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In Conversation

Accelerating the Growth of the Indian Drone Ecosystem: An Interview with Smit Shah

— Adita Joshi

The Drone Federation of India (DFI) is a non-governmental, not-for-profit, industry-led body formed to accelerate the growth of the drone ecosystem and make India a global drone manufacturing hub. DFI works with over 200 drone companies and 2000 drone pilots in five focus areas: policy advocacy, trade promotion, skill development, standards, and certification, all of which are executed using a 'community driven approach'.

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Smit Shah at his office, showcasing one of the drones that have landed on his desk.
Image credit: Drone Federation of India

A drone being used for locust control.
Image credit: Smit Shah

India in Focus

Bharat Drone Mahotsav: Celebrating a Paradigm Shift in Indian Socio-Economics

— PSA Content Desk

From faster goods deliveries to the digital mapping of properties, real-time surveillance, and flying taxis, drones can revolutionise the way the world functions.

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Top (Left to Right): Gayatri Kshirsagar, Ashwini Keskar, Prachi Pasalkar, Ajit Kembhavi, Anita Kane, Rashmi Urdhwareshe, Shilpa Jain, Poornima Sangewar, Priyanki Shah, Anupama Harshal, Manjari Desai. Bottom (Left to Right): Shraddha Gargatti, Disha Sawant, Preeti Nema
Image credit: Pune Knowledge Cluster

Science and Technology Clusters

In Conversation with Dr. Priya Nagaraj, Chief Operating Officer of the Pune Knowledge Cluster

— Adita Joshi

The Pune Knowledge Cluster, PKC in short, is one of six city clusters that are a part of the PSA Office's Science and Technology Clusters' initiative. The Pune cluster is anchored at the city-based Inter-University Centre for Astronomy and Astrophysics (IUCAA).

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The Marut Drones team with one of their key innovations, the Hepicopter.
Image credit: Marut Drones

Industry–Academia Engagement

When Sky is not the Limit: Meet Marut Drones, a Startup in the Drone Sector Making India Greener and Healthier

— Aarti Kumar

Five years ago, Prem Kumar and his batchmates from IIT Guwahati, Sai Kumar and Suraj Peddi, started their company, Marut Drones, which had but one mission: solve what has thus far seemed unsolvable.

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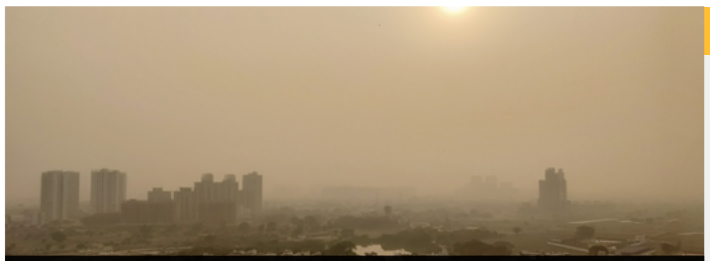

Image for representational purpose only

Events

Kickstarting the National Air Quality Resource Framework of India

— PSA Content Desk

On 22nd June 2022, a Brainstorming Workshop was held at the India International Centre, New Delhi, to kickstart the national mission on the National Air Quality Resource Framework of India (NAFRI).

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IN CONVERSATION

Smit Shah at his office, showcasing some of the drones that have landed on his desk.
Image credit: Drone Federation of India

Accelerating the Growth of the Indian Drone Ecosystem: An Interview with Smit Shah

—Adita Joshi

The Drone Federation of India (DFI) is a non-governmental, not-for-profit, industry-led body formed to accelerate the growth of the drone ecosystem and make India a global drone manufacturing hub. DFI works with over 200 drone companies and 2000 drone pilots in five focus areas: policy advocacy, trade promotion, skill development, standards, and certification, all of which are executed using a 'community driven approach'. Any individual or organisation engaged in drone manufacturing, designing, training, service provision, or software development can become a member of DFI. In this special issue of Vigyan Dhara, we speak to Smit Shah, the man leading the organization.

