and 17 National Missions.

In October 2022, PKC signed an agreement with Water Valley, Denmark, which is a water cluster to collaboratively work on enabling innovation and adoption of water technologies. PKC's COVID-19 projects are also part of a bigger national initiative implemented in three cities in India.

## Funding Partnerships

PKC is supported with funds by the Office of the PSA for operational expenses and seed grants for initiating projects. The cluster has also raised additional project funds worth INR 5CR+ from various national and international agencies through CSR programs, foundation grants etc. The PSA's office has proactively helped in such fund raising, systematically connecting the cluster to potential donors.

# PROJECTS

## I. Health

PKC's Health vertical has collaborations across academic and industry, NGOs and Govt departments in generating data critical for public health decisions such as sero-surveys, clinical, immunological, and environmental surveillance and creating an epidemiological database with comprehensive health information for Pune and access to real-time data. During the pandemic, PKC managed five COVID-19 projects in the city in collaboration with 10 partner organizations including research institutes, hospitals, pathology labs and government bodies.

Projects include

- COVID-19 Data Analysis and Forecasting for Pune City
- COVID-19 Sero-Survey
- COVID-19 Disease Surveillance (Genomic and Environmental)
- COVID-19 Long-Term Immunogenicity Study
- COVID-19 Epidemiological and Clinical Database for Pune
- Development of an Early Warning System for Infectious Diseases

## II. Sustainability and Environment

With the core emphasis on sustainability and climate action, Pune Knowledge Cluster supports India's commitment to the 2030 Agenda, by performing status quo assessments, developing monitoring systems and implementing sustainable solutions for environmental problems. PKC's Sustainability and Environment vertical currently has three priorities:

- Programs for Sustainable Increase of Vegetation Cover
- Programs Monitoring the Environmental Evaluations
- Policy Advocacy - Water Action Plan for Pune Metropolitan Region and National Biomass Policy

## III. Sustainable Mobility

PKC's Sustainable Mobility vertical aims to apply scientific and technical tools to address the rapidly growing and changing mobility requirements of the city. We wish to support the development of sustainable solutions toward carbon-neutral transportation. Working towards the Smart City Mission of GoI, the Pune city-administration is encouraging and enabling sustainable modes of mobility.

Current focus areas include:

- Vehicular E-Waste Recycling-Projects are being conceptualized with technology providers and the auto industry to pilot novel technologies for vehicle E-waste recycling at the city level through public-private partnership models
- Contributing to policy making for adoption of alternate (green) modes of transport

## IV. BIG Data & Artificial Intelligence

This vertical enables the development of various AI-driven Consortium for basic and applied research. Large-scale citizen science programs are being developed to involve citizens in analyzing BIG scientific data to foster scientific temper. One such program is called One-Million Galaxies where 1000+ citizens have analyzed over 25 GB of data (images of galaxies) on PKC's platform. PKC is also building collaborative projects between BIG Data and AI experts, chemists, and biologists to encourage inter-disciplinary skills and research through an AI consortium for Biology and Chemistry.

## V. Capacity Building

The capacity-building vertical of PKC aims to provide new opportunities to students, young researchers, and professionals to improve their knowledge base and acquire advanced skills through the following programs:

- Interdisciplinary Training Programs & Courses: Contemporary skill-building and knowledge enhancement

- Citizen centric science talks by experts
- STEM Education

PKC has conducted over 14 workshops and courses benefiting over 3000 stakeholders.

PKC's STEM education vertical focuses on promoting STEM education through technology-enabled training programs for school teachers and students, scholarship programs for women in STEM, gamification of learning, and setting up of STEM Labs.

## CONCLUDING REMARKS

**We have summarized above some key elements and projects of the PKC. Those are all described in greater detail in the following pages of the report. Most of our projects are multidimensional and interdisciplinary; they involve collaboration between a number of people and organisations and their common aim is to bring benefits to society. It is hard to convey through the written word alone the excitement that is felt in working on the projects and taking them towards completion. Hopefully the reader will get a flavour at least of PKC's journey over the past 2 years.**

# PARTNER PERSPECTIVES

**Dr. Pramod Chaudhari**
Founder - Chairman, Praj Industries Pvt Ltd

**Dr. Sanjay Juvekar**
Vadu Rural Health Program, KEM Hospital Research Centre, Pune

**Lt. Gen. Dr. Madhuri Kanitkar (Retd)**
Vice Chancellor, Maharashtra University of Health Sciences

**Mr. Dinanath Kholkar**
Senior Vice President and Global Head of Partner Ecosystems & Alliances, TCS
Chair, Industry Relations IEEE Pune Section

**Mr. Sanjay Kolte,** IAS
Chief Executive Officer, Pune Smart City Development Corporation Ltd.

**Dr. Satyajit Mayor**
Chairperson, (BLiSC), Centre Director, NCBS-TIFR

**Ms. Sanskriti Menon**
Senior Programme Director, Centre for Environment Education, Pune

**Dr. Nikhil Phadke**
Founder - Director, Chief Scientific Officer, GenePath Diagnostics

**Dr. Sapna Poti**
Director, Strategic Alliances Division, The Office of PSA, GoI

**Mr. Ayush Prasad,** IAS
CEO, Pune Zilla Parishad



**Dr. Pramod Chaudhari**
**Founder - Chairman**
**Praj Industries Pvt Ltd**

At the outset I wish to compliment office bearers and staff of Pune Knowledge Cluster (PKC) on successful completion of two years of existence. As a member of the Advisory Committee from the very inception I have been watching PKC's evolution from close quarters and I do wish to record my sincere appreciation of various initiatives and progress therein. True to its vision PKC is able to galvanise academia, R&D institutions, Industry to address important challenges using science and technology platforms.

It is heartening to note that within a two year time frame, PKC is able to build partnerships with 60 organizations in India and abroad in priority areas of health, sustainability & environment, Big Data & AI, sustainable mobility and Capability Building. I am impressed to note that PKC has also been able to mobilize funding of INR 5 Crores by way of grants and CSR funding from corporates to support various projects.

I admire PKC's contributions during COVID period in generating data critical for public health decisions and ongoing endeavours in compiling comprehensive health information for Pune and facilitating access to real-time data. We are witnessing ill-effects of climate change on humanity and I feel reassured that PKC has initiated concrete steps to establish biodiversity, taking firm steps aimed at carbon sequestration and biomass generation. Importance of water as a precious resource need not be overemphasised and I am glad that aligned with the National Water Mission, PKC is developing a sustainable water management plan for the Pune district.

I noted that to harness the true potential of big data and AI, PKC has teamed up with experts to build collaborative interdisciplinary research projects. I laud PKC's work in the area of capacity building that is aligned with Skill India Mission and National Education Policy. This will go a long way in leveraging demographic dividend – nation's competitive advantage.

Recognizing that decarbonization of the transportation sector has a big role to play in the fight against climate change, our company Praj is working closely with PKC. We are actively participating in national and international symposiums organised by PKC to create awareness about sustainable climate actions amongst stakeholders and foster partnerships.

Our Bio-Mobility platform of technologies for production of low carbon biofuels is very well received as a part of the sustainable mobility initiative of PKC. Bio-Mobility has synergies with PKC's overarching objective of sustainable development and is recognized as socio-economic-environmental growth enablers for the nation. Praj is associated with PKC on various strategic projects such as encouraging community biogas projects in Pune, biomass/energy crop cultivation on barren lands, etc. Giving complementary strength, I am certain that these initiatives will fructify in a big way.

Demographic dividend is India's cutting edge in the global economy and to leverage its full potential we need to arm our talent pool with contemporary knowledge and skills. I have a strong conviction that technology has the prowess to change the world for the better and create meaningful employment opportunities. In this regard, I endorse PKC's ambitious plan of setting up a Centre of Excellence for STEM education.

I believe PKC has an important role to play in helping realize the Hon. Prime Minister's vision of turning India into a developed nation by 2047 which is one of the "Panch Pran" mandates. I have full confidence that the partnership between Praj and PKC will help Pune endure its reputation as the innovation capital for biotechnology.



**Dr. Sanjay Juvekar**
**Vadu Rural Health Program, KEM Hospital Research Centre, Pune**

I would like to congratulate PKC on completing 2 years with some very notable achievements. In my interactions with PKC, I have been pleasantly surprised to see how a small team with leadership can generate a cluster of collaborators who are very much like-minded though with varied experience & expertise.

Incepted during the pandemic, PKC had the foresight to initiate some very important work at the city level for COVID-19. KEMHRC, Vadu was privileged to be associated with PKC for collaborative studies, including the VISION101 study which aims to understand the differences in magnitude and longevity of humoral and cellular immune responses generated following COVID-19 vaccination. Another study which we worked together on involved digitization and curation of retrospective data from confirmed hospitalized COVID-19 cases. These efforts will help in identification of correlations between virus genetics, clinical presentation, and the potential impact of interventions using machine learning and systems biology approaches. This is also an important capacity building exercise for all partner hospitals to venture into enhancing usability of hospital records which otherwise remain unutilized. Working with the PKC Team has been a pleasure because it gives a good sense of togetherness and confidence that data as well as knowledge generated will be used responsibly for the benefit of humankind.

I envision a much bigger role in strengthening the Science & Technology ecosystem of Pune, Maharashtra and going forward the nation.

PKC should act as a bridge between:

- Institutions involved in doing similar research work so that more representative evidence could be generated
- Institutions involved in different research work so that more interdisciplinary or integrative evidence could be generated
- Funding agencies and research institutions to enable forming a network of like minded people & institutions in Pune
- Evidence and practice by making available, all appropriate data or evidence to those in need especially the public systems and other policy makers
- Next generation of scientists, students and institutions doing work related to national priorities
- Science and citizens of Pune

I look forward to many more initiatives where PKC and KEMHRC,Vadu can collaborate and work together.



**Lt. Gen. Dr. Madhuri Kanitkar (Retd)**
**Vice Chancellor, Maharashtra University of Health Sciences**

In a short time span the PKC has achieved major milestones towards the goals entrusted to the City Clusters under the Office of the PSA GoI. The vision and growth along the set path is noteworthy.The aim of bringing together Academia, Research Organizations, Industry and local stakeholders including citizens to find solutions for local problems with global relevance has been amplified as noted in the report.

A special compliment to PKC for harnessing the local community for COVID related research and providing inputs to local governance. PKC enabled genomic analysis of over 15,000 COVID-19 samples, which accounts for 2% of all positive samples from Pune. This also resulted in a significant representation of Pune's cases on the national INSACOG platform (6% of data on the INSACOG platform for COVID-19 is from Pune).

The initiative to include a large number of the scientific community available in Pune has a huge potential for growth and I am sure in times to come the Cluster will support initiatives beyond the initial members and find innovative solutions in the area of Health, Environment, Big Data and AI and Mobility.

The Afforestation and Water Action Plan for Pune by PKC will be a huge project aligned to the National Action Plan on Climate Change and I am sure will make a difference to the local environment. The ideas and outcomes of these initiatives can be replicated by other cities and towns which are crumbling under urbanisation. A digital decision-making support system is planned by PKC using time-series and real-time absolute data, GIS maps, and analytics. This I am sure will harness the S&T potential of the city breaking silos.

The future looks bright with plans to build a centre for water management in collaboration with Water Valley, Denmark as well as a centre for carbon sequestration and renewable energy. The world is looking towards India and is willing to collaborate with Indian Academia to find sustainable solutions.

Capacity Building through webinars and workshops can be a huge help for skilling youth beyond the classroom and degree courses. PKC can be in a position to facilitate transdisciplinary courses as envisaged in the NEP2020 document. These courses can be tripartite between PKC and two or more universities and prepare youth for the job market. The envisaged Centre with a focus on innovation in school education, gamification in learning, STEM labs, girl education, and Math Circles is the way forward.

Using digital technologies PKC can connect people from diverse backgrounds to come together to work for common goals. I wish the PKC the very best and am sure PKC will establish itself as a leader showing the advantage of effective collaboration.



**Mr. Dinanath Kholkar**
**Senior Vice President and Global Head of Partner Ecosystems & Alliances at TCS**
**Chair, Industry Relations IEEE - Pune Section**

The Pune Knowledge Cluster (PKC) has achieved its objective of being a catalyst in bringing together industry, academia, researchers, social organizations, and governmental bodies to address challenges faced by the Pune region. As an advisory member to PKC, Chair of Industry Relations at IEEE and in my leadership role at TCS, I feel proud to have witnessed and contributed to this collaboration between these august organizations. Dr Kembhavi's participation in the IEEE 2021 workshop on "Next Practices in Industry-Academia Collaboration" set the tone for our engagement. Despite the challenges posed by the pandemic post its inception, PKC has come a long way in establishing itself as a well known and respected brand in Pune. It has taken up projects of strategic importance in the areas of environment, climate change, renewable energy, and others. A striking example of the value added by PKC was their valuable contribution to Pune cities efforts towards COVID-19 response. PKC was able to leverage TCS' Digital Twin solution created by Dr. Vinay Kulkarni of TCS to model the complex structure of the region and to enable an appropriate response. This is just one example of areas which typically need lot of collaboration across different sectors. Such collaboration can effectively be enabled by a credible entity like PKC.

TCS CTO has offered wholehearted support and enabled participation of TCS research teams in PKC initiatives. TCS has been focusing on shaping up as a partner for PKC which can significantly enhance the impact of PKC programs.
Sustainability & environment are close to our hearts today. PKC was a strategic partner for TCS Sustainathon Pune, a major event organized by TCS in the year 2021 on the theme of waste management. Me and couple of my colleagues at TCS were privileged to be part of the Round Table on Waste Management organized by the Norwegian Consulate and PKC.

The other areas PKC is contributing to and can contribute even more are the ones which are of crucial importance to the community but are financially not viable or attractive for the private and corporate sector. Areas like sustainability, open data, climate change, circular economy, renewable energy, public transport, health, and agriculture could typically fall under this category. PKC can provide thought leadership and contribute to policy making by making long term investments in such areas. Data is pervasive and is increasingly enabling AI to tackle challenges previously found un-addressable. I believe that there is significant opportunity to leverage the capabilities of emerging digital technologies to address real world challenges. TCS' Digital Empowers platform can enable bringing together the innovative capacity of entrepreneurs, and supplement it with the resources of the group, to alleviate the most pressing societal and sustainability challenges that PKC is tackling. Specifically, Digital Empowers has been bringing together partners that can expedite transition to circular economy, transform product lifecycles, and prolong product life. I look forward to leveraging these tracks to further PKC's mission.

Going forward PKC should take up strategic projects with a view to enable creation of a community capable of solving complex problems that are characterised by a system of systems nature and high degree of uncertainty. It needs to nurture an ecosystem that can support such a community by directing its efforts towards capacity building, entrepreneurship development and empowering NGOs. I believe that there is an opportunity and look forward to scale the collaboration between PKC and the various Tata group companies in the region. TCS and Tata Digital could contribute to capacity building, Big Data and AI, Tata Motors as India's largest EV seller could perhaps share its views on sustainable mobility, and Tata Trusts could lead with its views on health and sustainability. I look forward to enabling this knowledge contribution from the Tata group to PKC. The energy and drive of the youth could be tapped effectively for the community by leveraging the internship space opened by the new education policy. Through such internship projects, PKC can play a significant role in leveraging innovative practices for evolving impactful solutions to address challenges faced by the Pune region.

Another possible space for PKC to contribute is through various networks nurtured by different professional bodies. For example, MCCIA has a strong network of MSMEs, PIC is well connected with eminent personalities and thought leaders. IEEE has vast network of students and professionals and drives interesting programs like Eureka & "STEM to STEAM". TCS has more than 50,000 employees in Pune and has implemented some impactful programs like GoIT to educate school students on IT.

To sum it up, we have had a synergic partnership and have an even greater opportunity to scale it to make a significant impact and help set up a high benchmark for other metros.



**Mr. Sanjay Kolte, IAS**
**Chief Executive Officer,**
**Pune Smart City Development Corporation Ltd.**

पुणे स्मार्ट सिटी डेव्हलपमेंट कॉर्पोरेशन लिमिटेड
PUNE SMART CITY DEVELOPMENT CORPORATION LTD.

Outward no. PSCDCL/PKC/424/2022
Date: 15.09.22

**TO WHOMSOEVER IT MAY CONCERN**

The Pune Smart City Development Corporation Limited (PSCDCL) and the Pune Knowledge Cluster have had a successful collaboration since May 2021. The Pune Knowledge Cluster (PKC) approached PSCDCL last year, for a partnership on the PKC's program on Urban Forestry.

Improving climate resilience of the city is an important by-product of the Pune Smart City initiatives. The community engagement which is also a part of this program provides volunteering opportunities in the local communities for nurturing saplings planted by PSCDCL. This is an important step in stimulating citizen engagement and deepening the connection between the civic authorities and the citizens; as well as between the environment and the citizens.

A volunteering program requires significant work which was put up by the PKC with support from Centre for Environment Education (CEE, India). Nature Walks were conducted (26th February 22 at Oakwood Hills, Baner and 6th March 22 at Madhuban Society, Balewadi) and bamboo tree guards were installed to protect the saplings. The PSCDCL team, provided active support for these events. As a result of this effort, two citizen groups have come forward to "adopt" saplings in their neighbourhood. Paryavaran Sanrakshan Gatividhi is one of the groups that has committed their support towards nurturing saplings at Balewadi and establishing a model for government and citizen partnership.

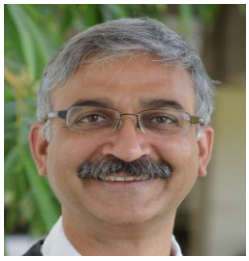
PSCDCL has planted 20 thousand saplings in the smart city area. These have been planted along the roadsides, place-making areas, in school / college / hospital premises in PMC gardens and so on. The PKC's "Plant and Adopt a Sapling" program has tremendous synergy with the plantation initiative of PSCDCL. The Plant and Adopt a Sapling program is backed by a technology platform – ConnecTree – developed by the PKC. With ConnecTree, it is possible to demonstrate and monitor the planted saplings. As a pilot demonstration, ~300 saplings planted by the smart city have been successfully mapped onto this GIS enabled platform - ConnecTree. PKC consulted the PSCDCL team during the design of this platform to ensure that it could be integrated with the smart city infrastructure in the future.

Pune Knowledge Cluster have collaborated effectively to pilot this concept successfully during the past year. This would encourage improved survival rates for roadside plantations and the creation of additional carbon sinks where carbon is stocked within through these plantations as a way to offset residual emissions and counter existing and future trends of increasing carbon emissions. I hereby strongly recommend PKC for extending the program to other cities.

PUNE SMART CITY Development Corporation Ltd.

**(Dr. Sanjay Kolte, IAS)**
**Chief Executive Officer**
**Pune Smart City Development Corporation Ltd.**

**PUNE SMART CITY DEVELOPMENT CORPORATION LTD.**
Reg. Office : "Manthan", A-3, Pashan Road (Near B.U. Bhandari Volkswagen Showroom), Abhimanshree Society, Pashan, Pune - 411008. Maharashtra.
T : 020 - 25252525 | Website: www.punesmartcity.in
**पुणे स्मार्ट सिटी डेव्हलोपमेंट कॉर्पोरेशन लि.**
नोंदणीकृत कार्यालय : ''मंथन'', ए३, पाषाण रोड (बी यु भंडारी शोरुम जवळ), अभिमानश्री सोसायटी, पाषाण, पुणे – ४११ ००८. महाराष्ट्र



**Dr. Satyajit Mayor**
**Chairperson, (BLiSC),**
**Centre Director, NCBS-TIFR**

I have been associated with PKC on multiple COVID-19-related projects since its inception. Environmental and clinical surveillance to identify genome variants of SARS Cov-2 and longitudinal study on immunological response to vaccination among diverse groups in Pune, Bangalore and Vellore, are some of the examples. PKC has been an active partner in all these efforts and its program management skills have been a key to the success of all our projects.

As a city cluster, I anticipate PKC playing a major role in putting together and managing large multi-faceted multi-organizational projects that facilitate public health research, policy and forecasting strategies. I strongly believe that given the multi-institutional nature of PKC, it can take a unique and proactive role in creating an effective pandemic or epidemic preparedness strategy for the Pune region, and this will undoubtedly serve as a template for many other regions, including ours in Bangalore.



**Ms. Sanskriti Menon**
**Senior Programme Director, CEE**

The Pune Knowledge Cluster is bringing science and technology applications to a range of issues for sustainable development in the Pune region. PKC is also fostering partnerships, thereby building on existing strengths and knowledge resources of civil society groups, industry, academia, and government entities. The backing and endorsement of the top scientific institution in the country helps to open doors and forge synergies among diverse actors.

For example, the ConnecTree initiative with CEE as a partner, is helping to prepare a database of tree plantations linked with individuals and groups who care for the saplings. The use of the ConnecTree app in a community engagement process that goes along with the plantation helps build interest, awareness, and a 'connection' to trees. In another initiative, PKC and its partners SPTM and CEE are conceptualizing the use of behavioural nudges to address mobility issues. Such application of scientific approaches and digital technology tools to address wicked issues along with locally embedded actors is expected to generate new knowledge, approaches, and on-ground initiatives.

We hope to see further development of systems understanding of critical issues in the Pune region, related databases and data collection processes. We also look forward to PKC creating inclusive platforms and processes for ideation and informed deliberation on critical sustainability issues: supporting green skilling and livelihoods in the Pune region, addressing air quality, water and waste water management, recycling and circular economy, mobility, biodiversity and nature-based solutions, heat stress, urban flooding and others that would enhance climate resilience.



**Dr. Nikhil Phadke**
**Founder - Director,**
**Chief Scientific Officer,**
**GenePath Diagnostics**

GenePath Diagnostics would like to congratulate Pune Knowledge Cluster on completing two years of operations. PKC has been a key partner of GenePath - a clinical molecular diagnostics and genomic testing and kit manufacturing company based in Pune, India and Ann Arbor, Michigan, USA - through the COVID-19 pandemic.

We would like to thank PKC, particularly Dr. LS Shashidhara, for all the suggestions, connections and assistance provided during the early part of the pandemic and helping with transport of critical raw materials for our COVID-19 kits and enabling evaluations of our kits at CSIR-CCMB for subsequent ICMR + CDSCO approval. At later points in the pandemic, GenePath and PKC had a highly successful partnership where PKC coordinated whole genome sequencing of SARS-CoV-2 clinical samples tested at GenePath at INSACOG partner labs like NCL and IISER, and many samples sequenced across country during the middle to late stages of the pandemic came from this partnership. In fact, this was the very study during which the first patient infected with the Omicron variant of concern in Pune city was identified and sequenced within three days of initial testing at GenePath.