The drone ecosystem in India is at a turning point and there is no better time than now to join the drone industry. The drone ecosystem is probably going to be at least equal, if not more game-changing than the IT revolution. Smit Shah explains why: *"We have the best drone policy, best financial incentives and the best import policy. It is an opportunity not to be missed."*

The mission to change drone regulations in India

In 2014, the Directorate General of Civil Aviation (DGCA) imposed a blanket ban on the civilian use of drones (photographers, weddings, and film industry, etc.) severely restricting their use. In response, DFI advocated for regularising and legalising the use of drones in the country. Drones

were legalised again in 2018, with the National Drone Policy, but with graded restrictions on manufacturing and operation, and strict compliance requirements. Further, each drone needed to be registered with a Unique Identity Number (UIN) with the DGCA. Getting involved in drone manufacturing, selling, and operations meant undertaking extensive paperwork including applying for multiple licenses, complex procedural requirements, and numerous permissions.

All of this changed with the new 'Drone Rules 2021' introduced in August 2021. Many restrictions were lifted, and the number of permissions or licences needed reduced from 25 to just five. Speaking of how the 2021 rules came about, Shah says, *"I am proud to mention that DFI has played an active role in policy advocacy by representing the industry's views and perspectives to government stakeholders to ensure a regulatory ecosystem that enables the industry's growth while keeping the mandate of safety and security."*

Security forces had their concerns on the negative impact that the technology might have. But Shah reassures, *"We had sensitization programmes, workshops, and technology demonstrations in the strategic defence sector, and also on the potential of this technology in agriculture, disaster management, and healthcare delivery. We put in multiple efforts in sensitizing the stakeholders in the central and state governments, and defence forces, on the multiple benefits that drone technologies can bring about and how these outweigh the very rare possibility of drone technology being misused. We were able to bring about a change in the way this technology and its applications were viewed."*

Now, in 2022, the sky looks clear for a drone ecosystem to soar high, with no permissions needed for research and development in the drone space, and only one key requirement for manufacturing drones—'Type' certification. Every drone still must have a UIN and pilots must have a 'Remote Pilot Certificate' from a remote pilot training school. *"This is similar to driving a registered car with a driver's licence,"* Shah explains.

Drones in industry 4.0

"The drone industry is a representation of how industry 4.0 can evolve to the next era with the use and deployment of automated unmanned vehicles," Shah says. He believes that automation will first be realised in the air as there are no road-related complexities to manage.

"One success story is the agriculture sector," says Shah. *"DFI used a community-driven approach wherein drone manufacturers, service providers, pilots, and pesticide companies conducted sensitization programs for farmer producer organisations (FPOs) and Krishi Vigyan Kendras (KVKs). This resulted in a provision of 100% subsidy for government affiliated institutes, KVKs, and agricultural universities on an expenditure of up to ₹10 lakhs for buying drones. FPOs and rural local entrepreneurs can buy a drone with 75% and 40% subsidy, respectively,"* he explains.

Similarly, pesticide rules were a barrier to the usage of drones in agriculture. DFI worked with multiple technical committees and pesticide companies, the Indian Agricultural Research Institute (IARI), Indian Council of Agricultural Research (ICAR), and the drone industry to facilitate studies to solve this challenge. As a result, the spraying of more than 400 different types of pesticides and other chemicals has been approved by the Ministry of Agriculture for collecting data, based on which full approval can be obtained after two years.

Drones can be used for basic industrial security surveillance, pipeline monitoring, land surveys, and applications in disaster situations like floods and earthquakes. Cargo logistics can also use drones effectively. For example, the delivery of vaccines and critical medicines in areas of the northern Himalayas, Leh Ladakh, and the northeast, where it takes over 4 hours for essential services to reach, will transform with the use of drones. Shah says, *"We have conducted pilot projects with ICMR to showcase this technology—the government will create hubs and centralize the storage, management, and delivery of critical medicines to be delivered anywhere around a 150 km area on a notice of one phone call within 30–60 mins."*

Shah further explains, *"We are expecting about 2–3 lakhs jobs to be created in the drone industry for the youth."* They can enter the drone ecosystem in three broad areas:

1) Design manufacturing: The youth can pursue airplane manufacturing, design, electronics assembly, system integration, programming, etc. Universities and colleges are teaching courses that can help the youth secure good jobs in leading drone companies.