In parallel, PKC has also been a key partner with organizations across the country that have been using GenePath quantitative SARS-CoV-2 RT-PCR kits to monitor viral abundance in waste-water samples. This work has allowed advance prediction of localized spikes through the multiple waves seen in the country without the need to test individuals. In addition to all the practical benefits of the work carried out by the PKC-led coalition during the pandemic, there has also been a tremendous building of community, pan-organizational collaboration, and academic progress.

We look forward to a continued long-term mutually beneficial association between all the partners under the PKC umbrella.



**Dr. Sapna Poti**
**Director,**
**Strategic Alliances Division,**
**The Office of PSA, GoI**

The Pune Knowledge Cluster (PKC) has been one of the pioneers in leading the way for Indian Science, Technology and Innovations clusters. The cluster has redefined India's growth story in various areas of science and technology. Their leadership i.e. Dr. Mashelkar, Prof. L.S.Shashidhara, Prof. Ajit Khembavi and Prof. Somak Raychaudhury have been inspirational to the cluster institutions. The COO, Dr. Priya Nagaraj has been dynamic in leading various initiatives in Health, Capacity Building, Sustainability & Environment and Mobility.

The cluster has worked closely with the State Government and made an impact during the pandemic within the State and the Nation at large, especially in surveillance and genome sequencing. The working model that the cluster architected and leveraged during the pandemic has also formed the core of high impact success that the cluster is experiencing consistently post pandemic in all their Science and Technology projects as well. Focus has been on sustainability and scalability.

Since its formation the cluster has focused on both fundamental and applied R&D Projects balancing it appropriately. They have forged effective partnerships with Industries and harnessed all collaborations that were shared by the office of the PSA, GoI seamlessly along with their own efforts of Industry engagements. The cluster has focused in areas that are of National importance and has gone beyond its mandate of focusing on the State. Several National programs have been designed in areas of Genome Sequencing, Environment, Health, Big data and AI, STEM education and implemented throughout the Nation. PKC has managed various partners of eminence such as BASF Chemicals India Pvt Ltd, Hindustan Unilever, Rockefeller Foundation, Persistent Systems, Lenovo India Foundation.

Further, the cluster has excellent inter-cluster relationships and has collaborated as well as worked extensively towards capacity building of other clusters and institutions across the Nation. Currently several newer organizations are looking to engage with PKC in various capacities including setting up of relevant Centers of Excellence, National Gamification Repositories, Mobility initiatives and more.

Though the Cluster is fairly young the results have already been demonstrated by the team and is a testament to the impact the cluster has made to the current Science and Technology ecosystem in the Nation. Wishing the leadership of the cluster and all its institutes, startups, industry partners and state Government good luck for its future endeavours.



**Mr. Ayush Prasad, IAS**
**CEO,**
**Pune Zilla Parishad**

We started interactions with the Pune Knowledge cluster about a year ago on a few focus areas of interest to the Pune Zilla Parishad. We had several meetings over many months discussing projects for school improvement, STEM education, community biogas and water conservation initiatives.

PKC in collaboration with the District Institute of Education and Training (DIET) conducted a survey with 1500 + Zilla Parishad school teachers to understand learning gaps as a result of the pandemic. On the basis of the survey, PKC designed and conducted an online workshop for school teachers called "Concepts in Science and Skill Development" in association with the Pune Zilla Parishad and DIET. The workshop focused on training teachers from Zilla Parishad schools to use digital technologies and methods for teaching. 450 teachers participated in the workshop and it was well received.

We also had several detailed meetings with PKC about a community biogas project which ZP aims to mobilise in villages strengthening the existing 400 Biogas plants. PKC contributed by providing economic and technology feasibility analysis for the project and also advised on how solid waste and agricultural waste from villages can be used to make CBG leading to overall socio-economic development of villages.

The Pune Zilla Parishad has identified 108 water stressed villages in Pune district which are in need of interventions for water conservation. PKC undertook a study for one such village, Washere in Khed Taluka to holistically understand water issues in the village. They interacted with the local community, used experts from the Cluster to do GIS based mapping of the region and plan where water bodies could be constructed. PKC mapped 12 locations for creating water storage systems and submitted the map to Zilla Parishad.

A science and technology driven Cluster that facilitates bringing together various stakeholders to work for the betterment of the city is essential for the growth and development of a city like Pune. I see immense value in supporting an initiative like this and look forward to working with PKC on many more initiatives going forward.

IMPACT REPORT | 2020-22

# HEALTH



> “Vaccination, testing and surveillance were vital to check the Covid spread and emergence of new variants in India. It is crucial to strengthen surveillance (SARI, ILI and wastewater monitoring) to understand how the virus is circulating in the community. We should also sequence a small percentage of the circulating viruses to know if there are new emerging variants. The data should be shared globally. If every country does this, we can stay ahead of the virus”
>
> **Dr. Soumya Swaminathan,**
> Chief scientist, World Health Organisation (WHO)

Pune was one of the worst hit cities in India during the COVID-19 pandemic. Being need of the hour, the Pune Knowledge Cluster played an integral role in supporting the public health system and government strategies aimed at disease containment and management.

PKC's COVID-19 efforts focused on comprehensively understanding the epidemiology of the SARs-CoV-2 virus and work toward strategies to mitigate and reduce the disease burden in the Pune region (Fig. 1).

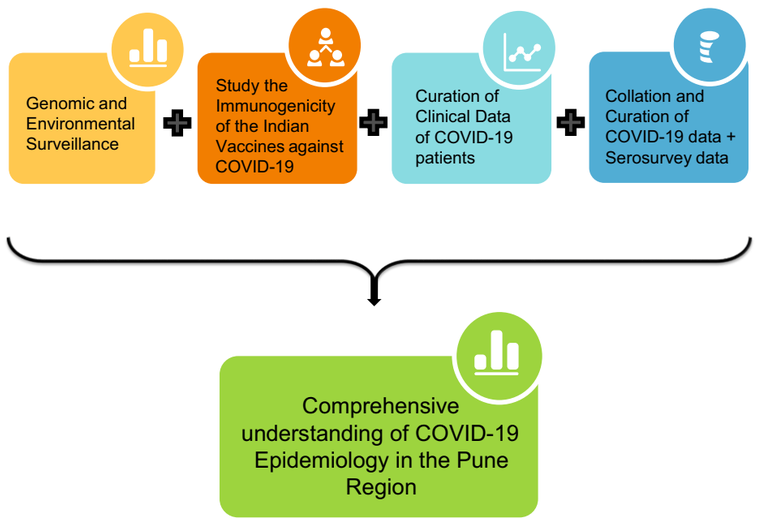



Fig. 1: PKC’s strategy for understanding COVID - 19 comprehensively at the city level

Projects of this vertical align with:

**NATIONAL MISSIONS**

- National Health Mission
- Integrated Disease Surveillance Project (IDSP)

**SUSTAINABLE DEVELOPMENT GOALS**

03 GOOD HEALTH & WELL-BEING

09 INDUSTRY, INNOVATION AND INFRASTRUCTURE

17 PARTNERSHIPS FORTHE GOALS

## Objectives

- Build synergistic collaborations to aid systematic collection, analysis, and interpretation of public health data, and policy making
- Work with the local government to understand their health and disease priorities and build prevention and mitigation strategies
- Creating awareness on public health management and innovation amongst citizens via talks by experts

## Highlights

- **Funds raised for COVID-19 projects**
  - INR 5.25 CR
  - Facilitated raising of INR 3.68 CR for partner institutions

- **Strong scientific support created for the local government during the pandemic**
  - Creation of a COVID-19 dashboard for Pune city
  - Sero-surveys in high disease-incidence wards

- **Significant contribution to COVID-19 testing in the country; facilitated the sequencing of**
  - 2% of all positive samples from Pune sequenced
  - 6% of all data submitted to INSACOG was facilitated by PKC

- **Enabled scientific research in COVID-19**
  - Scientific Publications : 6

## Activities

- COVID-19 Data Analysis and Forecasting for Pune City
- COVID-19 Sero-Survey
- COVID-19 Disease Surveillance (Genomic and Environmental)
- COVID-19 Long-Term Immunogenicity Study
- COVID-19 Epidemiological and Clinical Database for Pune
- Development of an Early Warning System for Infectious Diseases

# COVID-19 Data Analysis and Forecasting - Pune City

During early stages of the pandemic, the Indian Government and the Indian Council of Medical Research (ICMR) constituted guidelines for centralized collection of demographic and clinical data such as total case count, mortality, hospital occupancy as well as guidelines for clinical management. Pune city managed by Pune Municipal Corporation (PMC), successfully initiated and maintained the Government mandated norms for data compilation from clinics and hospitals.

PMC and PKC entered into a collaborative agreement in April 2020 to develop and implement local policies based on the analysis of COVID-19 patient data.

**PKC's role in the collaboration** (Fig. 2):

- Curation of data
- Analysis of data at the sub-region level (Prabhags)
- Modelling of the data to project the pandemic curve
- Constitution of a project to assess the prevalence of positive serology among the population and coordination for resource procurements and allocation

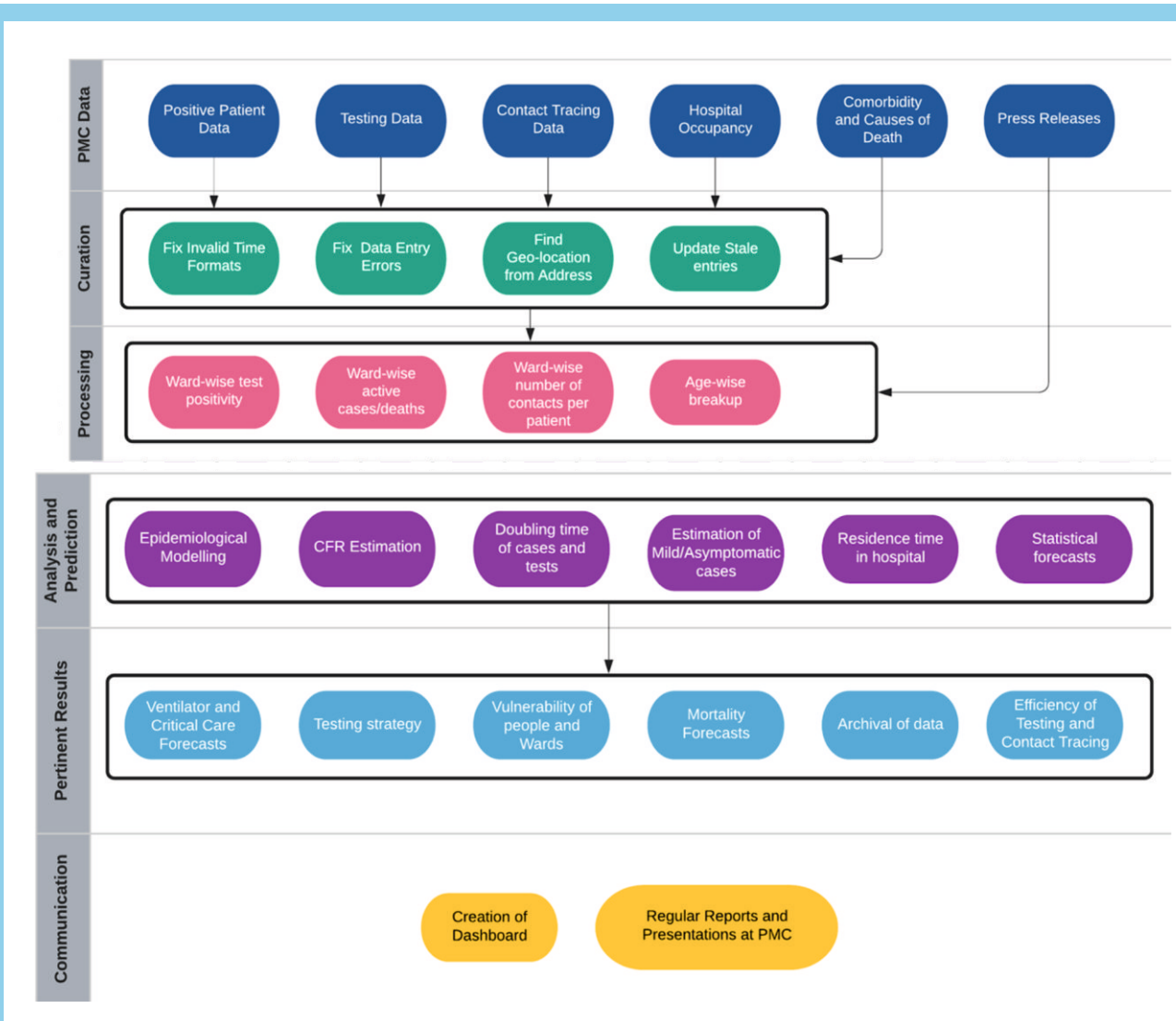



Fig. 2: COVID-19 activities undertaken by PKC in collaboration with Pune Municipal Corporation

**Impact**

- A publicly available dashboard was developed to forecast the incidence of COVID-19 in Pune. This was developed on the incidence of COVID-19 cases over time, case doubling time and trajectory at the city levels and sub-region levels
- The epidemiology and impact of lockdowns on the incidence of COVID-19 cases was assessed
- Accurate forecasting of the incidence of COVID-19 was done by experts associated with PKC. This enabled timely procurement of SARS-CoV-2 test kits, ventilators, and the establishment of additional test facilities,flu clinics and COVID-19 care centers
- COVID-19 hotspot pockets with high population density were identified. These areas were contained to limit transmission

# COVID-19: Sero - Survey

A large proportion of SARS-CoV-2 infections remain asymptomatic and undetected unless screened for antibodies against the virus. Serological testing of a representative sample population is essential to estimate cumulative incidence of disease in the community. Sero-prevalence of antibodies against SARS-CoV-2 in five high-incidence Prabhags (subwards) of Pune was assessed to gain insights into the spread of the pandemic in the city. The study recruited 1664 individuals in 5 selected Prabhags (20th July - 5th August 2020).

**Sponsor:**
Persistent Foundation, Pune

**PKC's role in the project:**
- Putting together a consortium to implement the project
- Enabling fundraising, obtaining permissions from PMC and dissemination of data

**Partners:**
- Indian Institutes of Science Education and Research (IISER), Pune
- Savitribai Phule Pune University
- Pune Municipal Corporation (A key partner and stakeholder for this study. Data generated from the study has been submitted to PMC)
- Christian Medical College, Vellore
- Translational Health Science and Technology Institute (THSTI), Faridabad

**Impact:**
- The sero-surveillance dissected statistical profiling of Pune prabhags and indicated that there has been an extensive spread of infection in these Prabhags. 51.5% (CI: 49.1-53.9%) seroprevalence was reported in the five high-incidence Pune city Prabhags sampled.

- Based on the sero-survey, local officials were alerted about the imminent heavy load on the public health care system of the concerned Prabhags. Consequently, the city administration proactively increased testing and surveillance in these Prabhags.

**Publications:**
- Community prevalence of antibodies to SARS - CoV-2 and correlates of protective immunity in an Indian metropolitan city. *Aurnab Ghose, Sankar Bhattacharya, Arun S. Karthikeyan, Abhay Kudale, Joy M. Monteiro, Aparna Joshi, Guruprasad Medigeshi, Gagandeep Kang, Vineeta Bal, Satyajit Rath, L. S. Shashidhara, Jacob John, Susmita Chaudhuri, Aarti Nagarkar*; medRxiv 2020.11.17.20228155; doi: https://doi.org/10.1101/2020.11.17.20228155

- Into the thirteenth Month: A Case Study on the Outbreak Analytics and Modeling the spread of SARS-CoV-2 Infection in Pune City, India. *Joy Monteiro, Bhalchandra Pujari, Sarika Maitra Bhattacharrya, Anu Raghunathan, Ashwini Keskar, Arsh Shaikh, Prasad Bogam, Shweta Kadu, Nikita Raut, Devendra Vavale, Rupa Mishra, Ajit Kembhavi, L. S. Shashidhara, Vidya Mave;* medRxiv 2021.06.22.21259295; doi: https://doi.org/10.1101/2021.06.22.21259295

# COVID-19: Disease Surveillance & Genomic Sequencing

During the pandemic, a national-level consortium called The Indian SARS-CoV-2 Genomics Consortium (INSACOG) was created jointly by The Union Health Ministry, The Department of Biotechnology (DBT), The Council for Scientific & Industrial Research (CSIR) and The Indian Council of Medical Research (ICMR). The consortium consists of premier academic institutes, research institutes, philanthropic groups and industry organizations came together to conduct nationwide genomic sequencing and bioinformatics - based research.

PKC is a part of this consortium and has helped synergize a multi-stakeholder collaboration in Pune (Fig 3) to upscale genomic surveillance by ramping up sequencing efforts and bio-informatics. Genomic sampling strategy was based on epidemiological data and clinical meta-data. PKC facilitated prospective, clinical, and retrospective sequencing of samples with a focus on vaccine breakthroughs and reinfection cases. Experts correlated the epidemiological dynamics and clinical outcomes of patients and aided in the implementation of appropriate public health and medical counter measures. Environmental Surveillance focused on the collection and analysis of sewage and wastewater samples from various parts of the city to complement human surveillance and enable early detection of disease, considering that a large proportion of infected people are asymptomatic.

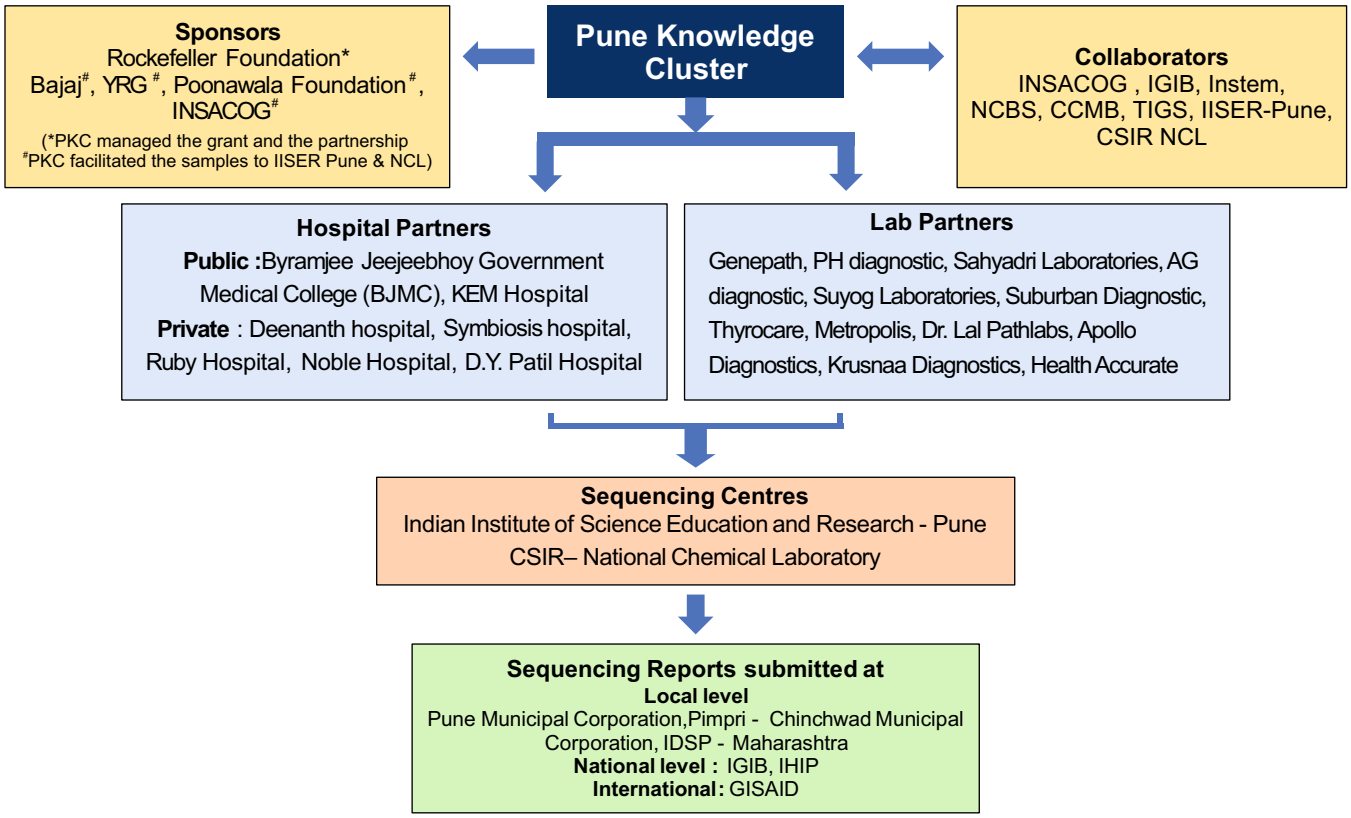



Fig. 3: Information and sample flow (Environmental surveillance & Clinical Sample Variant surveillance)

**Sponsor:**

- Rockefeller Foundation

**Impact:**

The project contributed significantly to COVID-19 sequencing efforts in India (Fig. 4). Through the project, 2% of all positive samples from Pune have been sequenced and 6% of all data submitted to INSACOG was facilitated by PKC.

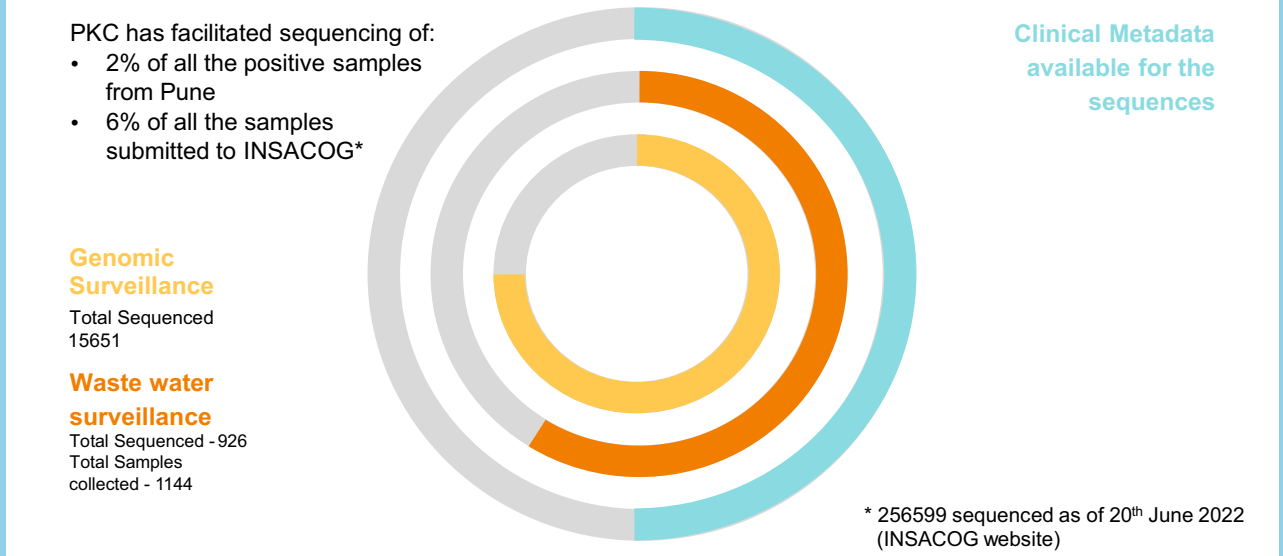



Fig. 4 : COVID-19 Surveillance (Genomic & Environmental) facilitated by PKC

**PKC's role in the Project:**
- Identification and selection of stakeholders
- Sample acquisition and sampling strategy
- Standardization of sample collection procedures
- Building and maintenance of data depository
- Dissemination of results to relevant stake-holders
- Fund Management and People Management

**Project Status :** Ongoing

**Reporting of data:**
- Weekly reports submitted to PMC
- Data was also shared with Pune Platform for COVID-19 Response (PPCR) and other key stakeholders to enable city level decisions
- Sequences shared on International and National databases for analysis

**Publications:**

- Mave, V., Shaikh, A., Monteiro, J. M. et al. Association of national and regional lockdowns with COVID-19 infection rates in Pune, India. Sci Rep 12, 10446 (2022). https://doi.org/10.1038/s41598-022-14674-0
- Bogam P, Joshi A, Nagarkar S, Jain D, Gupte N, Shashidhara L. S., Monteiro JM, Mave. VBurden of COVID-19 and case fatality rate in Pune, India: an analysis of the first and second wave of the pandemic. IJID Reg. 2022 Mar;2:74-81, Epub 2021 PMID: 35721428; PMCID: PMC8690685 https://doi.org/10.1016/j.ijregi.2021.12.006
- Dharmadhikari, T., Yadav, R., Dastager, S. et al. Translating SARS-CoV-2 wastewater-based epidemiology for prioritizing mass vaccination: A Strategic Overview. Environ. Sci. Pollut. Res. 28, 42975–42980 (2021). https://doi.org/10.1007/s11356-021-15169-7
- Dharmadhikari, Tanmay, et al. High throughput sequencing based direct detection of SARS-CoV-2 fragments in wastewater of Pune, West India. Science of The Total Environment 807 (2022): 151038. https://doi.org/10.1016/j.scitotenv.2021.151038

# COVID-19: Long-Term Immunogenicity Study

The kinetics and longevity of immune responses generated by COVID-19 vaccines in the Indian population are not completely understood. To bridge this knowledge gap, a research study for multi-dimensional understanding of immune responses to SARS-CoV-2 was conducted in two cities including Pune (Fig. 5). The primary objective of the study was to understand differences in magnitude and longevity of humoral and cellular immune responses generated after vaccination with Indian vaccines for COVID-19 in individuals with or without evidence of prior SARS-CoV-2 infection based on sero-positivity.

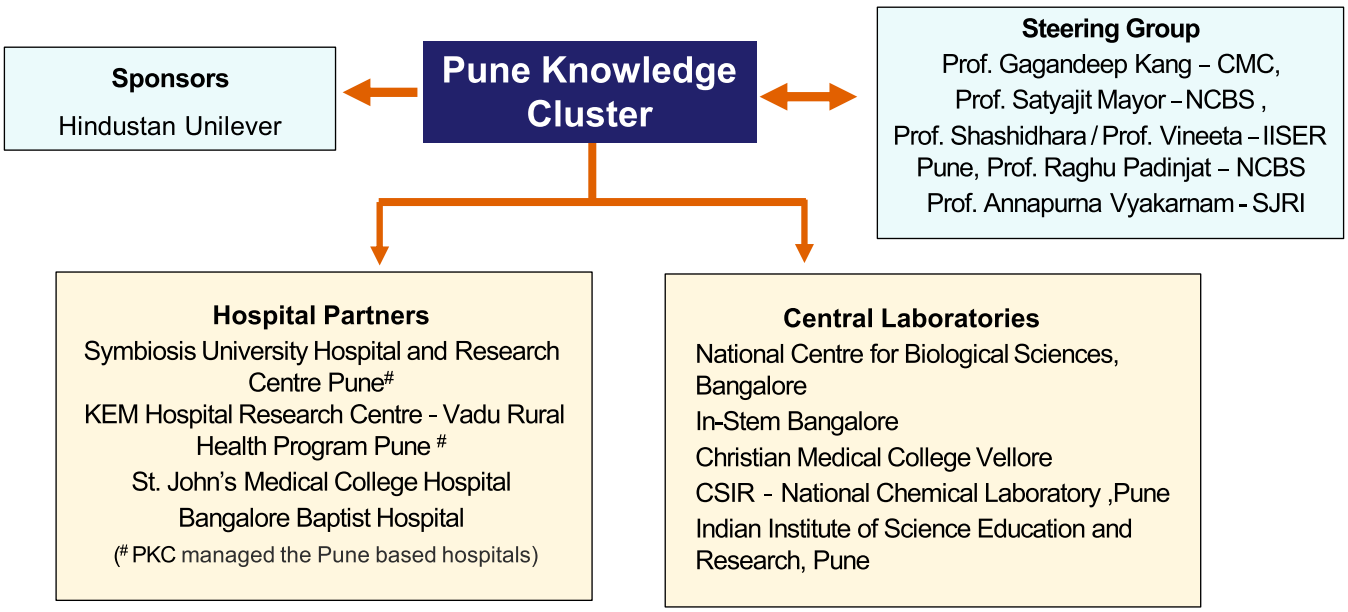



Fig. 5: Organizations Involved in the COVID-19 Long-Term Immunogenicity Study

**Sponsor:**
- Hindustan Unilever Ltd.

**PKC's role in the Project:**
- Identification and selection of stakeholders
- Development of Electronic Case Report Forms (eCRFs), and Standard Operating Procedures (SOPs) for sample collection and clinical investigations
- Fund Management and People Management
- Working and liaising with trial sites and laboratories

**Impact:**
- More than 300 individuals from Pune city participated in the COVID-19 Long Term Immunogenicity Study over a 9-month period
- Insights were generated for the role of innate immunity, microbiome, and micronutrient biomarkers on the immune response to the COVID -19 vaccine in the Indian subpopulation (Manuscripts under preparation)

**Project Status:** Phase 1 Completed; Study has been extended

# COVID-19 Epidemiological And Clinical Database

PKC has used a data driven approach to understanding and implementing measures for COVID-19. Over the past 2 years, PKC in collaboration with hospitals, research organizations and civic bodies in Pune has collected and curated data for COVID-19 at various levels (Fig. 6). This includes data for disease prevalence, hospitalized patients, testing and mortality (Fig. 7). PKC is working to build comprehensive open source databases consisting of epidemiological, clinical and genomic data for COVID-19 which can be used by researchers and civic authorities to build city level models for understanding disease impact and progression (Fig. 8).

**Project Status :** Planning phase

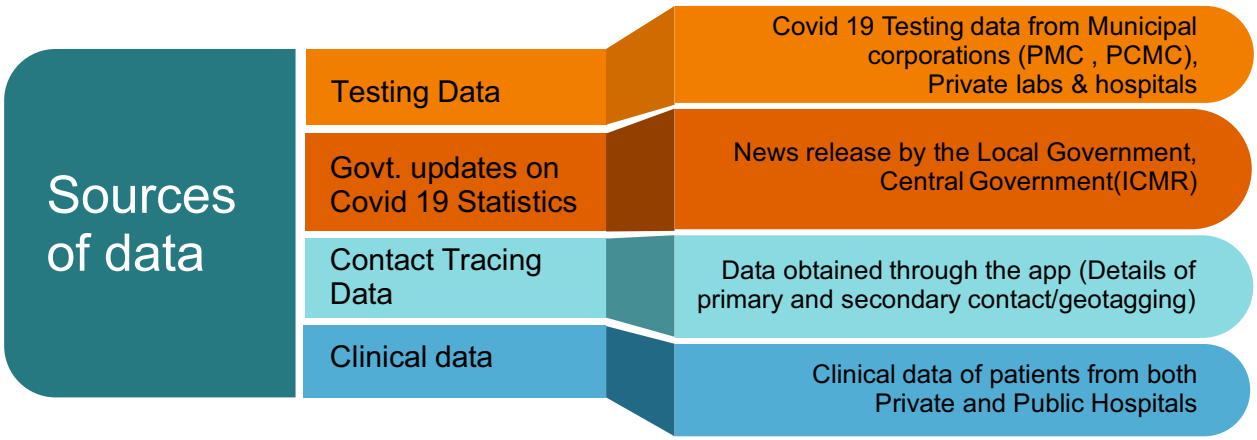



Fig. 6: Sources of COVID-19 Data Collected by PKC

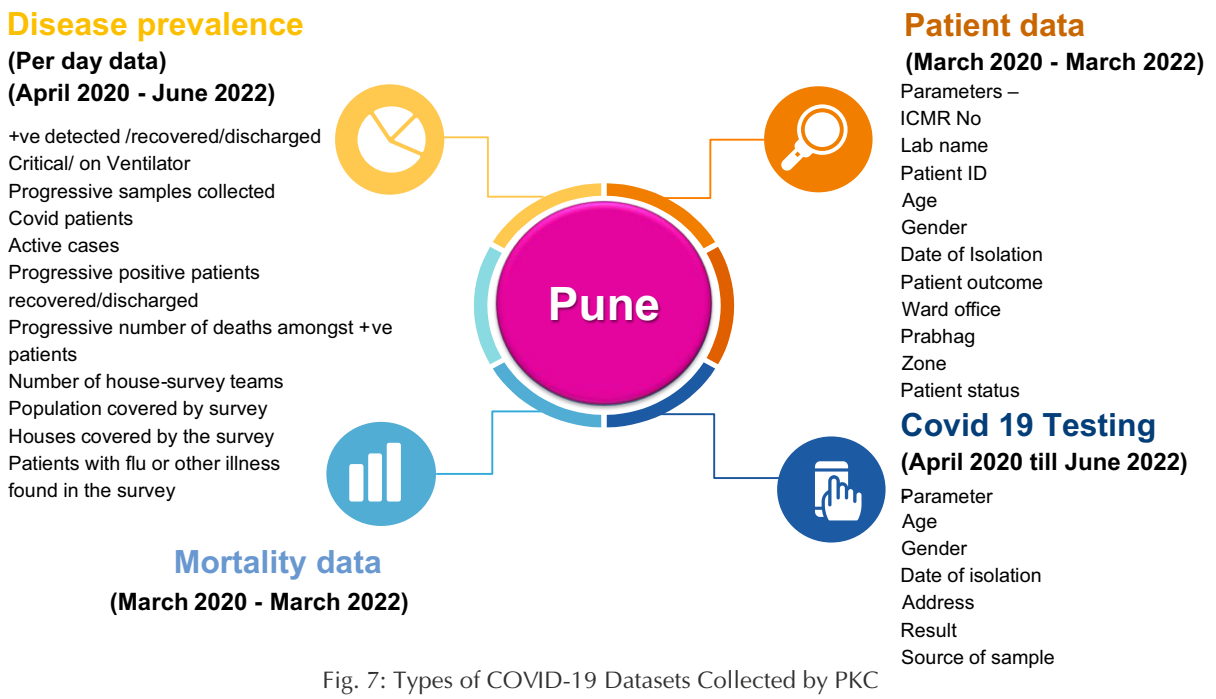



Fig. 7: Types of COVID-19 Datasets Collected by PKC

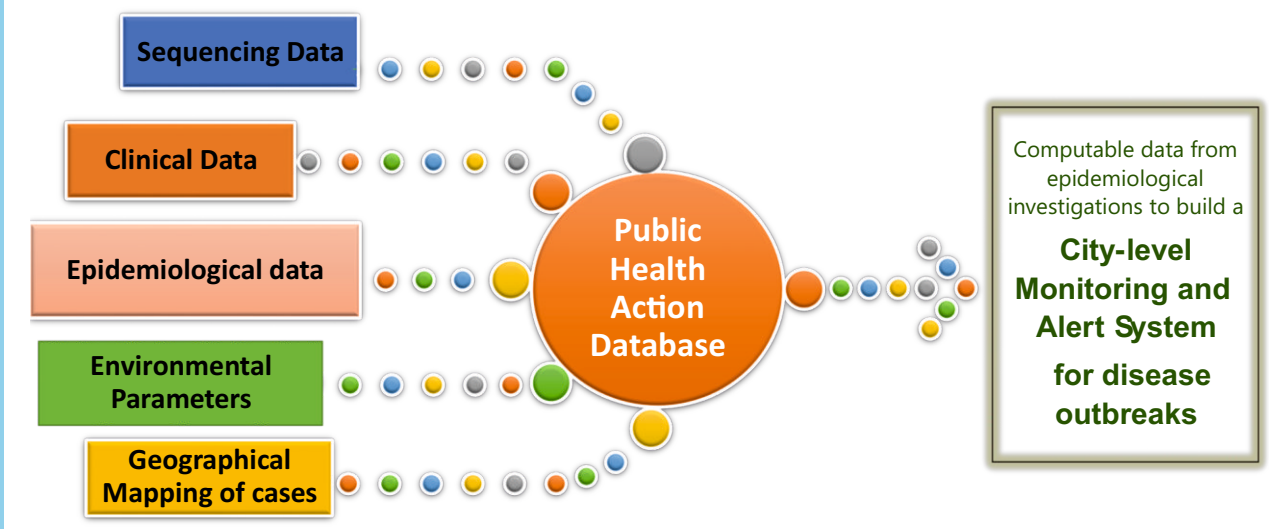



Fig. 8: COVID-19 Public Health Action Database for Pune Envisioned by PKC

## Projects in pipeline

Development of an early warning system for infectious diseases: PKC plans to build an integrated surveillance system for Dengue and Anti-Microbial Resistance (AMR). The system will include channels for information flow between clinical and administrative partners to allow for timely prediction of disease risk and spread in communities.

# Partners

## Funding Partners

PERSISTENT FOUNDATION

Hindustan Unilever Limited

The ROCKEFELLER FOUNDATION

## Program Partners

पुणे महानगरपालिका

कटिबध्दा जनहिताय

IISER PUNE

CCMB

NOBLE HOSPITALS

PUNE

MUHS

FLAME UNIVERSITY

bots

inStem

SUYOG LIFE CARE
REDEFINING DIAGNOSTICS

Genepath LABORATORIES

thsti
ट्रांसलेशनल स्वास्थ्य विज्ञान एवं प्रौद्योगिकी संस्थान
TRANSLATIONAL HEALTH SCIENCE AND TECHNOLOGY INSTITUTE

illumina

NCCS

ncl

TIGS
Tata Institute for Genetics and Society

ncbs
National Centre for Biological Sciences
Tata Institute of Fundamental Research

Premas Biotech

PERSISTENT FOUNDATION

ASHOKA UNIVERSITY

SUBURBAN DIAGNOSTICS
PRECISE TESTING · HEALTHIER LIVING

Sahyadri Hospitals

P.H. DIAGNOSTIC CENTRE
Healthcare that cares

SYMBIOSIS UNIVERSITY HOSPITAL AND RESEARCH CENTRE

Oxford NANOPORE Technologies

Apollo DIAGNOSTICS
Expertise. Empowering you.

अविद्यया मृत्युं तीर्त्वा विद्यया अमृतम् अश्नुते ।
ज्ञान प्रबोधिनी
JÑĀNA PRABODHINĪ

IGIB
INSTITUTE OF GENOMICS & INTEGRATIVE BIOLOGY
Genomics Knowledge Partner

INSACOG
INDIAN SARS-COV-2 GENOMICS CONSORTIUM

IMPACT REPORT | 2020-22

# Sustainability and Environment



Projects of this vertical align with:

## NATIONAL MISSIONS

- National Mission on Strategic Knowledge for Climate Change
- National Mission for a Green India
- National Biodiversity Mission
- National Mission on Sustainable Habitat
- National Water Mission
- National Jal Jeevan Mission

## SUSTAINABLE DEVELOPMENT GOALS




> "Just as our vision behind Agenda 2030 is lofty, our goals are comprehensive. It gives priority to the problems that have endured through the past decades and, it reflects our evolving understanding of the social, economic and environmental linkages that define our lives……
>
> The sustainable development of one-sixth of humanity will be of great consequence to the world and our beautiful planet."
>
> **Shri. Narendra Modi, Prime Minister of India**
> - At the UN Sustainable Development Summit (2015)

With a core emphasis on sustainability and climate action, the Pune Knowledge Cluster supports India's commitment to the 2030 Agenda. The activities of PKC's Sustainability and Environment vertical particularly aligns with the SDGs 6, 7, 8, 11, 13, 15, 17.

## Objectives

- Improving vegetation cover in Pune and surrounding regions to contribute to the national objective of additional natural carbon sinks while meeting local socio - economic and environmental needs through afforestation and habitat improvement measures
- Understanding regional environmental problems, developing policies for efficient use of resources, and facilitating the implementation of solutions via collaboration between various stakeholders - civic bodies, citizens, NGOs and corporate sponsors
- Working towards climate-proofing of the Pune Metropolitan Region by securing water, food & livelihood through programs focused on multi-dimensional sustainability

## Highlights

- **Funds raised for programs : INR 23 Lakhs**
- **Number of policy documents under development : 2**
- **Number of Digital platforms and tools for Environmental Monitoring developed/ under development : 2**
- **Number of citizen engagement events conducted : 8**

## Activities

- Programs for Sustainable Increase of Vegetation Cover
- Monitoring and Evaluation of Environmental Programs
- Policy Advocacy

# PROGRAMS FOR SUSTAINABLE INCREASE OF VEGETATION COVER

Pune Knowledge Cluster is working towards enhancing the carbon sinks on both public and private land by facilitating plantation activities in urban, peri-urban and rural areas (Fig. 1). As a knowledge partner, PKC helps in the incorporation of aspects of multi-dimensional sustainability at the social, economic, and ecological levels in plantation and afforestation activities.

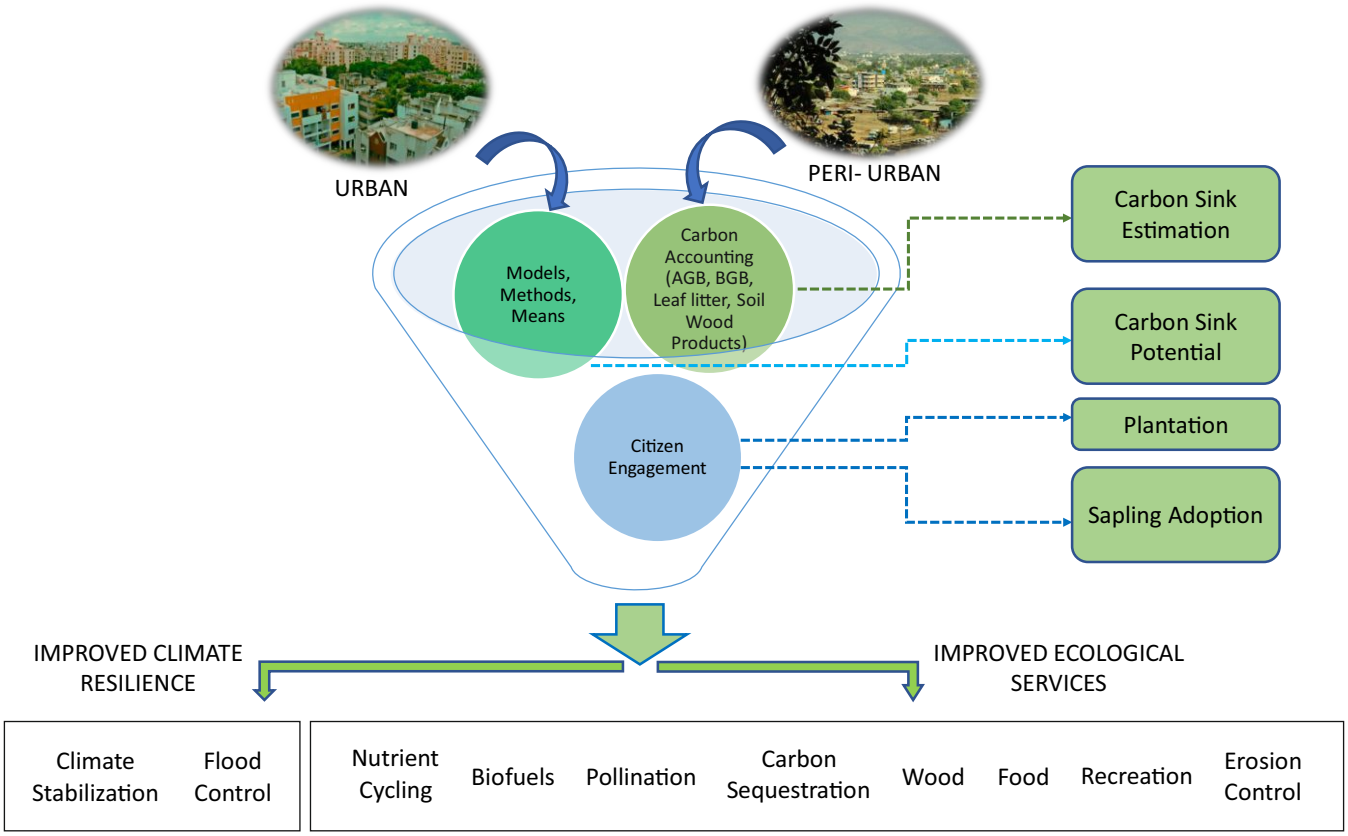



Fig. 1 : PKC's approach toward the sustainable increase of vegetation cover

**PKC's Role as a Knowledge Partner in Sustainable increase of vegetation cover:**

**Defining Objectives for Plantation**

- PKC helps stakeholders to define objectives of afforestation such as Carbon Sequestration, Greening, Biomass Production, Food Forest & Fodder, Medicinal Plants, Argo-forestry, Disaster Risk Management, Soil Enrichment and Biodiversity Parks

**Conducting Pre-Plantation Studies**

- Status study of 5 pillars of the plantation - Water, Land, Forest, Animals and Humans
- Plantation site identification
- Sustainability Plan - Ecological, Social, Economical
- Integrated learnings from natural forests
- Water conservation action plan
- Soil conservation action plan
- Species selection, composition and density based on inter-intra species interactions

**Building of Technology based Monitoring and Reporting Tools**
- Estimation of carbon sink potential pre-plantation
- Platform to adopt, monitor and track planted saplings through citizen engagement
- Automated, scalable platform for tree census using satellite imagery and drone based LiDAR

**Conducting Training and Skilling Programs for Sustainable Socio-Economic Development**
- Courses on Nursery Development
- Awareness program on Scientific plantation methods
- Introductory and advanced courses on Environmental, Social & Governance (ESG)

## Forestry Programs

**Piloting Sustainable Large Scale Afforestation on degraded lands:**
While, PKC's projects have a strong focus on protecting the environment (including biodiversity) and addressing climate change, the ideas are centred around food, water and livelihood security in the backdrop of opportunities for economic growth. Towards this objective we design our projects to meet multiple objectives including sustainable production of raw materials for meeting industry requirements such as biomass for biofuel industry (short-term), soft wood for paper and plywood industry (medium term) and hard-wood for furniture and construction industry (long-term).

PKC aims to develop socially, financially, and environmentally sustainable Biodiversity Parks on degraded public and private forest lands. Sites identified are Loni-Kalbhor (outskirts of Pune) and Medhankarwadi, Chakan, Maharashtra (industrial area in the Western ghats known as a biodiversity hotspot).

**Planned activities**
- Develop an Integrated Conservation and Management Plan for the area
- Watershed activities, soil preparation, and irrigation-related activities
- Plantation activities along with its maintenance and temporary supporting infrastructure such as storage, roads and fencing and supplementary livelihood activities such as pisciculture, apiculture and tourism
- To make the forest self-sustainable, plantation models based on inter and intra-species interactions will be developed to increase yields of timber, wood for the paper and plywood industry, NTFPs and biomass for bio-fuels to supplement domestic and agri-waste
- Development of a buffer zone along the forest boundaries to check encroachments and grazing by livestock

**Intended Impact**
- Green House Gas (GHG) sequestration of 10-20 tonnes $CO_2$ per ha per annum
- Increment in tree density up to 1000 trees per ha. on 900 ha to increase richness and abundance of flora and fauna respectively
- Employment to laborers through tourism, NTFP (biomass and other products), and management activities
- Revenue through sale of NTFPs, tourism, biomass (biofuels), apiculture and pisciculture
- Supplementing Bio-CNG plants with biomass from the forests shall improve farmer's income by INR 2,000/- p.ton from dry agri wastes and saving of waste disposal costs namely INR 2,000/- per ton of wet domestic wastes per day for gram panchayat
- Reduced emissions through 5 tonnes of Bio-CNG about 1 million $tCO_2$ eq. per annum

# GreenWeb - Urban Forestry Program

Pune Knowledge Cluster works on various initiatives to promote and sustain urban forestry. The objectives of GreenWeb Urban Forestry Program include:

- Promoting urban forestry with particular emphasis on the plantation of native and ecologically suitable species
- Public engagement through plantation drives and nature walks
- Developing an easy-to-use IT platform for tracking & monitoring sapling health through citizen engagement
- Facilitating interaction between civic bodies, citizens, and sponsors to create sustainable greenery in the city

**Sponsor:**

- Cummins Foundation
- Schlumberger

**Intended Impact**

- To increase survival rates of sapling plantations in the city using a data and technology driven approach
- Improved conservation efforts through public participation & scientific knowledge

**Green Web Programs:**

- ConnecTree
- TreeVerse
- Carbon Neutral Campus

## ConnecTree

ConnecTree is an AI-enabled interactive platform for choosing, promoting, tracking, and maintaining sapling plantations by citizens, sponsors and local government bodies. Through this platform, PKC in collaboration with NGOs facilitates plantation drives and nature walks to increase awareness about the importance of ecological conservation amongst citizens and sponsors (Fig. 2, and Fig. 3).

**Status**

- No. of saplings brought under ConnecTree: 200
- No. of saplings sponsored: 11
- NGO Caregivers: 3 (CEE India, Environment Conservation Association, Paryavaran Gatividhi)
- Survival rate of sponsored saplings: 70%



Fig. 2: PKC team members and Officials of Pune Municipal Corporation & Pune Smart city participating in Adopt a sapling program.



Fig. 3 : Volunteer collecting sapling health data using ConnecTree platform

## Monitoring and Evaluation of Environmental Programs

### TreeVerse

A computational model for carbon sink estimation which can enable city authorities/ administrators for planning initiatives for carbon neutrality.

TreeVerse program is an AI-based automated tree demography model that provides a tech - based platform to carry out ecological studies on urban plantations. It will also contribute, in part, to the nation's commitment to the enhanced transparency framework that provides information on the implementation and achievement of national objectives as part of the nationally determined contributions (NDCs) in the Paris Agreement.

**Activities**

- Carbon Accounting
  a. Geo-spatial data mining to estimate and characterize the tree cover of a region
  b. Calculating current Carbon potential using current tree census
- Estimating Carbon Sink Potential
  a. Tree - growth modelling & predicting carbon sequestration

**Intended Impact**

- Estimation of required carbon sink capacity in 2030/ 2035 for Pune Municipal Corporation
- Development of a tool for Urban Planners and Industries to plan and implement their carbon sequestration efforts
- Improved biodiversity & habitats through data-driven conservation strategies
- Identification of additional greening capacity




Fig. 4 : Trees tagged at IISER Pune Campus

**Progress**

- Preliminary estimate of Carbon sink for Pune City calculated
- Tree statistics for growth modeling within PMC:
  - Species tagged: 32
  - Trees tagged: 1,018
  - No. of sites [Public Gardens, Institutional Campuses (Fig. 4)] tagged : 24

## Carbon Neutral Campus Initiative

PKC is working with Samuchit Enviro Tech, a member of the Indian Network on Ethics and Climate Change (INECC) as well as Climate Collective Pune (CCP) on a collaborative project called The 'Carbon Neutral Campus Initiative (CNC) - which aims to trigger climate change discussion and climate action in educational and institutional campuses. The overarching objective of CNC is to motivate and mentor administrations of educational institutes to go low carbon (preferably carbon neutral) on their campuses.

**Activities**

Under this project, carbon accounting for campuses is performed by estimating their carbon emissions (eg. fossil fuel consumption, electricity consumption) and the carbon sequestration capacity coming from the green cover (trees). Based on these calculations, recommendations are made by experts for possible new technologies, services, structural and procedural changes that may be undertaken to further reduce carbon emissions and/or increase carbon sequestration through sinks and offsets on and off the campuses.

**Progress**

Carbon accounting for two educational institutions has been completed (Fig. 5), and the report has been submitted to the institute administration. The work has been accepted as an abstract in the in the 8th IEEE International Smart Cities Conference (ISC2 2022) - "Community Smartification and towards ZERO emission Smart Cities for a Green New Era", to be held at Paphos, Cyprus from 26-29 September 2022.

**Publications:**

- Animesh Mehta, Gayatri Doctor, Anita Kane, Disha Sawant, "Study for achieving carbon-neutral campus in India," 2022 IEEE International Smart Cities Conference (ISC2), 2022, pp. 1-4, doi: 10.1109/ISC255366.2022.992222

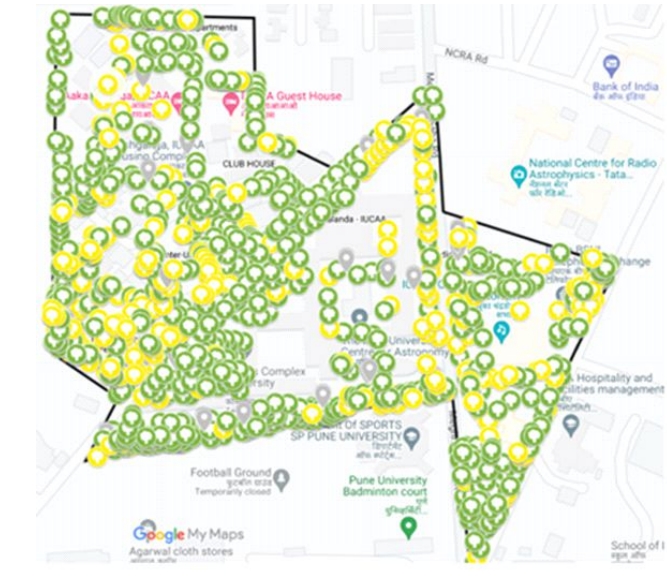



Fig. 5 : Carbon sink accounting for a campus done as part of the Carbon Neutral Campus Initiative

# POLICY ADVOCACY

PKC works with in-house experts and external agencies to create vision documents and action plans to enable development of sustainable solutions for environmental problems.

Key initiatives include:
- Sustainable Water Action Plan for Pune Metropolitan Region
- National Biomass Policy Document

## Sustainable Water Action Plan for PMR

Government of Maharashtra notified an Integrated State Water Plan (ISWP) for five major rivers namely Narmada, Godavari, Krishna, Tapi and Mahanadi and also the West flowing rivers. The Water Plan is developed using geomorphology-based landscape approach defined by rivers, sub-rivers, watershed and micro-watersheds. The PKC-facilitated participatory Sustainable Water Action Plan (SWAP) for Pune Metropolitan Region pilots the ISWP approach. The SWAP aims to underpin the ISWP by converging the efforts and resources of all stakeholders towards "water security". The idea of the SWAP is to create water observatories for collecting, collating and analyzing data related to water availability, usage, discharge including sewage and effluents, land-use changes, climate and schemes/programs/policies of the government. The other outcomes of SWAP will a decision support system for all stakeholders especially the government and industries.

**Key Beneficiaries of SWAP:**

- **Administrators & Policy Makers:**

It would act as a decision support system where all information regarding water (availability, use, discharge), land use (with land use change), human habitation, economic activities, climate change vulnerability, etc. will be available at both macro and micro levels. The tools and systems can be used by decision makers to plan, synergize and deploy resources more efficiently.

- **Industries:**

It will help the private sector (existing and upcoming industries) understand their socio - economic - environmental impact at macro and micro level. The private sector would benefit through the knowledge of availability/limitations of resources and can help in maximizing and securing returns on investments.

- **Research and Education Institutions:**

Knowledge of river basin problems and availability of data to address the problems can help academic and research institutions to undertake pointed research and education activities, and develop implementable technologies.

- **Civil Society Organizations:**

Knowledge of ongoing schemes/ programs/ initiatives of public and private sector, and other organizations can help synergize efforts and maximize outputs.

- **Citizens:**

Knowledge of water availability can help in decision making and investment in housing and businesses with better potential for return.

**Status :**

An outline of the Pune Metropolitan Region divided into 11 river/ sub-river/ watersheds has been prepared using geomorphology based landscape approach (i.e., watershed, catchment, and zone of influence) (Fig. 6). The Action Plan will prescribe solutions to problems at macro-micro level.

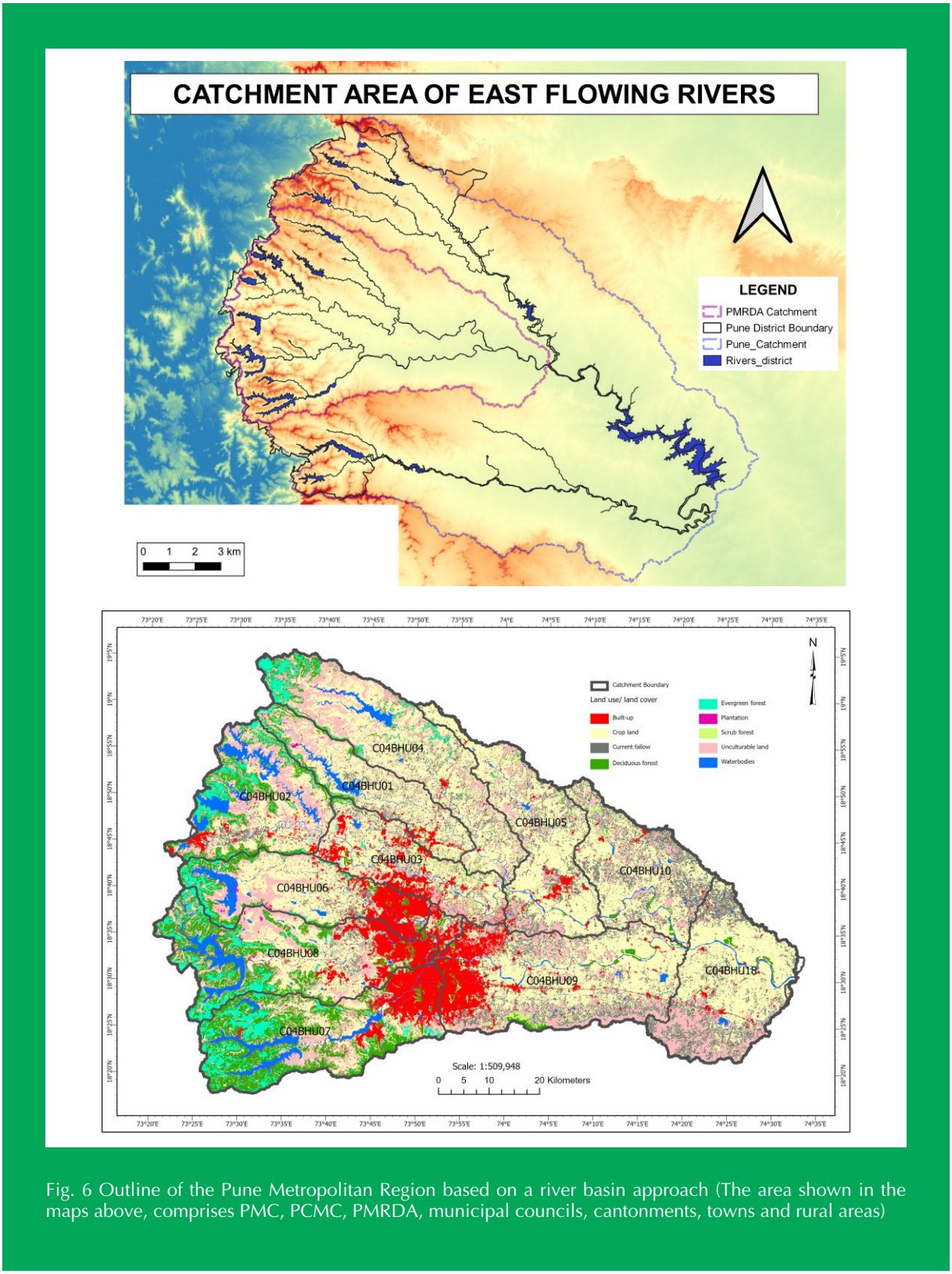



Fig. 6 Outline of the Pune Metropolitan Region based on a river basin approach (The area shown in the maps above, comprises PMC, PCMC, PMRDA, municipal councils, cantonments, towns and rural areas)

PKC is actively working as a knowledge partner with the local administration (Pune Municipal Corporation and Pune Zilla Parishad) for technology evaluation, project feasibility studies, and creating water conservation plans for water-stressed villages identified by the Pune Zilla Parishad. As a pilot PKC has chosen one water stressed village (Washere, Khed Teshil, Pune District - Fig. 7) to prepare a water action plan for increasing water availability and development of the village.







Fig. 7: Washere - Water stressed village (Khed Teshil, Pune District)

## Development of a National Biomass Policy

PKC is preparing a National Biomass Policy that aims to increase biomass availability for biofuels, energy resources for power generation, agriculture (organic fertilizers), timber, nutrition, and micro-entrepreneurship. The policy will promote increasing biomass on uncultivated and degraded lands, both public (forests and village) and private (farms, industrial, and mines), watersheds and catchment areas of wetlands and rivers. This policy will not only lead to accelerated development and utilization of bio-fuels but many other objectives of the Government of India such as making India a 5 trillion economy, doubling farmers income, restoration of 26 million ha of degraded lands and to create an additional carbon sink of 2.5 – 3 $tCO_2$ eq.

# Partners

## Funding Partners

Cummins

Schlumberger

## Program Partners

पुणे महानगरपालिका

पुणे स्मार्ट सिटी डेव्हलपमेंट कॉर्पोरेशन लिमिटेड
PUNE SMART CITY DEVELOPMENT CORPORATION LTD.

ARI

MISSION GROUNDWATER
भूजल अभियान

महाराष्ट्र वन विभाग

पर्यावरण संरक्षण

CEE
Centre for Environment Education

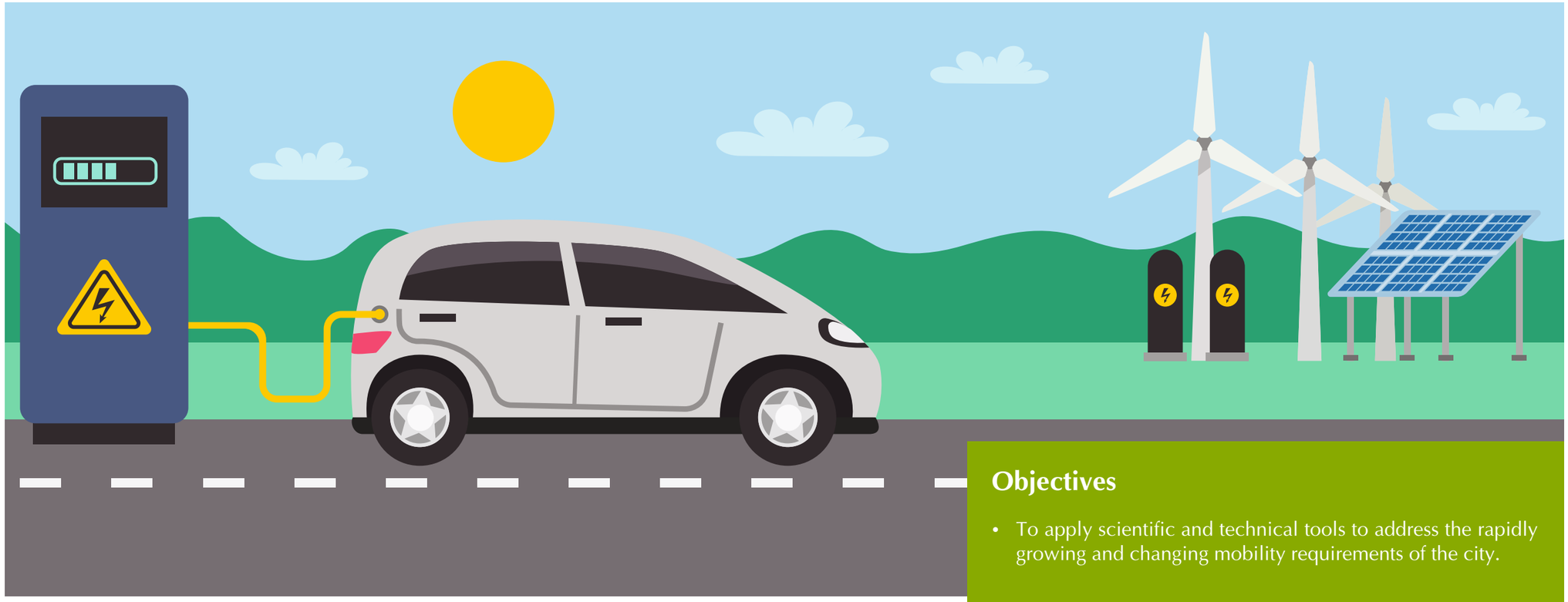
GAIA
The Earth Foundation

WRCS

Centre for Ecological Sciences, IISc

IMPACT REPORT | 2020-22

# Sustainable Mobility



## Objectives

- To apply scientific and technical tools to address the rapidly growing and changing mobility requirements of the city.
- To support the development of sustainable solutions for carbon - neutral transportation.

> "Conversion of India's vehicles to electrical vehicles has a potential to save fossil fuels worth about $100 bn annually, which in turn would save the country precious foreign exchange, prevent the dependence on imported petroleum products and reduce the pollution in cities by 80 - 90%."
>
> **Shri. Piyush Goyal,**
> Union Minister of State (IC), Power, Coal, New & Renewable Energy & Mines,
> - At The World Conference on Environment 2017

According to 'India 2020 - Energy Policy Review', published by International Energy Agency (doi: 10.1787/9faa9816-en), the Indian transport sector accounts for 13.5% of the country's energy-related carbon dioxide emissions, with road transport accounting for 90% of the sector's final energy consumption. Other than greenhouse gases, the transport sector is also a major emitter of several toxic gases such as Nitrogen Oxides (NO), which cause local air pollution, resulting in the prevalence of adverse health effects and premature deaths, especially in urban areas. With growing needs of the population, it is crucial to adopt large scale measures for clean mobility. The Pune Knowledge Cluster in collaboration with local civic authorities, research institutions, and think tanks, is working towards promoting modes of sustainable mobility in the Pune metropolitan region.

## Highlights

- A technical and financial analysis of EV potential for Pune city prepared as part of a commissioned study
- A brainstorming workshop for building vehicular E-waste recycling capacity conducted in which over 30 stakeholders including civic bodies, industries and research institutions in Pune participated

## Activities

- Technical & Financial Analysis Of EV Potential In PMR
- Initiatives to promote Vehicular E-Waste Recycling

Projects of this vertical align with:

### NATIONAL MISSIONS

- National Electric Vehicle Mission
- National Electric Mobility Mission Plan (NEMMP) 2020
- National Mission on Transformative Mobility and battery Storage
- Waste to Wealth Mission
- Smart City Mission

### SUSTAINABLE DEVELOPMENT GOALS



## Technical & Financial Analysis of EV Potential in PMR

- Through a study commissioned by The Pune International Center, PKC prepared a comprehensive report on technical and financial feasibility of electric vehicle potential in the Pune Metropolitan Region. The objective of this report was to provide an overview of key traffic routes and potential areas for installing EV charging stations and to calculate the potential and feasibility of Renewable Energy powered charging stations for EVs. The report is a part of a larger Action Plan for implementing Carbon Neutrality measures in PMR. This report includes the following:
  - Feasibility of converting Buses andTrucks to EVs and other low carbon technologies
  - Assessment of 2W, 3W, and 4W conversion potential to EVs in PMR
  - Assessment of the potential to integrate low-carbon public transportation in PMR

## Initiatives to promote Vehicular E-Waste Recycling

PKC is conceptualizing projects with technology providers and the auto industry to pilot novel technologies for vehicle E-waste recycling at the city level through public-private partnership models.

### Activities

- Identify feasible technologies for recovery of Lithium and precious metals in batteries, catalytic converters in a costeffective and safe manner
- Develop an E-waste Management Center (Demo Unit) to demonstrate technical and economical feasibility of novel technologies

### Intended impact

The demonstrative unit will have capabilities for segregation, shredding, chemical processing and material recovery (Lithium, Cadmium and others) and piloted technologies will be available for commercial use.

### Progress

Pune Knowledge Cluster and Automotive Research Association of India (ARAI) co-organized a workshop on “Developing Action Plan for Automotive E-Waste Management & Recycling” at ARAI Pune on 2 July 2022. Panel discussions were held on the challenges & possible solutions for E-waste Management in Pune city involving civic bodies, industries & research institutions. (Fig. 1).



Fig. 1: Workshop on “Developing an Action Plan for Automotive E-Waste Management & Recycling”, 02 July 2022 co-rganised by PKC and ARAI Pune. Participants included- Members of Local civic bodies (Pune Municipal Corporation, Regional Transport Office, Pimpri-Chinchwad Municipal Corporation Pune Smart City Development Corporation Limited), Industries (Mercedes Benz India Pvt. Ltd, Mahindra CERO, Attero Recycling, Exigo Recycling, Delhi, Tata Chemicals, , Eaton, Frost & Sullivan, Reteck Envirotech Pvt. Ltd.. Exide Industries Limited, Second life Li-ion Batteries, Nunam, Badve Enginnering Ltd, Green IT recycling. ANTAL International, Badve Enginnering Ltd, Nile Limited) and Research Institutions (ARAI Pune, Physics Department Savitribai Phule Pune University, CSIR NCL, CMET, Hyderabad).

# Partners

SAE INTERNATIONAL

PUNE INTERNATIONAL CENTRE

MET

ARAI
Progress through Research

IMPACT REPORT | 2020-22

# Big Data and AI



> “India today is well-positioned to become a global leader in Artificial Intelligence (AI) and there is a need to adopt it across all sectors”.
>
> **Shri. Amitabh Kant**
> Ex - CEO, Niti Aayog

Big data and Artificial Intelligence are slowly percolating in technological aspects of all sectors be it healthcare, education, agriculture, transport, or infrastructure. The application of AI for societal good has the potential to accelerate the growth of the Nation by multiple folds.

Pune Knowledge Cluster is currently involved in leveraging the immense potential of Big data and AI in various fields such as Health, Education, and Climate action through several innovative programs

## Objectives

- Facilitating open access to data - by developing state - of - the - art web - based platforms where scientists are provided with customized survey applications and citizens get access to scientific data sets (images/ plots/ handwritten documents) and a user interface to be able to analyze/ decode/ digitize data
- Increasing opportunities for interaction between the scientific community and the general public with a special emphasis on inclusivity via Citizen Science initiatives and public talks
- Promoting data science literacy via various capacity - building initiatives, industry - relevant training programs, and scholarship programs

Projects of this vertical align with:

**NATIONAL MISSIONS**

- National Mission for Artificial Intelligence
- National Supercomputing Mission
- National Mission on Education through Information and Communication Technology (NMEICT)

**SUSTAINABLE DEVELOPMENT GOALS**

03 GOOD HEALTH & WELL-BEING

09 INDUSTRY, INNOVATION AND INFRASTRUCTURE

17 PARTNERSHIPS FORTHE GOALS

## Highlights

**Crowd sourced data collection and analysis platforms developed for astronomy (Citizen Science)**

- Completed and publicly accessible: 1
- Under development: 2
- Citizens enrolled: 1000+

**Crowd sourced data collection and analysis platforms developed for urban forestry (Citizen Engagement)**

- Completed and publicly accessible: 1
- Citizens enrolled: 100+

## Activities

- Citizen Science Programs
- Development of Artificial Intelligence Consortium Biology and Chemistry
- Technologically enabling urban forestry efforts in Pune

## Citizen Science Programs

Scientific advancement in any field often encounters issues like enormous data size, instrumentation, computational constraints, a limited number of trained researchers, etc. Artificial intelligence (AI) appears as a possible solution for dealing with gigantic datasets. However, AI can be efficiently employed, only if the preliminary requirement of a large number of training datasets and trained analysts is fulfilled. Here the power of crowdsourcing or citizen science can be utilized.

Citizen science is the practice of public participation and collaboration in scientific research. Through citizen science programs, the general public share and contribute to data collection, monitoring, and analysis. PKC aims to involve enthusiastic volunteers from the public to perform data analysis and build such training datasets.

### ONGOING PROJECTS

**One Million Galaxies**

Images of the universe have the power to kindle curiosity in people from all walks of life. PKC's first citizen science project is based on image analyses of Galaxy images from a Japanese Telescope 'Subaru'. Astronomy enthusiasts from the public are trained by expert astronomers to identify nuanced features of the galaxy images and then provided with an intuitive user-interface to mark the peculiarities (Fig. 1). The project is developed under the guidance of Prof. Ajit Kembhavi and Prof. Sudhanshu Barway (Indian Institute of Astrophysics, Bangalore).

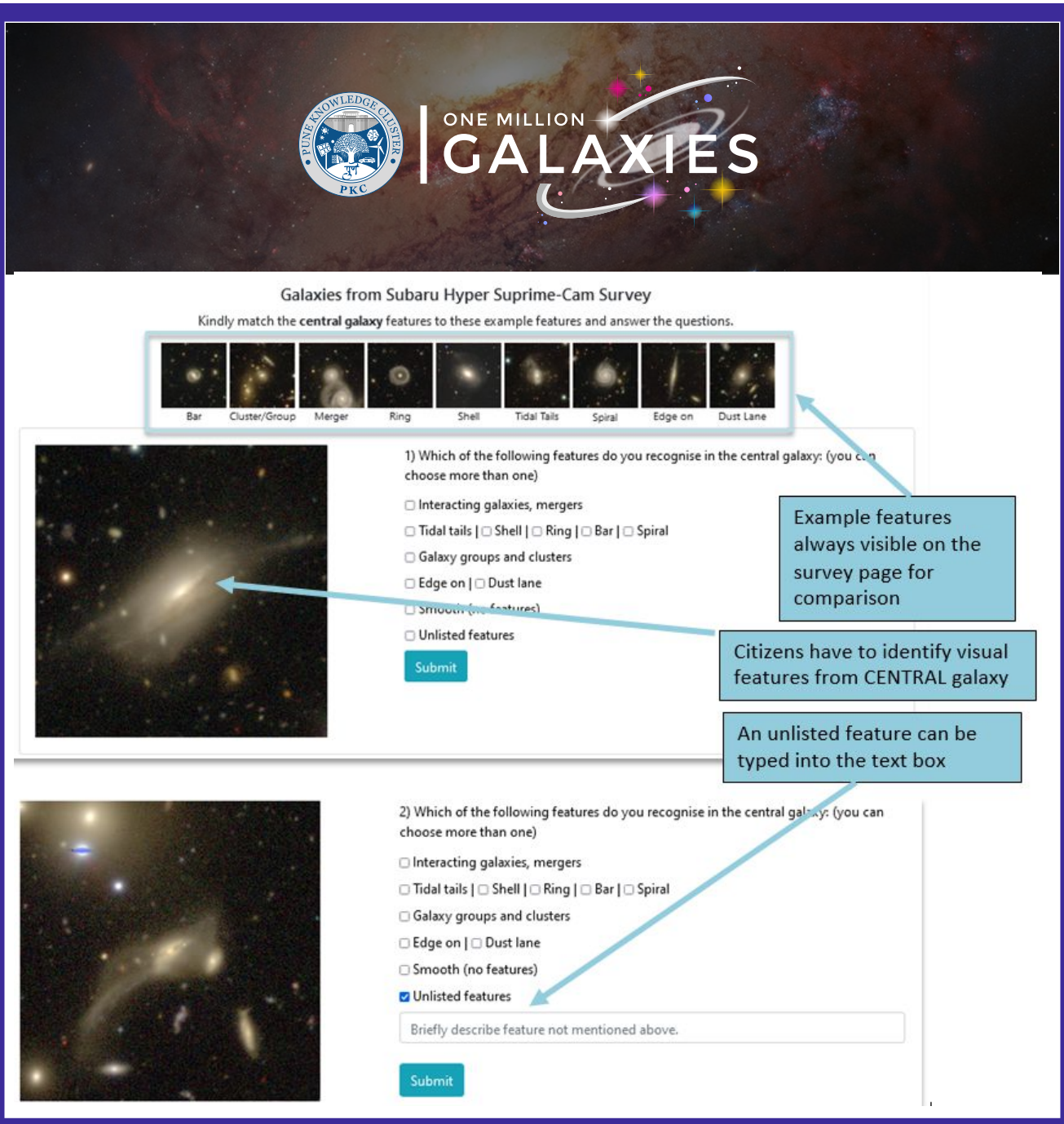



Fig. 1 User interface of One Million Galaxy Platform

**Activities**

- Amateur astronomy groups and planetariums were sensitized about the program and interested citizens were onboarded.
- A pilot platform was developed for the citizens, after beta testing of the platform by a group of amateur astronomers and science enthusiasts, the platform was launched for the general public on National Science Day, 28th February 2022 ( Fig. 2) . The platform is accessible at https://csa.pkc.org.in/

One Million Galaxies platform is publicly available at: https://csa.pkc.org.in/

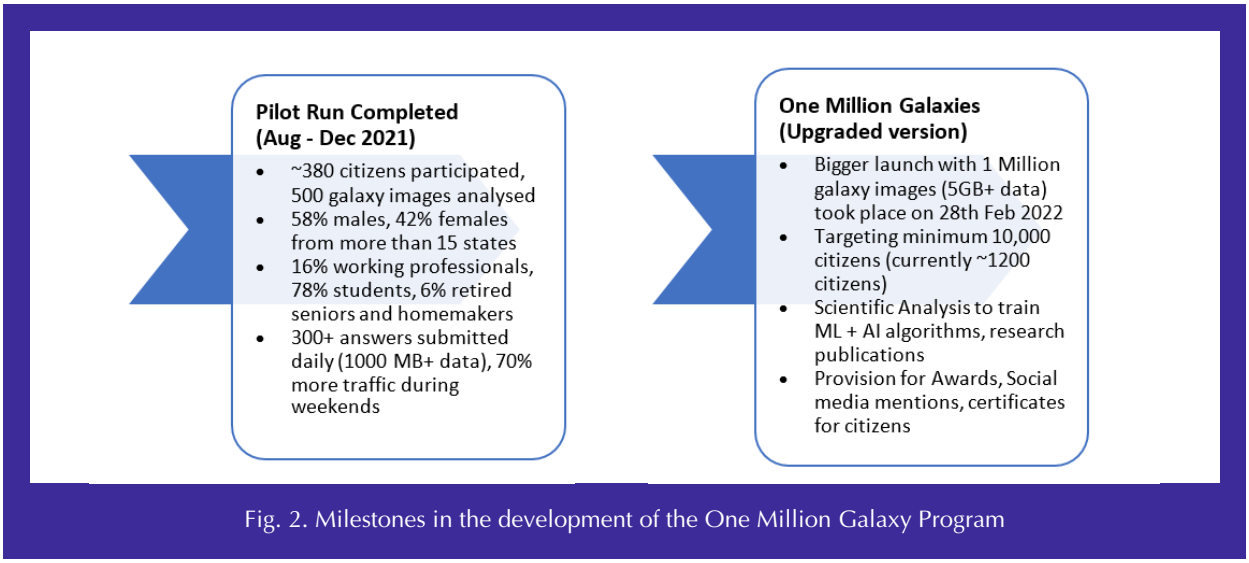
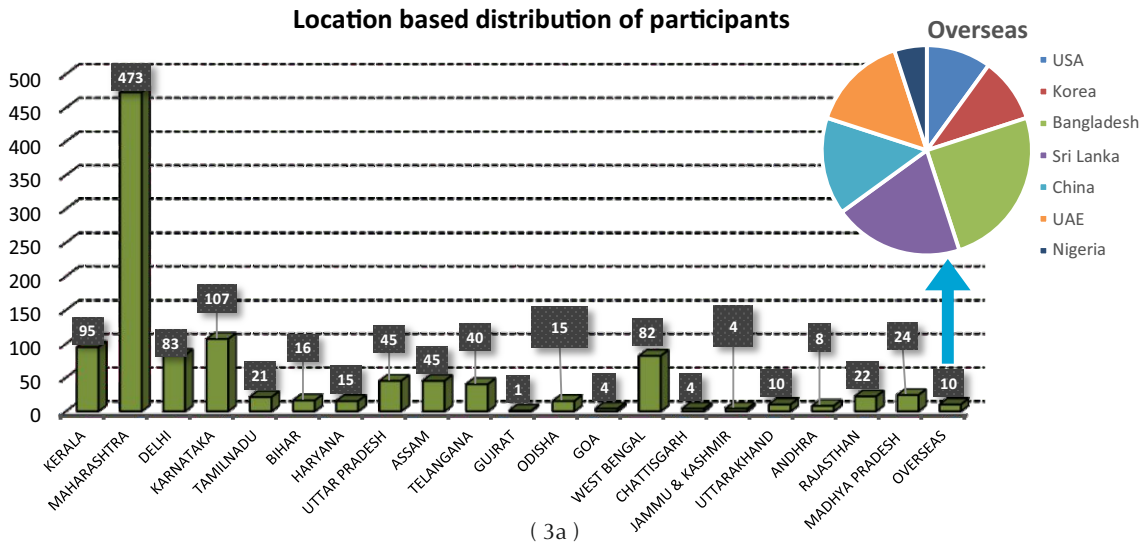


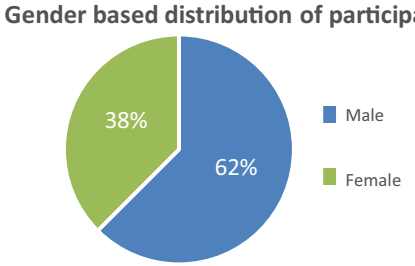

Fig. 2. Milestones in the development of the One Million Galaxy Program

## Progress

- More than 1000 citizen-scientists have enrolled on the platform from India & overseas (Fig. 3 (3a, 3b )




( 3a )




( 3b )

Fig. 3 Demographics of citizens participating in the One Million Galaxies program

3a. Location-based distribution of participants
3b. Gender-based distribution of participants

- Around 80,000 features from galaxy images have been identified until the end of July 2022. (Fig. 4)

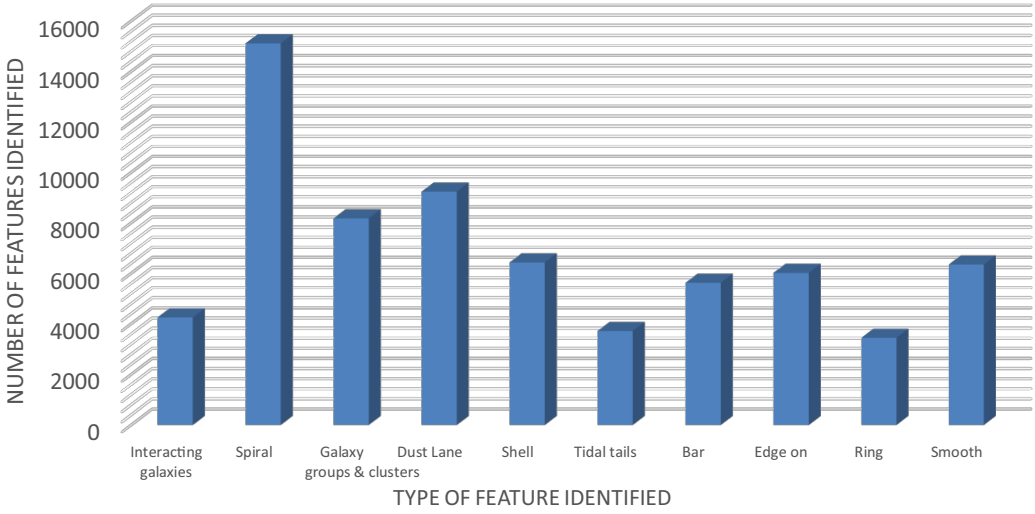



Fig. 4. Galaxy features identified using One Million Galaxies

## Highlights

**Various podiums where the program was invited to be presented:**

- Workshop on "Brainstorming pandemic-era outreach methodologies in astronomy and related fields" organized by Indian Institute of Astrophysics, Bangalore on 2-3 August 2021
- State Level Amateur astronomer's meet organized by APJ Abdul Kalam Astro-space and Science Centre in Aurangabad on 7-8 May 2022

## Acknowledgments

**The team members have been acknowledged for their contributions:**

- Dr. Disha Sawant was invited on the discussion panel for Multi-stakeholder Roundtable on Citizen Science Policy and Practices in India organized by DST - Centre for Policy Research - IISc, Bengaluru, 10 May 2022
- Atharva Bagul (IISER Bhopal), Research Assistant - One Million Galaxies won a "Citizen Science Fellowship" by EarthWatch India worth INR 1 Lakh

# Projects in pipeline

## 1. Quest for Quasars

Moving beyond images and slightly towards complex kinds of datasets, we would like to explore variability in Quasars (Active Galactic Nuclei) by studying their spectral features. A pilot platform is being designed in collaboration with Prof. Vivek M. from Indian Institute of Astrophysics, Bangalore, This project will focus on two tiers of citizens.

- **Type I:** Identifying quasar type using simple layout, simple question: for the general public
- **Type II:** Exploring the detailed features in absorption, and emission by quasars by comparing their multi-epoch spectra: for students with experience in astronomy (Fig. 5)

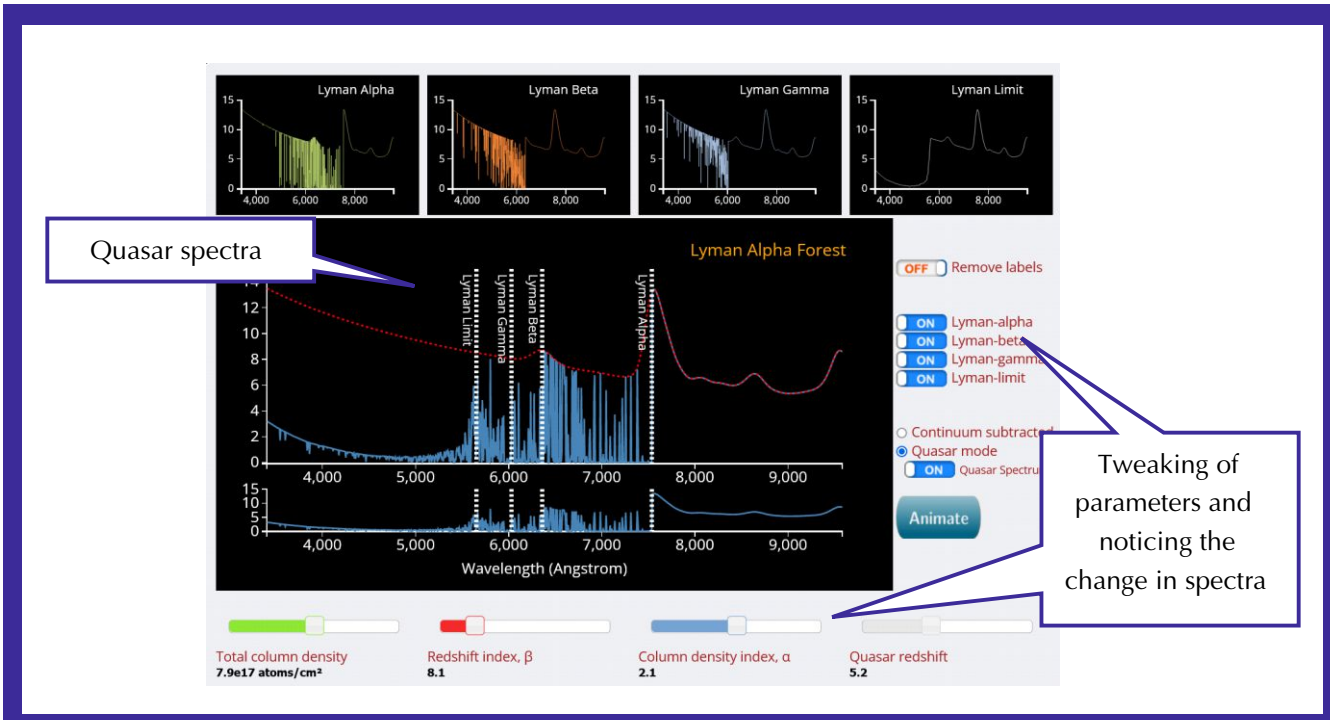



Fig. 5 User interface for analyses of quasar spectra

- A pilot-scale platform will be developed based on the feedback of the in-house astronomers
- The selection of niche students with astronomy backgrounds would begin in November 2022. Based on test cases and feedback, an upgraded version will be launched in January 2023

## 2. Discovery of exoplanets & Astronomy for inclusion

PKC plans to make another exciting citizen science program for the general public based on analysing data for the search for exoplanets i.e. habitable planets beyond Earth. PKC will collaborate with Dr. Ravi Kopparapu, planetary scientist, NASA Goddard Space Flight Centre who is an expert in exoplanet research to develop this project.

When observing emissions from a star, usually there is a dip in the brightness observed when a planet transits in front of its host star. This dip in the stellar spectra can be identified in two ways:
1. General public looking for the dip in the graphical data
2. The audio data from such stars getting analysed by visually impaired citizens where they identify changes/ gaps, empowering the visually impaired for astronomical data analysis

Researchers can convert various 2D datasets into audio using open access software developed by a visually impaired astronomer Dr. Wanda Diaz-Merced (European Gravitational Observatory, Cascina) to complete the parenthesis. This technique is termed as 'sonification'. Using such audio clips, we can introduce basic astronomical concepts to the visually impaired. Since the data gets analysed using a different medium, it adds to the accuracy of the analyses.

Most importantly, it boosts the confidence of visually impaired citizens where their hearing capacity can be used as a resourceful asset in scientific research. This project is likely to commence in mid-2023.

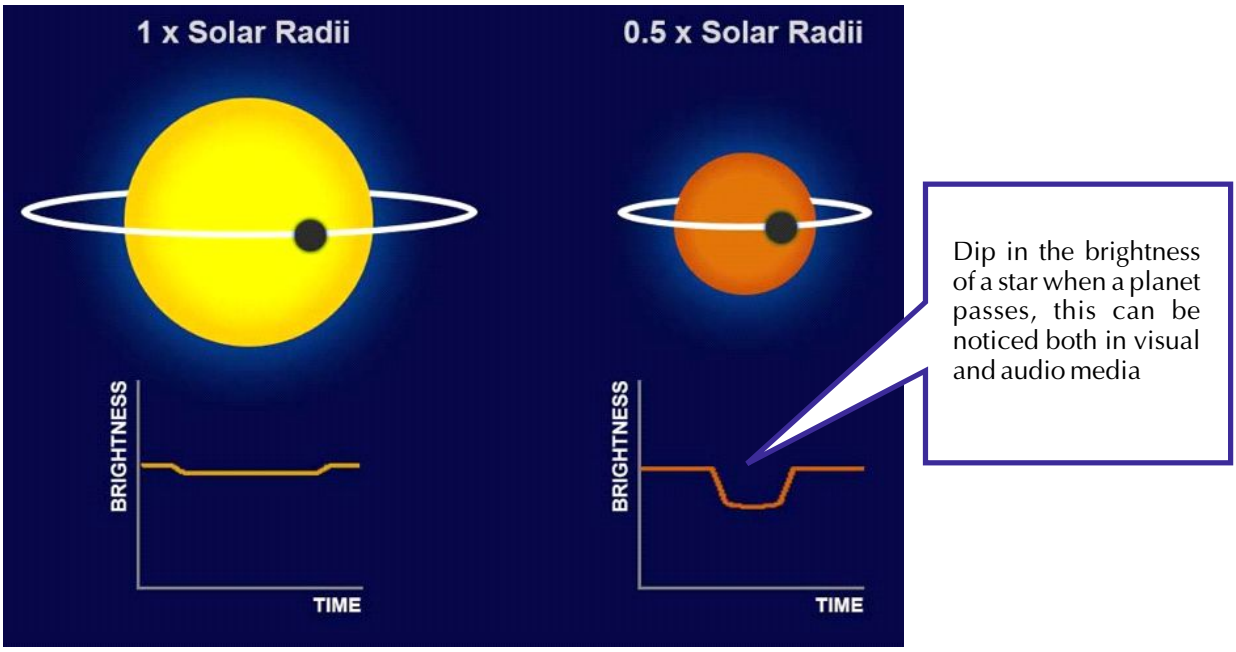



Fig. 6 : The Transit method used for detection of exoplanets

### Planned activities

- Reach out to numerous science enthusiasts among the citizens via amateur clubs and societies
- Reach out to scientists from various domains to invite them to host the data for analysis
- Develop a platform for astronomical analyses for visually impaired citizens

## Development of Artificial Intelligence Consortium for Biology and Chemistry

There are groups with expertise in data analytics and AI in various institutions and industries in Pune. Researchers from these groups have been collaborating with domain experts from biology and chemistry on problems of mutual interest.

These collaborations have led to significant development of tools, techniques, and publication of research papers which have been very well received by the community. To broaden the areas over which such collaborations can take place in a sustained fashion, and to provide a common platform for the purpose, PKC initiated a meeting of senior scientists from the National Chemical Laboratory (NCL), National Centre for Cell Science (NCCS), IISER-Pune and PKC in June 2022. These discussions led to the conceptualization of the program - Artificial Intelligence Consortium for Biology and Chemistry. Additional experts from institutes and industries in Pune will be joining the program.

### Activities

The consortium will enable biologists, chemists, and people with expertise in the application of AI to perform the following:

- Undertake problems in the broad areas of biology & chemistry which would benefit from the use of AI

- Conduct workshops and meetings with national and international experts to identify new areas in biology and chemistry where AI can make a significant contribution
- Conduct courses in data science and AI appropriate for students and young researchers in biology and chemistry as a part of skills development
- Conduct an internship program for undergraduate and masters level students from institutions and universities
- Create a website for the exchange of ideas, results, codes, and other development.
- Over time, scale the programme to other clusters and groups

**Progress**

- A number of problems for applications of AI to Chemistry have been identified in discussion between PKC and groups in NCL and work on those has been initiated. Similarly, work on applications of AI techniques to biological problems has commenced with groups in NCCS
- Discussions have been initiated with the National Supercomputing Mission for the use of high-end supercomputing resources which would be needed for certain applications, like developing digital twins of pilot scale chemical plants
- Courses and workshops are being planned for the last quarter of 2022. Discussions have begun with some institutes for starting an internship program and funding sources are being approached for various parts of the program including skill development

## Technologically enabling urban forestry efforts in Pune

Drawing from databases related to urban morphology, land records, weather, and climate, soil types, vegetation and tree census, groundwater, etc, as well as agent modeling and crowd-sourced information, 'ConnecTree' is capable of enhancing the synergy and efficiency of plantation drives conducted by citizens, corporates and civic bodies.

**Intended Impact**

- Increased survival of plantations in urban public places
- Improved conservation efforts through interaction between citizens and civic bodies

**Progress**

- No. of saplings brought under tracking / IT platform: 200
- Survival Rate of sponsored saplings: 70%

ConnecTree platform is publicly available at: https://bit.ly/3ff1arL

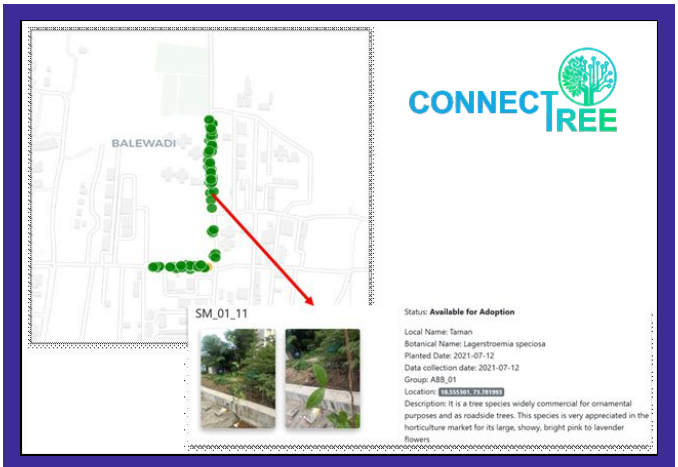



Fig. 7 . User interface of the ConnecTree Platform

# Partners

## Funding Partners

University of Southampton

## Program Partners

ज्योतिर्विद्या परिसंस्था
JYOTIRVIDYA PARISANSTHA PUNE

IUCAA

iia

tifr HBCSE

Khagol Vishwa

Nehru Centre

IMPACT REPORT | 2020-22

# CAPACITY BUILDING



> How nations develop their human capital can be a more important determinant of their long-term success than virtually any other factor.
>
> **The Global Human Capital Report 2017**
> (World Economic Forum)

According to the Periodic Labour Force Survey (PLFS) 2017-2018, conducted by the Ministry of Statistics and Programme Implementation, GoI, India will have a total workforce of 404.15 million people, with around 70 million individuals of working age (15-59 years) by the year 2023. To ensure that a large portion of the task force is employable, there is an urgent need for skill development as per contemporary industry needs.

India is on its way to becoming a major global knowledge-based economy. Development of skills pertaining to Science, Technology, Engineering, and Mathematics (STEM) amongst youth is needed to achieve this goal. Recognizing this requirement, the Pune Knowledge Cluster is working towards providing opportunities to students, educators, young researchers, and professionals to improve their knowledge base and acquire advanced skills through interdisciplinary training programs.

PKC in collaboration with industry and academia conducts capacity-building programs aligning with its various verticals namely Health, Environment, Sustainable Mobility, Big Data, and Artificial Intelligence. PKC's prime focus is to bridge the knowledge gap between skills acquired through conventional education and that required by industries and research institutions. PKC is committed to empowering STEM education in schools and colleges through various pedagogical programs and outreach activities.

Through its various initiatives, PKC's Capacity Building vertical aligns with several SDGs, national missions, and national policies.

Projects of this vertical align with:

## NATIONAL MISSIONS

- National Education Mission
- National Mission on Education through Information and Communication Technology (ICT)
- National Education Policy (NEP) 2020

## SUSTAINABLE DEVELOPMENT GOALS

04 QUALITY EDUCATION

17 PARTNERSHIPS FOR THE GOALS

## Objectives

- To facilitate high-end skilling and knowledge enhancement in youth by conducting interdisciplinary training programs & courses
- To promote scientific temperament in society by hosting ciitizen centric science talks by experts
- To promote STEM education via training programs on digital literacy and 21st century skills for students, pedagogy training programs for teachers, and scholarships & mentorship programs for girls students and entrepreneurs in STEM

## Highlights

**Number of Inter-disciplinary Training Courses conducted : 12**
Beneficiaries : 668 Mentors involved : 115

**Number of Inter-disciplinary Training Workshops conducted : 2**
Beneficiaries : 62 Mentors involved : 11

**Number of Citizen-centric Talks conducted : 49**
Beneficiaries : 4859

**Funds raised for STEM Programs: INR 86 Lakhs**

## Activities

Various activities conducted under the capacity building vertical include:

- Citizen-Centric Science talks
  - Special Talks
  - India S&T@75 series
  - Domain-Specific Talks
- Interdisciplinary Training Programs & Courses
- STEM Initiatives

# Citizen-Centric Science Talks

**Impact:**
A total of 49 talks have been hosted by PKC which have been attended by more than 4800 individuals. All the talks are available on PKC's official YouTube channel which can be used as a knowledge repository as per the learning requirements of the audience /subscribers.

## Special Talks



**Dr. R. A. Mashelkar**
(Former Director - General of the Council of Scientific and Industrial Research (CSIR), President of Indian National Science Academy (2004-2006), President of Institution of Chemical Engineers (2007) and also the President of Global Research Alliance (2007-2018). First Chairperson of Academy of Scientific and Innovative Research (AcSIR). Fellow of the Royal Society, Fellow of the Royal Academy of Engineering (FREng), Foreign associate of US National Academy of Engineering and the US National Academy of Sciences.

**Title of the talk : Sustainable Inclusive Growth through Gandhian Engineering**
**Held on : 2nd October 2020**

---



**Lieutenant General (Dr.) Madhuri Kanitkar**
PVSM, AVSM, VSM

**Title of the talk : My Journey: In Search of Research**
**Held on : 30th January 2021**

---



**Prof. Raghavendra Gadagkar**
DST Year of Science Chair Professor, Centre for Ecological Sciences,
Indian Institute of Science (IISc), Bangalore

**Title of the talk : Can We Learn from Insect Societies?**
**Held on : 10th July 2021**

---



**Dr. Gagandeep Kang**
MD, PhD,
FASc, FNASc, FNA, FRCPath, FAAM, FPH, FRS

**Title of the talk : Prevention is Health and Wealth**
**Held on : 30th October 2021**

---

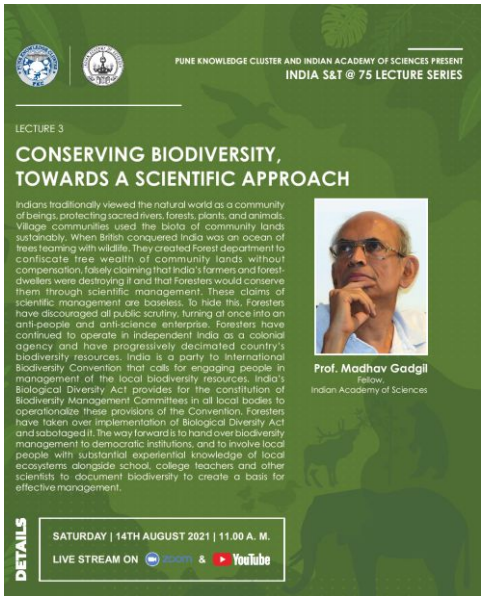
# India S&T@75 Series

## CELEBRATING 75 YEARS OF INDIA'S S&T JOURNEY

As a part of the "India S&T@75" events, during the countdown to the 75th year of India's independence, PKC in association with the Indian Academy of Sciences (IAS) organized a number of lectures on scientific topics. These lectures were delivered by Fellows and Associates of the Indian Academy of Sciences (IAS). The lectures covered a wide variety of topics, highlighting some of the cutting edge science and technology developments made in the country over the past 75 years.

10 webinars have been conducted under the "India S&T@75" series.

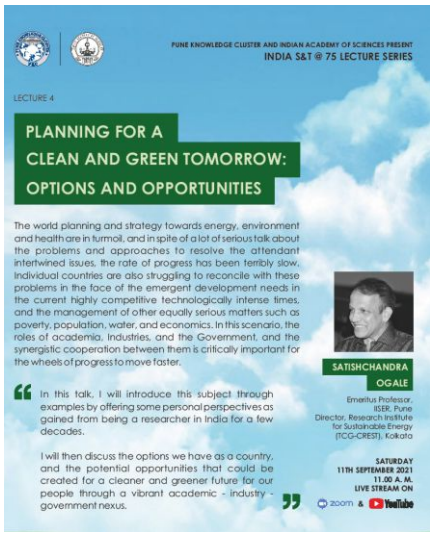
| Date | Topic | Speaker |
|---|---|---|
| 19th June 2021 | Statistical Search for a Genetic Connection Between Tobacco & Oral Cancer | Prof. Anil Gore |
| 26th July 2021 | Mathematical Physics & Reality | Prof. Sunil Mukhi |
| 14th Aug 2021 | Conserving Biodiversity, Towards a Scientific Approach | Prof. Madhav Gadgil |
| 11th Sept 2021 | Planning for a Clean & Green Tomorrow: Options and Opportunities | Prof. Satishchandra Ogale |
| 9th Oct 2021 | The Indian Monsoon & its Variability | Prof. Sulochana Gadgil |
| 13th Nov 2021 | Nature & Nurture: How the Environment Shapes our Genes | Prof. Sanjeev Galande |
| 22nd Jan 2022 | Building Science Park: Exploratory, Innovative Space for Experiential Learning | Prof. Dilip Kanhere |
| 9th April 2022 | M N Saha & S S Bhatnagar as pioneers of Research & Development in India | Prof. Arun Grover |
| 28th May 2022 | Phase transition in spaces of non-integer dimensions : Fractals | Prof. Deepak Dhar |
| 9th July 2022 | Evolution, Energetics & Environment of Energetic Explosions | Dr. Poonam Chandra |





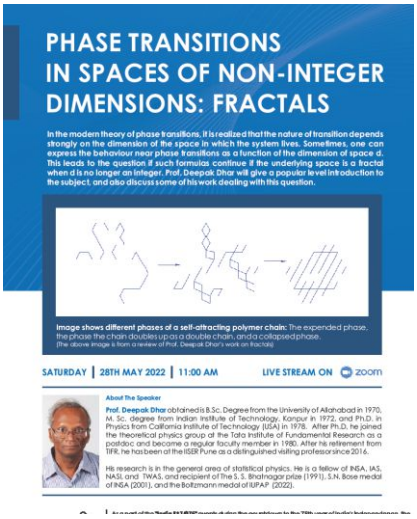





PUNE KNOWLEDGE CLUSTER AND INDIAN ACADEMY OF SCIENCES PRESENT
INDIA S&T @ 75 LECTURE SERIES
LECTURE 4
PLANNING FOR A CLEAN AND GREEN TOMORROW: OPTIONS AND OPPORTUNITIES
The world planning and strategy towards energy, environment and health are in turmoil, and in spite of a lot of serious talk about the problems and approaches to resolve the attendant intertwined issues, the rate of progress has been terribly slow. Individual countries are also struggling to reconcile with these problems in the face of the emergent development needs in the current highly competitive technologically intense times, and the management of other equally serious matters such as poverty, population, water, and economics. In this scenario, the roles of academia, industries, and the Government, and the synergistic cooperation between them is critically important for the wheels of progress to move faster.
In this talk, I will introduce this subject through examples by offering some personal perspectives as gained from being a researcher in India for a few decades.
I will then discuss the options we have as a country, and the potential opportunities that could be created for a cleaner and greener future for our people through a vibrant academic - industry - government nexus.
SATISHCHANDRA OGALE
Emeritus Professor, IISER, Pune
Director, Research Institute for Sustainable Energy (TCG-CREST), Kolkata
SATURDAY
11TH SEPTEMBER 2021
11.00 A. M.
LIVE STREAM ON
zoom & YouTube


PUNE KNOWLEDGE CLUSTER AND INDIAN ACADEMY OF SCIENCES PRESENT
INDIA S&T @ 75 LECTURE SERIES
LECTURE 5
THE INDIAN MONSOON AND ITS VARIABILITY
The monsoon governs the very pulse of life in our country. The monsoon visits us, without fail, year after year, but not always with the same gusto. So, every summer as the heat scorches the landscape around us, scientists, farmers, as well as economists start wondering how the monsoon is going to behave.
Over centuries, the monsoon has captured the imagination of the finest minds and great advances in our understanding the meteorology of the tropics and the monsoon have been made particularly in the last few decades. Yet the problem of forecasting whether the monsoon will be 'normal' as in 2020 or a drought as in 2015 still remains a challenge.
What makes the problem of prediction of the monsoon difficult is that the rain-giving clouds and the system that gives us the monsoon rains are all a culmination of instabilities and arise from multi-scale, nonlinear interactions between the land, the tropical atmosphere, and the oceans. Thus, understanding and predicting the vagaries of the monsoon is perhaps the most challenging problem in atmospheric science today. In this lecture, the Speaker shall introduce the physics of this fascinating phenomenon, share the present understanding of some facets of monsoon variability, and the challenges ahead for better predictions.
DETAILS
SATURDAY | 9TH OCTOBER 2021 | 11.00 A. M.
LIVE STREAM ON zoom & YouTube
About the Speaker
Prof. Sulochana Gadgil
Fellow, Indian Academy of Sciences
Sulochana Gadgil, one of the world's leading monsoon meteorologists, has made significant contributions to our understanding of the Indian monsoon and its variability, its links with atmospheric convection over tropical oceans and the relationship of such convection with the sea surface temperature. Sulochana Gadgil was trained at Harvard, with a PhD. in Applied Mathematics, a post-doctoral fellow at MIT, and later joined the Indian Institute of Science in 1973. She played a key role in the establishment and nurturing of the Centre for Atmospheric and Oceanic Sciences at the Indian Institute of Science and spearheaded the efforts to formulate the Indian Climate Research Program (ICRP). She is a recipient of several awards including Norman Borlaug Award and Lifetime excellence award in Earth Sciences of 2016 from the Ministry of Earth Sciences 2016.

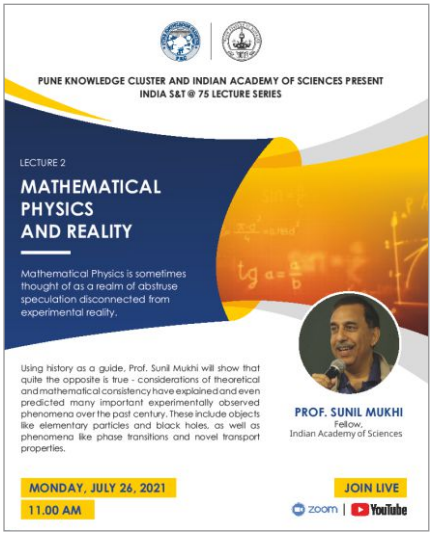

LECTURE 7
Building Science Park:
Exploratory, Innovative Space for Experiential Learning
The speaker plans to take the audience on a brief and exciting tour of the Science Park at Centre for Science Education and Communication of SPPU, Pune. For the past 7 years or so he has been developing an experiential science center for school children on the campus of Savitibai Phule Pune University (SPPU). He began work in his small office. Presently they have 15000 sq feet of the designed building, over 1000 kits/ demo exhibits /experiments. They have used all available resources like the web, youtube, science museums, off-the-shelf toys, and vendors for acquiring our exhibits.
They have also designed and built several demonstration experiments/exhibits. The target audience is mostly school children, high school included. However general public can easily enjoy more than a couple of hours in the museum section.
The tour will begin with a trailer from our short film on the ecosystem (Noel's Dream, produced by Science Park), exhibits like talking trees depicting the importance of a Habitat, a show on termite hill introducing the structure of termite society. This will be followed by a look at "Our Body" using various models (A talking skeleton show, a full body with completely detachable internal organs.
He will also visit several models in physics such as demonstration of the law of induction, magnetism, etc. We will end our tour by showing a powerful workshop facility, all on the tabletop, such as cutting tools, wood and metal lathe, shaping tools,
PROF. DILIP KANHERE
Distinguished Professor,
Coordinator, Centre for Science Education & Communication,
Savitibai Phule Pune University
Fellow of Indian Academy of Sciences.
About the speaker Prof. Dilip Kanhere, Distinguished Professor, and Coordinator, Centre for Science Education and Communication, Savitibai Phule Pune University (SPPU). Prof. Kanhere has a Ph.D. from the Indian Institute of Technology, Kanpur in Computational Condensed Matter Physics. He joined the University of Pune as a lecturer. His major contribution in his formative years was to bring in a culture of computerization in the University of Pune by introducing computational courses at M.Sc. and B.Sc. levels. Since then he has been a strong motivating factor in the significant and continuing growth of an ICT (information, communication technology) culture and infrastructure on the campus. Some of his significant contributions are parallel and high-performance computing (HPC) activities, the establishment of state-of-the-art optic-fiber-based campus-wide LAN (as early as 1993), the establishment of several HPC facilities and a unique

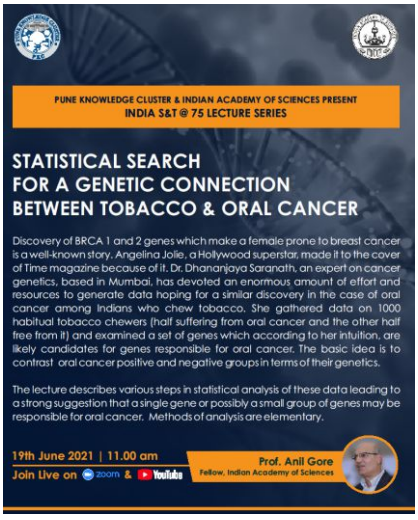

PHASE TRANSITIONS IN SPACES OF NON-INTEGER DIMENSIONS: FRACTALS
In the modern theory of phase transitions, it is realized that the nature of transition depends strongly on the dimension of the space in which the system lives. Sometimes, one can express the behaviour near phase transitions as a function of the dimension of space d. This leads to the question if such formulas continue if the underlying space is a fractal when d is no longer an integer. Prof. Deepak Dhar will give a popular level introduction to the subject, and also discuss some of his work dealing with this question.
Image shows different phases of a self-attracting polymer chain: The expended phase, the phase the chain doubles up as a double chain, and a collapsed phase. (The above image is from a review of Prof. Deepak Dhar's work on fractals)
SATURDAY | 28TH MAY 2022 | 11:00 AM
LIVE STREAM ON zoom
About The Speaker
Prof. Deepak Dhar obtained is B.Sc. Degree from the University of Allahabad in 1970, M. Sc. degree from Indian Institute of Technology, Kanpur in 1972, and Ph.D. in Physics from California Institute of Technology (USA) in 1978. After Ph.D. he joined the theoretical physics group at the Tata Institute of Fundamental Research as a postdoc and became a regular faculty member in 1980. After his retirement from TIFR, he has been at the IISER Pune as a distinguished visiting professor since 2016.
His research is in the general area of statistical physics. He is a fellow of INSA, IAS, NASI, and TWAS, and recipient of The S. S. Bhatnagar prize (1991), S.N. Bose medal of INSA (2001), and the Boltzmann medal of IUPAP (2022).


INDIA
SCIENCE & TECHNOLOGY
75


PUNE KNOWLEDGE CLUSTER AND INDIAN ACADEMY OF SCIENCES PRESENT
INDIA S&T @ 75 LECTURE SERIES
LECTURE 8
M. N. Saha
S. S. Bhatnagar
PIONEERS OF RESEARCH AND DEVELOPMENT IN INDIA
ABOUT THE SPEAKER
Prof. Arun Grover
Fellow,
Indian Academy of Sciences
A condensed matter physicist from TIFR, served as the 12th Vice-Chancellor of Panjab University, Chandigarh (2012-18). He received the Homi Bhabha Science and Technology Award of BARC in 1985 for his contributions in Magnetism and Superconductivity. Elected (1997) Fellow of NASI as well as that of IASc., Bangalore, he served as the Vice President of IASc. from 2018-18.
An initiative commenced in 2012 by him, which caught the nations' attention, has been the nucleation of Chandigarh Region Innovation and Knowledge Cluster (CRIKC), which brought together all the institutions in and around Chandigarh on a common platform.
The talk will focus on the narrative as to how Saha and Bhatnagar seized up the opportunities immediately before and after the start of the second world war to conceive plans for scientific research and development of India. Bhatnagar had reached out to teachers in Universities as small grants were made available to the newly created Board of Scientific and Industrial Research. Saha masterminded the getting together of scientists at a meeting in Calcutta in September 1943. A British MP and the Secretary of The Royal Society of London, Nobel Laureate Dr. A V Hill, visited India from November 1943 to April 1944, endorsed the plans of Indian teacher scientists, and submitted a report titled 'Scientific Research in India' in August 1944.
The recommendations enshrined in it became the agenda for implementation. The close synergy between scientists and political leaders at the forefront of the independence
SATURDAY | 9TH APRIL 2022 | 11.00 AM


LECTURE 6
NATURE & NURTURE:
HOW THE ENVIRONMENT SHAPES OUR GENES
The past decade has witnessed the explosion of information in biomedical sciences due to the availability of genome sequences and the development of techniques that assay epigenetic modifications. These modifications highlight how the dynamic changes in the environment ultimately affect the expression of genes on a day-to-day basis and throughout a lifetime. As a result, we pass on much more information than that encoded by our genes to the next generation. Hence, having settled the long-standing nature versus nurture debate, we now appreciate that nature and nurture together make us what we are. The Speaker will illustrate the technological breakthroughs and trans-disciplinary approaches that have enabled a deeper understanding of disease susceptibility, especially focusing on lifestyle disorders.
PROF. SANJEEV GALANDE
Dean, School of Natural Sciences,
Shiv Nadar University, Delhi NCR.
Professor (on lien), IISER - Pune
Fellow, Indian Academy of Sciences
SATURDAY | 13TH NOVEMBER 2021 | 11.00 AM
LIVE STREAM ON zoom
Dr. Galande obtained his PhD in Biochemistry from the Indian Institute of Science in 1996. As a postdoctoral fellow at the Lawrence Berkeley National Laboratory, the USA from 1996-2001, he studied cancer biology. Dr. Galande joined the National Centre for Cell Science in Pune, India in 2001 as a senior scientist. In 2010 Dr. Galande joined as a Professor at the Indian Institute of Science Education and Research (IISER Pune). Research in Galande laboratory is focused on studying how the dynamic changes in higher-order chromatin assembly govern gene expression spatially and temporally. At IISER he leads the Centre of Excellence in Epigenetics (CoEE) and has assembled a team of scientists to study the evolution of epigenetic mechanisms using multiple model systems. The CoE in Epigenetics focuses on epigenetic modifications underlying a variety of biologically important phenomena and their role in gene expression, regeneration, cancer, behavior, aging and evolution. To fulfil these goals Dr. Galande has established a multidisciplinary program engaged at the interface of biochemistry, molecular biology, bioinformatics, cell biology, proteomics and genomics.


PUNE KNOWLEDGE CLUSTER AND INDIAN ACADEMY OF SCIENCES PRESENT
INDIA S&T @ 75 LECTURE SERIES
LECTURE 2
MATHEMATICAL PHYSICS AND REALITY
Mathematical Physics is sometimes thought of as a realm of abstruse speculation disconnected from experimental reality.
Using history as a guide, Prof. Sunil Mukhi will show that quite the opposite is true - considerations of theoretical and mathematical consistency have explained and even predicted many important experimentally observed phenomena over the past century. These include objects like elementary particles and black holes, as well as phenomena like phase transitions and novel transport properties.
PROF. SUNIL MUKHI
Fellow,
Indian Academy of Sciences
MONDAY, JULY 26, 2021
11.00 AM
JOIN LIVE
zoom | YouTube


PUNE KNOWLEDGE CLUSTER & INDIAN ACADEMY OF SCIENCES PRESENT
INDIA S&T @ 75 LECTURE SERIES
STATISTICAL SEARCH FOR A GENETIC CONNECTION BETWEEN TOBACCO & ORAL CANCER
Discovery of BRCA 1 and 2 genes which make a female prone to breast cancer is a well-known story. Angelina Jolie, a Hollywood superstar, made it to the cover of Time magazine because of it. Dr. Dhananjaya Saranath, an expert on cancer genetics, based in Mumbai, has devoted an enormous amount of effort and resources to generate data hoping for a similar discovery in the case of oral cancer among Indians who chew tobacco. She gathered data on 1000 habitual tobacco chewers (half suffering from oral cancer and the other half free from it) and examined a set of genes which according to her intuition, are likely candidates for genes responsible for oral cancer. The basic idea is to contrast oral cancer positive and negative groups in terms of their genetics.
The lecture describes various steps in statistical analysis of these data leading to a strong suggestion that a single gene or possibly a small group of genes may be responsible for oral cancer. Methods of analysis are elementary.
19th June 2021 | 11.00 am
Join Live on zoom & YouTube
Prof. Anil Gore
Fellow, Indian Academy of Sciences

IMPACT REPORT | 2020-22



# Domain-Specific Talks

## CODATA Talk series (BIG Data and AI)

PKC - CODATA Webinar series:
This webinar series is run in collaboration with CODATA - National Committee & The Indian National Science Academy (INSA). This series aims to promote Data Science outreach, and FAIR data advocacy.

| Date | Topic | Speaker |
|---|---|---|
| 20th July 2021 | Data Democratization | Dr. Neeta Verma Director General, NIC |
| 24th August 2021 | COVID-19 Data and Analysis | Dr. Joy Merwin Monteiro, IISER Pune |
| 21st Sept 2021 | Big Data & The Square Kilometer Array (SKA) Telescope | Prof. Yogesh Wadadekar, National Centre for Radio Astrophysics - Tata Institute of Fundamental Research, Pune |
| 15th Nov 2021 | Machine Learning & Artificial Intelligence for Geoscience Applications | Dr. Deepak Subramani, Indian Institute of Science (IISc), Bangalore |

## SustEN Talk Series (Sustainability and Environment)

PKC's Sust-En series consists of public talks, focused group discussions and workshops with experts in the environment and sustainability space. Through this series, PKC aims to promote collaborations, co-creation of technologies, and conceptualization of city-scale projects to solve key issues related to carbon emissions, waste-water treatment, improving air quality, and green energy production.

| Date | Topic | Speaker |
|---|---|---|
| 22nd March 2022 | Importance Of Green Spaces For Well Being Of Citizens | Dr. Jayant Kulkarni,<br>Indian Forest Service (IFS) |
| 22nd June 2022 | How India can expand forest and tree cover to meet its Sustainable Development (SDGs) and Climate Goals | Dr. Rajiv Kumar Chaturvedi,<br>Assistant Professor at BITS Pilani,<br>K. K. Birla, Goa Campus. |

## Health Talk Series (Health)

PKC's Health talk series aims to promote active discussions on mapping, tracking, mitigation, and understanding the impact of diseases at a city level. The series hosts talks, stakeholder meetings, and workshops to highlight health issues that plague the city and potential measures for their mitigation. It will also showcase research, and clinical and technological advances in the healthcare ecosystem.

| Date | Topic | Speaker |
|---|---|---|
| 7th- 8th July 2022 | Targeted therapies in Oncology | Dr. Anuradha Choughule, Professor & Faculty Scientist, Homi Bhabha National Institute (HBNI) Consultant Molecular Laboratory,Medical Oncology at Tata Memorial Hospital (TMH), Mumbai. |
| 17th May 2022 | Prevention and Control of Hypertension | Dr. Harshal Pandve, Professor & Head, Dept. of Community Medicine (PSM), PCMC's PGI-YCMH, Pimpri, Pune |
| 28th June 2022 | Importance of Epidemiology from a Public Health Perspective | Dr. Prakash Doke, Professor, Department of Community Medicine, MGM Medical College |
| 27th July 2022 | Evidence-based Decisions in Healthcare: The Role of Statistics | Dr. Chitra Lele, President & Founder, Actu-Real, Inc. |

## Sustainable Mobility

PKC's Sustainable Mobility talk series aims to foster active discussions on the use of effective and sustainable transportation systems for cities.

| Date | Topic | Speaker |
|---|---|---|
| 26th Feb 2022 | PKC National Science Day special talk: Electric and Sustainable Mobility | Mr. Manoj Kumar Daniel, Deputy General Manager, Maha-Metro Rail Corporation Limited Pune<br><br>Dr. Rahul Walawalkar, Founder & President, India Energy Storage Alliance (IESA), President & MD, Customized Energy Solutions India Ltd.<br><br>Dr. Sushil Ramdasi, Deputy Director, Powertrain Engineering Laboratory, Automotive Research Association of India (ARAI) |

# STEM Popularization Talks

## a) Popularization of Citizen Science

| Date | Topic | Speaker |
|---|---|---|
| 22nd July 2021 | Finding features in Galaxies: Introductory Lecture 1 | Prof. Ajit Kembhavi, Principal Investigator, PKC |
| 24th July 2021 | Finding features in Galaxies: Introductory Lecture 2 | Prof. Ajit Kembhavi, Principal Investigator, PKC |
| 27th July 2021<br>31th July 2021<br>4th Aug 2021<br>8th Aug 2021 | Finding features in Galaxies:<br>Training Session 1<br>Training Session 2<br>Training Session 3<br>Training Session 4 | Prof. Sudhanshu Barway, Assistant Professor, Indian Institute of Astrophysics, Bangalore |
| 28th Feb 2022 | One Million Galaxies! Launch event | 1. Prof. Kembhavi (Principal Investigator, PKC)<br>2. Prof. Barway (Assistant Professor, Indian Institute of Astrophysics, Bangalore)<br>3. Dr. Ashish Mahabal (Lead Computational and Data Scientist, California Institute of Technology)<br>4. Prof. Changbom Park (Professor, Korea Institute for Advanced Study)<br>5. Dr. Disha Sawant (Assistant Program Manager, PKC) |
| 13th July 2022 | The Search for Alien Life in our Galaxy | Dr. Ravi Kopparapu , Scientist at NASA Goddard Space Flight Center |

### b) Conversations with Women Role Models in STEM

An initiative which aims to bring forward the journey of women in various fields of Science, Technology, Engineering & Mathematics (STEM). This series is conducted in an informal conversational format to help the audience relate to the lives of successful women professionals in S&T, knowing first-hand about their success stories, their failures, and how they moved ahead to make a mark in their field. We hope this initiative will inspire young women to break gender stereotypes, societal barriers and encourage them to pursue careers in STEM.

| Date | Topic | Speaker |
|---|---|---|
| 30th June 2022 | My Journey in Chemistry | Dr. Shobha Waghmode, Professor & Head, Department Of Chemistry, MES Abasaheb Garware College, Pune. |
| 30th July 2022 | My Pursuit of a Research Career in Drug Discovery | Prof. Sadhana Sathaye, Professor of Pharmacy, Institute of Chemical Technology (ICT), Mumbai. |

## Interdisciplinary Training Programs & Courses

PKC in collaboration with diverse stakeholders conducts courses and training programs with an aim to empower students, young researchers and working professionals with employability skills pertaining to Industry, academia, entrepreneurship.




Responsible Artificial intelligence (5 April - 22 March 2021), in partnership with Persistent Systems Ltd.

## Impact

14 training courses across different technical domains of science, technology, and innovation have been conducted so far (Fig. 1) by experts from different partner organizations including R & D organizations, academic institutions, and incubation centers (Fig. 2).

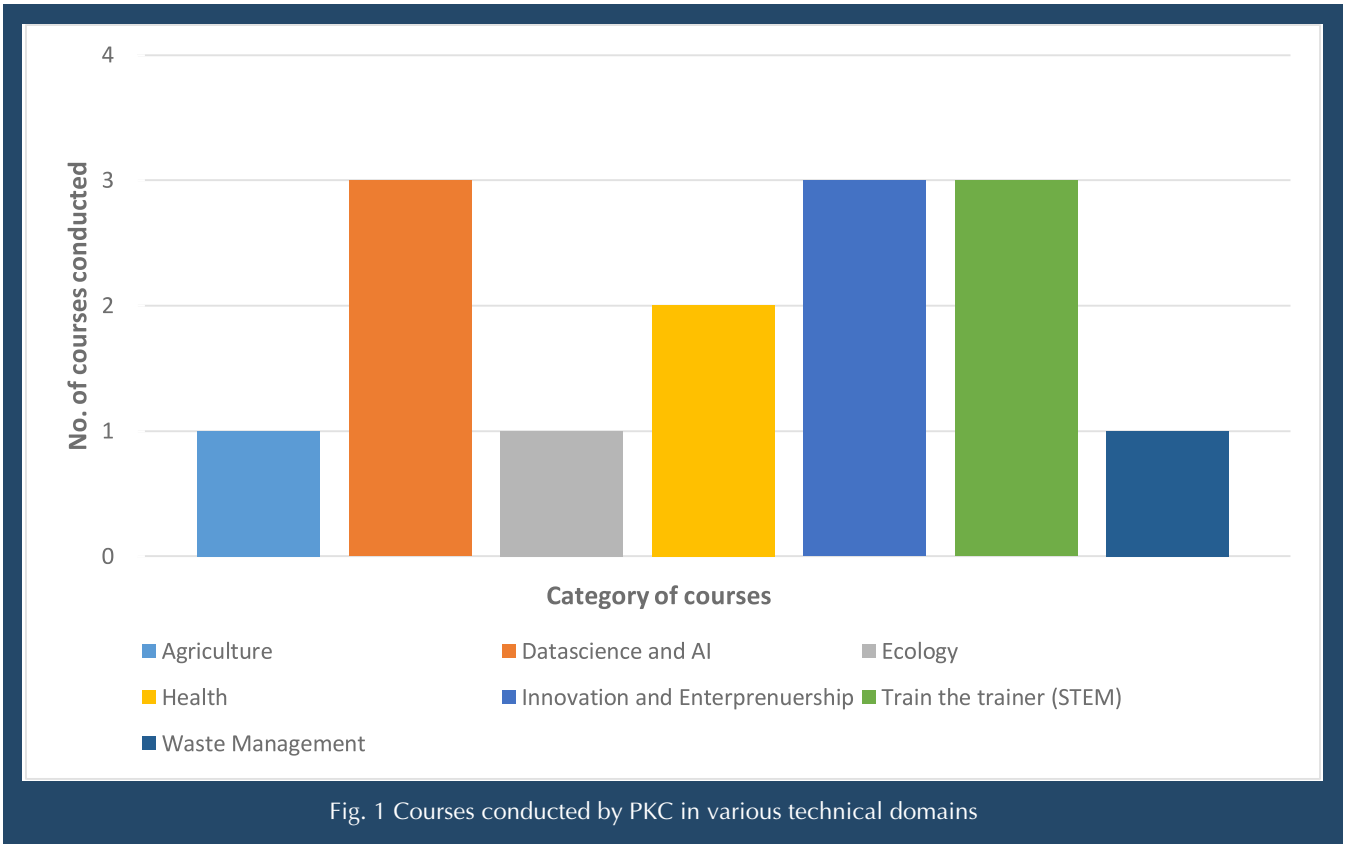



Fig. 1 Courses conducted by PKC in various technical domains

A total of 727 individuals benefited from the various courses conducted by PKC. (Fig. 3). 53% of the participants were females (Fig. 4), 23% were students, 40% were teachers and 37 % were working professionals (Fig. 5).

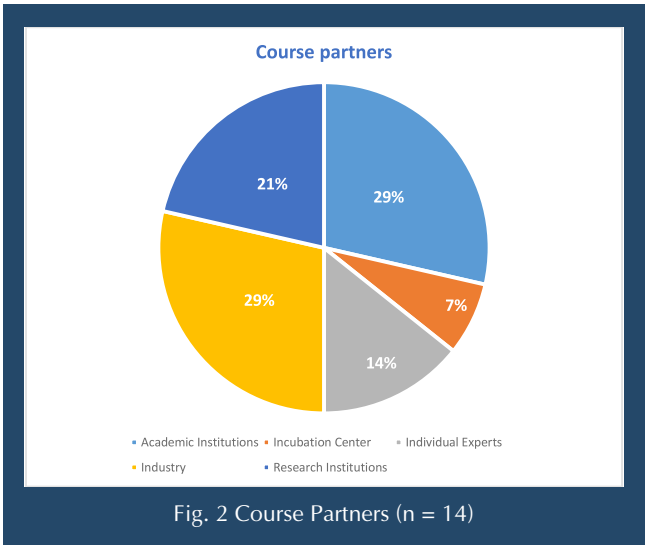



Fig. 2 Course Partners (n = 14)

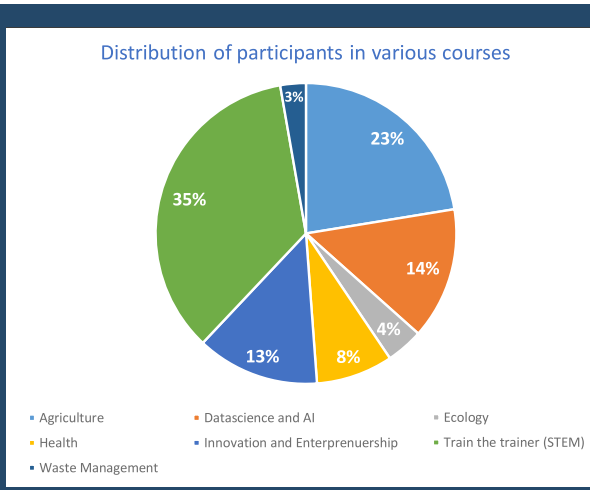



Fig. 3. Distribution of participants in various courses (n = 727)

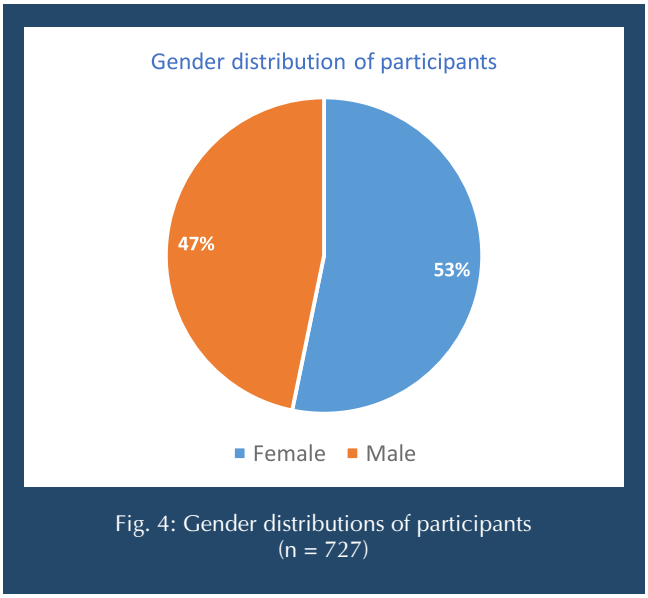



Fig. 4: Gender distributions of participants (n = 727)

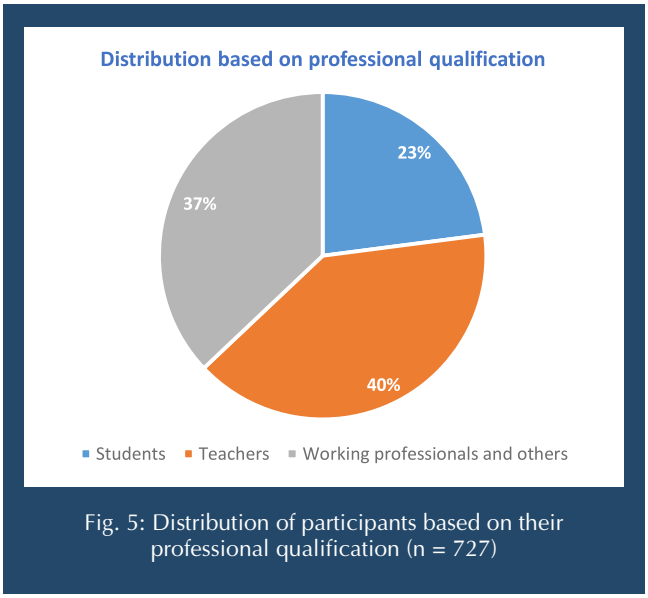


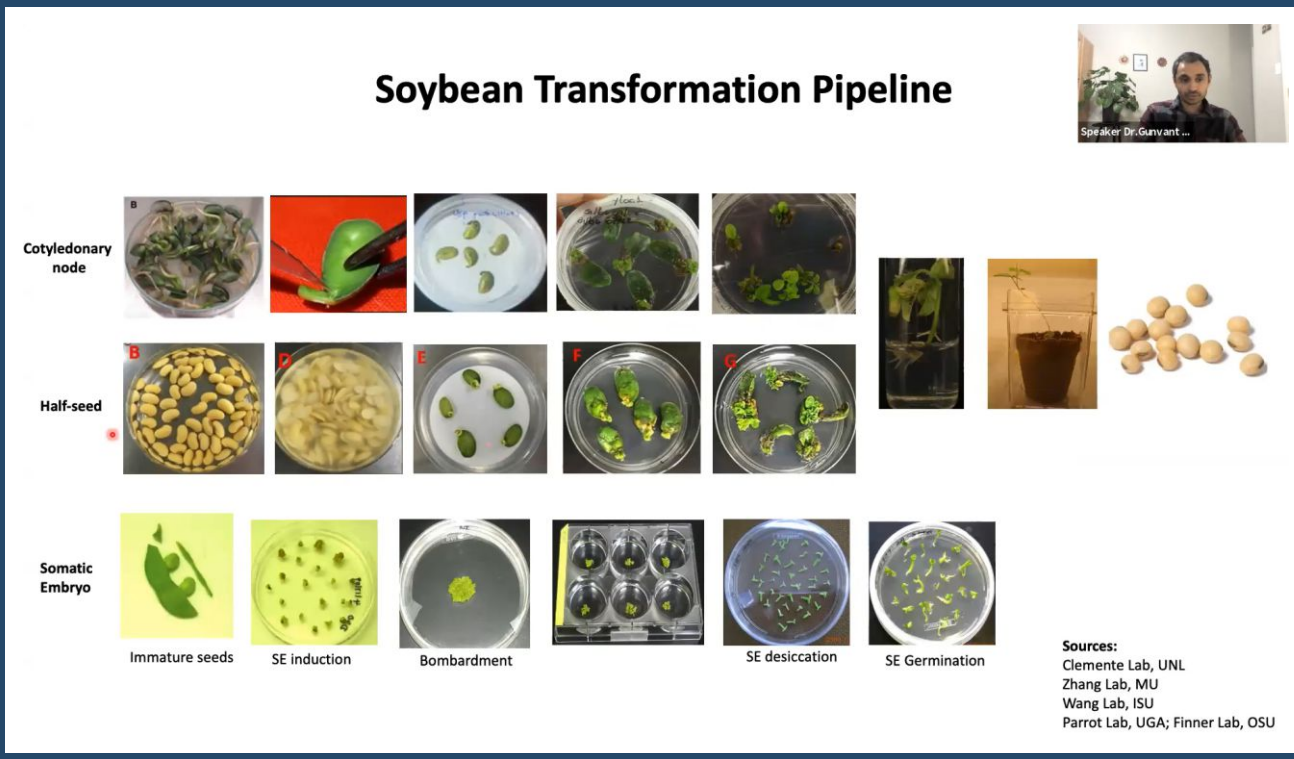

Fig. 5: Distribution of participants based on their professional qualification (n = 727)

## Details of courses conducted by PKC during Jan 2021- May 2022

| Title | Partner Organisation | Date | Total Sessions | Total Beneficiaries |
|---|---|---|---|---|
| A virtual Course on Vaccine production, Basics, Pitfalls, and Troubleshooting (An industry perspective on vaccine production) | Serum Institute of India, PVT.LTD, Pune | 15th Jan '20 - 5th Feb '21 | 10 | 28 |
| Microbial Processes for Energy Recovery from Organic Wastes (Theoretical knowledge and industrial know-how on working of microbial biofuel cells ) | Agharkar Research Institute, Pune | 15th Feb - 26th Feb '21 | 12 | 20 |
| Skills for Innovators (Soft skills and management principles for effective innovation and entrepreneurship) | Venture Center, Pune | 16th Feb - 25th Feb '21 | 4 | 13 |
| Natural language processing (NLP) acceleration Program (latest trends and techniques in NLP ) | Icertis, Pune | 8th April - 25th May '21 | 9 | 48 |
| A primer on biodiversity and ecology of Freshwater ecosystems of the western ghats (A food chain-based approach to learning biological components of the freshwater ecosystem in western ghats) | Agharkar Research Institute, Pune | 15th April - 30th April '21 | 9 | 29 |

| Title | Partner Organisation | Date | Total Sessions | Total Beneficiaries |
|---|---|---|---|---|
| Responsible Artificial Intelligence (Current status, challenges, and future opportunities ) | Persistent Systems, Pune | 5th April - 31st May '21 | 15 | 23 |
| Plant Breeding Today: New Techniques, New Skills (Real-time development of new varieties by molecular methods) | Dr. Vidya Gupta (CSIR- NCL, Pune), Prof. Sujata Bhargava (Dept Of Botany, SPPU) | 14th June - 25th June '21 | 10 | 163 |
| Understanding and exploring Epidemiology (Concepts and methods in modern times) | School of Health Sciences, (SPPU) | 20th July - 27th August '21 | 10 | 32 |
| Entrepreneurial skills development course for young researchers in biotechnology (Idea generation, opportunity evaluation, company formation, funding opportunities for biotech start-ups) | Agharkar Research Institute, Pune | 11th Oct - 29th Oct '21 | 20 | 63 |
| Starting the Innovation Journey (Basics and best practices in innovation) | Dr. Aditya Gondhalekar, Capgemini, Pune | 20th- 27th Nov - 4th Dec '21 | 3 | 20 |
| Concepts in science and Skill Development Program विज्ञान विषयातील संकल्पना आणि कौशल्य विकसन कार्यक्रम (Bilingual pedagogy training for teachers) | District Institute of Education and Training (DIET), Pune | 18th Oct '21 - 10th Jan '22 | 12 | 194 |
| Course with Hands on Training: Artificial Intelligence and Machine Learning in Cyber Security (Primer on IBM's industry-leading Security Intelligence solutions for aspiring Cyber Security Professionals) | IBM India Software Labs (ISL) | 28th Feb - 4th April 2022 | 12 | 32 |
| STEM Teacher Training Workshop (Pedagogy training using hands-on activities and science toys) | SPPU science park, Savitribai Phule Pune University | 21 - 22 April 2022 | 4 | 40 |
| Tools and Techniques in STEM Education (Pedagogy training using hands-on activities and foldscope) | Ajeenkya DY Patil University,Pune | 27 May 2022 | 1 | 22 |




Plant Breeding Today: New Techniques, New Skills (14 - 25 June 2021)

# STEM INITIATIVES





As per predictions by the National Science Foundation, 80% of jobs in the next decade will require skills pertaining to Science, Technology, Engineering, and Mathematics (STEM). Exam-focused learning model which emphasizes more on fact memorization or rote learning is leading to a lack of creativity, innovativeness, and problem-solving skills in Indian students. Therefore there is a need for including inquiry-based learning modules to be incorporated in school curriculum along with development of skill sets like digital literacy and sustainability amongst students.

Pune Knowledge Cluster is deeply engaged in programs that encourage teachers to adopt pedagogical techniques focused on inquiry-based teaching and learning with the use of digital tools. The programs are especially run in schools that are low on resources with an emphasis on engaging in hands-on activities for experiential learning.

PKC has two ongoing STEM initiatives:

- Improvement Programs for STEM Teaching & Learning in Classrooms
- Support Programs for Women in STEM



## Objectives

- In line with NEP 2020, foster critical thinking, analytical ability, logical reasoning and curiosity
- Encourage teachers to adopt pedagogical techniques focusing on inquiry-based, hands-on learning
- Follow a train-the-trainer approach for scaling initiatives
- Setting up or strengthening of Atal Tinkering Labs in schools
- Focus on the use of digital tools, introduce AI and ML in high schools
- Create a digital repository of STEM resources

## Improvement Programs for STEM Teaching-Learning Methodologies in Classrooms

### Ongoing Projects

### Capacity building of school teachers in STEM

PKC in collaboration with the local administrative authorities has been actively involved in creating programs for teachers in government schools in and around Pune.

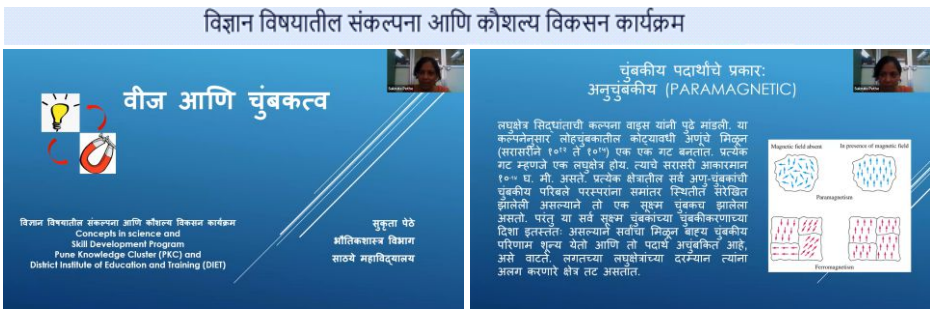



PKC team at the launch of 'Shala Sudhar Karyakram' organized by Pune Zilla Parishad and District Institute of Education and Training (DIET), Pune at The Divisional Commissioner's Office on 6th May 2021. Launched by Hon. Deputy Chief Minister Shri. Ajit Pawar, the Shala Sudhar Program aims to improve the quality of school infrastructure and teaching in and around Pune.

### Concepts in Science and Skill Development Program (विज्ञान विषयातील संकल्पना आणि कौशल्य विकसन कार्यक्रम)

PKC and District Institute of Education and Training (DIET), Pune surveyed 1500+ school teachers in the Pune district, to understand gaps in teaching methodologies for STEM. Pedagogical methods were designed based on the analysis of the data collected and over 450+ teachers from Pune Zilla Parishad schools were trained on using these methods for effective classroom and virtual teaching.



**Hands-on STEM Teacher Training**

PKC in collaboration with the Center for Science Education and Communication (CSEC), Savitribai Phule Pune University (SPPU) organized a 2 Day Hands-on STEM Teacher Training Workshop on 20th and 21st April 2022. The workshop was attended by 42 school teachers teaching 6th to 9th grades.

The workshop focused on hands-on training and conceptual understanding of scientific topics which teachers face challenges in teaching using conventional methods. This workshop was funded by Lenovo India under PKC's 'Teach with Tech' initiative.








## Improvement Programs for STEM Teaching-Learning Methodologies in Classrooms

### Ongoing Projects

### Digital Literacy Skill Development Programs for Students

PKC in collaboration with Lenovo India implements a program called 'Teach with Tech' a two-tier STEM program for school students from 6th to 9th grade and their teachers to complete parenthesis. This project aims to provide an opportunity to students and teachers to access and adopt digital content related to science, mathematics and technology. PKC works with five schools - Vidyapeeth School (Pune University campus), Modern High School (Ganeshkhind), Shivaji Vidya Mandir (Aundh), Gholap High School (Sanghvi) and Nutan Marathi Vidyalaya Girls School (Sadashiv Peth) in Pune.












## Planned Projects

### a. Gamification in STEM Learning

PKC is working with a group of education experts to develop programs which include gamification at the curriculum level in schools. It aims at designing and developing gaming software/tools and training programs that are mapped with school and undergraduate curriculum at elementary & secondary levels. The training programs will be designed to train teachers to develop and design game based tools in alignment to NEP 2020. The broad objective is to create a pool of trained teachers (train-the-trainer approach), who will in turn train more teachers which will benefit a larger group of students. In the course of time, a repository of game-based teaching-learning platforms will be developed through a participatory approach and deployed at scale.

### b. STEM labs

The Atal Tinkering Labs (ATLs), established across the country by Atal Innovation Mission (AIM), NITI Aayog, aim to foster curiosity, creativity, and imagination in young minds; inculcate skills such as design mindset, computational thinking, adaptive learning, computing, etc. PKC aims to integrate various themes aligned with its verticals such as air pollution, sustainable mobility, water management, solid waste management, public health and effective education with ATL-based activities and develop innovative projects to solve problems of the city. PKC aims to identify gaps in the use of already existing ATL STEM labs in the city to enable their strengthening. PKC also will enable ATLs to train teachers and students to utilise the ATL labs effectively. PKC aims to pilot this program in 5 ATLs STEM labs in Pune.

## Support Programs for Women in STEM

PKC is committed towards enhancing the participation of women in basic and applied sciences through mentoring, research and scholarship programs.

### Ongoing Project

**WEnyan Scholarship**
**& Mentoring Program for Women in Chemistry**

An initiative by Pune Knowledge Cluster and BASF Chemicals India Private Limited, the program aims to offer funding support, mentorship and entrepreneurial skill development to deserving women candidates in Maharashtra. Scholarships and grants are offered to women from marginalized communities at the undergraduate and post graduate level for pursuing research or entrepreneurship in Chemistry and allied areas. Through this initiative, PKC aims to increase enrollment and retention of women in scientific streams creating a more gender-equal workforce.




Wenyan Awareness Sessions:- Left -Guru Nanak College of Arts, Science, and Commerce, Mumbai, 23rd June 2022, Top Right: Guru Nanak Institute of Research and Development (GNIRD) Mumbai, 22nd June 2022. Bottom Right: Yashwantrao Bhonsale College of Pharmacy, Sawantwadi, 24th May 2022. PKC conducted WEnyan Awareness Sessions in 22 colleges across various districts of Maharashtra. between April - June 2022. Sessions were attended by 1442 students.

# Partners

## Funding Partners

BASF We create chemistry

Lenovo

## Program Partners

पुणे जिल्हा परिषद . पुणे

जिल्हा शिक्षण व प्रशिक्षण संस्था, पुणे
District Institute of Education and Training (DIET) Pune

VENTURE CENTER

TATA CONSULTANCY SERVICES

COMMITTEE ON DATA CODATA INTERNATIONAL SCIENCE COUNCIL

SERUM INSTITUTE OF INDIA PVT. LTD.
Cyrus Poonawalla Group

IBM

Persistent

Icertis

ARI

# PARTNERS

| FUNDING |
| --- |
| BASF Chemicals India Private Limited |
| Cummins Foundation |
| Hindustan Unilever |
| Lenovo India |
| Persistent Foundation |
| Rockefeller Foundation |
| Schlumberger |
| University of Southampton |
| ACADEMIC ORGANIZATIONS |
| Armed Forces Medical College, Pune |
| BJ Medical College, Pune |
| Dr. Bhanuben Nanavati College of Architecture for Women, Pune |
| Indian Institute of Science Education and Research, Pune |
| Jnana Prabodhini Foundation, Pune |
| Maharashtra University of Health Sciences, Nashik |
| Savitribai Phule Pune University, Pune |
| Symbiosis International University, Lavale, Pune |
| Symbiosis Medical College for Women, Pune |
| Symbiosis Statistical Institute, Pune |
| RESEARCH ORGANIZATIONS |
| Agharkar Research Institute, Pune |
| Automotive Research Association of India, Pune |
| Centre for Development Of Advanced Computing, Pune |
| Centre for Materials for Electronic Technology |
| Christian Medical College, Vellore |
| CSIR-Centre for Cellular and Molecular Biology, Hyderabad |
| CSIR-National Chemical Laboratory, Pune |
| Deenanath Mangeshkar Hospital |
| Defence Institute of Advanced Technology, Pune |
| FLAME Centre for Earth and Environment, FLAME University, Pune |
| King Edward Memorial Hospital and Research Centre, Pune |
| National Centre for Biological Sciences, Bengaluru |
| Noble Hospital, Pune |
| Symbiosis University Hospital and Research Centre |
| Wildlife Research & Conservation Society, Pune |

# PARTNERS

| SOCIETIES & ASSOCIATIONS |
|---|
| CODATA National Committee |
| Indian Academy of Sciences |
| Indian National Science Academy |
| Institute of Electrical and Electronic Engineers, Pune |
| Society of Automotive Engineers, India |
| **GOVERNMENT BODIES** |
| District Institute of Education and Training, Pune Zilla Parishad |
| Pune Municipal Cooperation |
| Pune Smart City |
| **INCUBATION/ INNOVATION CENTERS** |
| C4i4 - Center for Industry 4.0, Pune |
| Venture Center, Pune |
| **NGOS & CLUSTERS** |
| Bhujal Abhiyaan, Mission Groundwater, Pune |
| Center for Environment Education, Pune |
| Samuchit EnviroTech, Pune |
| Water Valley, Denmark |
| **INDUSTRY** |
| Genepath Laboratories |
| GI BOTS |
| Icertis |
| Illumina |
| Infosys Springboard |
| International Business Machines |
| Persistent Systems |
| PH Diagnostics |
| Praj Industries |
| Premas Biotech |
| Sahayadri Speciality Labs |
| Serum Institute of India |
| Suburban Diagnostics |
| Suyog Lifecare Diagnostics |
| TATA Consultancy Services |
| Thyrocare |

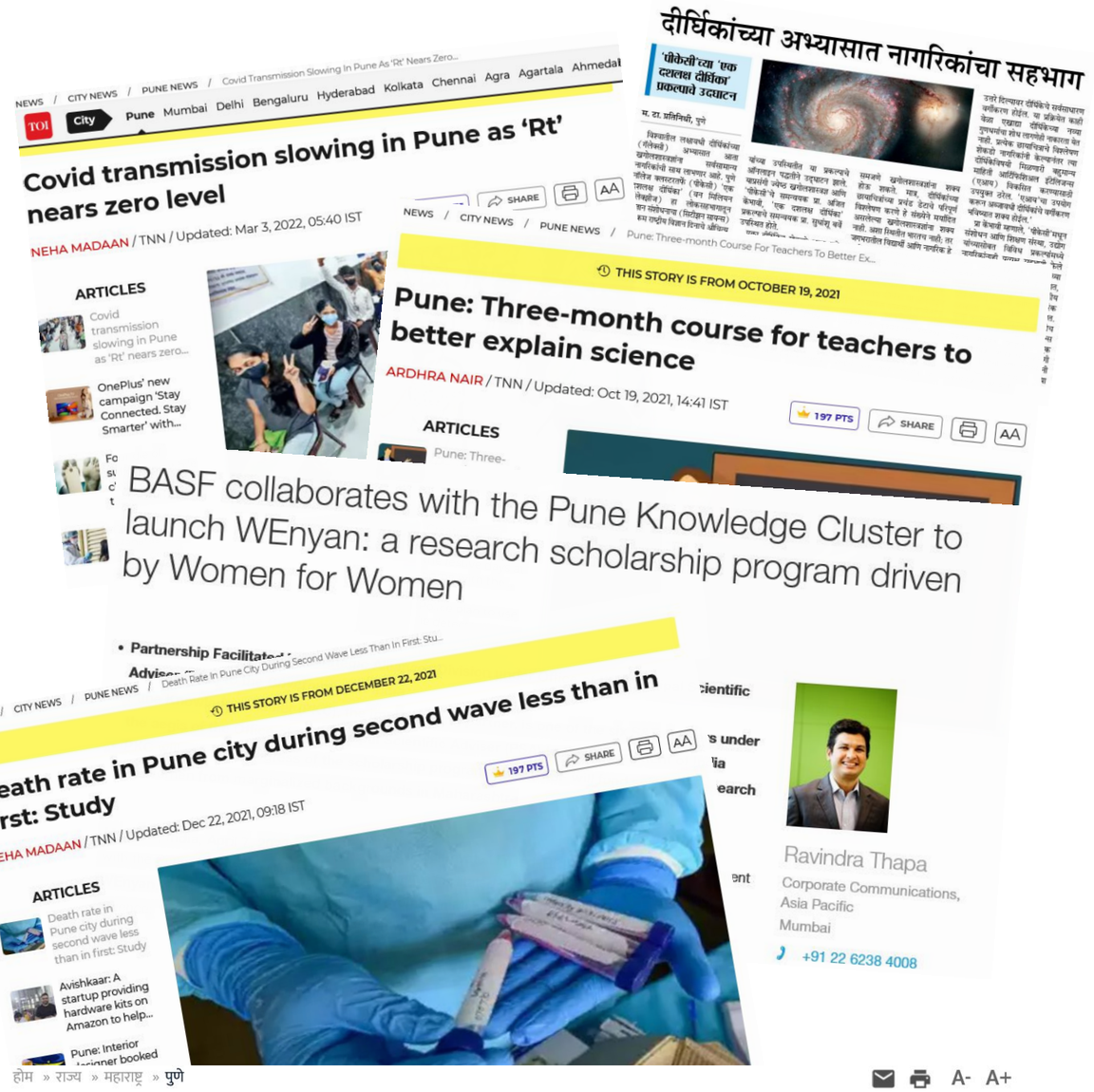
# MoU's & MoA's

PKC has signed Memorandum of Understandings (MoU's)/ Memorandum of Associations (MoA's) with 30 organizations.

| |
|---|
| Ajeenkya D. Y. Patil University, Pune |
| Armed Force Medical College (AFMC), Pune |
| Automotive Research Association of India (ARAI) , Pune |
| BASF Chemicals India Private Limited |
| B. J. Medical College, Pune |
| Centre for Materials for Electronics Technology (C-MET), Hyderabad |
| Centre for Development Studies and Activities, Pune |
| College of Engineering Pune (CoEP), Pune |
| CSIR - Centre For Cellular And Molecular Biology (CCMB), Hyderabad |
| CSIR - National Chemical Laboratory, Pune |
| Defence Institute of Advanced Technology (Deemed to be University), Pune |
| District Institute of Education and Training (DIET), Pune |
| Dr. D. Y. Patil Vidyapeeth, Pune |
| Entrepreneurship Development Center, Venture Center, Pune |
| FLAME Centre for Earth and Environment, FLAME University, Pune |
| GAIA - The Earth Foundation |
| Indian Institute for Science Education & Research (IISER), Pune |
| Infosys Springboard |
| King Edward Memorial Hospital and Research Centre (KEMHRC), Pune |
| Lenovo India |
| MACS - Agharkar Research Institute, Pune |
| Maharashtra University of Health Sciences, Nashik |
| MKSSS's Dr. Bhanuben Nanavati College of Architecture for Women, Pune |
| National Centre for biological Sciences - Tata Institute of Fundamental Research, Bengaluru |
| Savitribai Phule Pune University (SPPU), Pune |
| Symbiosis International (Deemed University) Symbiosis Statistical Institute, Pune |
| Symbiosis International (Deemed University), Pune for and behalf of its Constituents 'Symbiosis Medical College for Women (SMCW)', Pune and 'Symbiosis University Hospital and Research Centre', Pune |
| Symbiosis International University, Lavale, Pune |

IMPACT REPORT | 2020-22

# PKC IN NEWS









**PUNE KNOWLEDGE CLUSTER**

Office Address: 3rd floor, Placement Cell, Savitribai Phule Pune University Campus,
Ganeshkhind Rd, Ganeshkhind, Pune, Maharashtra 411007.
Phone: +91 78238 92474 | Email: contact@pkc.org.in

**www.pkc.org.in**