2) Drone operations: The youth can become involved in giving different kinds of demos and trainings; operating drones is a huge requirement in the drone ecosystem. Any person who has graduated class 10 and is 18 years of age can get trained at a DGCA-approved drone training school. Shah explains, *"A five-day course can get one a decent-paying sophisticated job compared to the blue-collar jobs normally available for this age and education."*

3) Data analysis: The youth can work to develop data processing and data analytics software to capture, manage, and analyse the data collected by drones.

Indeed, a drone revolution is brewing, and perhaps, a world in which you fly to your workplace or get food from your balcony could be a mere few years away.

A drone spraying pesticides on crops
Image credit: Smit Shah

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INDIA IN FOCUS

Various types of drones, from locust control to land surveying, disaster response, and public announcements
Image credit: Smit Shah

Bharat Drone Mahotsav: Celebrating a Paradigm Shift in Indian Socio-Economics

—PSA Content Desk

From faster goods deliveries to the digital mapping of properties, real-time surveillance, and flying taxis, drones can revolutionise the way the world functions. Showcasing this potential, India organised its first national-level festival on drones this year, the Bharat Drone Mahotsav or Drone Festival of India—"India's largest drone conference!" The two-day event held on 27th and 28th May at Pragati Maidan, New Delhi, was filled with stunning moments of live open-air demonstrations on a variety of drones or unmanned autonomous vehicles (UAVs)—nearly all of which were 'Made in India'—product launches of some pioneering technology, and a drone expo. It also hosted lectures and panel discussions focused on Drone Rules 2021, the drone airspace map, PLI scheme, Drone Traffic Management Policy, and Drone Import Policy.

Hon'ble Prime Minister Narendra Modi inaugurated the forum, interacted with Kisan drone pilots and startups, and handed out 150 remote flying certificates. He even flew a drone himself! In his address to the crowd, he highlighted how drones are a smart tool that will become part and parcel of people's lives, rising in use in agriculture, healthcare, sports, defence, disaster management, traffic control, and more. His speech highlighted that drones will especially impact those areas where speed is of the essence (delivery of healthcare products and services being an example). He said that *"drone technology is another medium of advancing our commitment to good governance and ease of living."*

The festival comes merely ten months after the Central Government finalised the Liberalised

Drone Rules 2021. These rules were created with the aim to essentially open up the airspace to the people. The rules do away with extensive paperwork and permissions and expand the potential flying zones for drones. The new rules also make it much simpler to become a licensed pilot, allow increased investment in drone tech from both domestic and foreign bodies, allow small drones to be flown across short distances permission-free, and cover much larger UAVs than before, including drone taxis.

Keeping up with the times, these rules have truly opened doors to the realisation of India's potential to become a global drone hub by 2030. For after all, as union aviation minister Jyotiraditya Scindia said at the event, *"Today, there are 270 drone startups in India."* And more are being built. These innovators are keen on solving some of India's biggest problems, things that have remained challenges for decades but might now finally have solutions with drone technology applications.

Making reference to perhaps one of the most awe-inspiring of drone innovations, the flying taxi for the common man, Scindia said earlier in 2021, *"I believe this is very much possible."* The Bharat Drone Mahotsav 2022—through its expos and in-depth discussions on drone manufacturing, insurance in the drone sector, testing and certification, commercial applications, drones in agriculture, and drone data processing—is a celebration of these incredible application possibilities, and more that we have yet to imagine in the burgeoning drone industry.

In an indirect way, the festival also is a celebration of India's acceptance of the power of drones and the additional government policies that reflect that. For instance, the production-linked incentive (PLI) scheme announced for aviation provides the drone industry a total incentive of ₹120 crores over three years to promote the growth of the drone manufacturing sector in India.

Smit Shah, President, Drone Federation of India, explained other government incentives in an interview for this issue: *"If you are doing a business of ₹100 crores and ₹25 crores is your raw material, meaning the remaining ₹75 crores is either your profit margin, cost of labour, salaries, processing costs, etc., the government has proposed a 20% cashback on these ₹75 crores of value creation. If you compare this with other industries such as automobile or electronics, the requirement is minimum investment, minimum job creation, and minimum revenue. For a drone manufacturing company, the eligibility is just ₹2 crores of revenue and for a drone components company, it is ₹50 lakhs of revenue just to ensure that the company trying to avail the incentive is serious about doing business."*

These incentives are key to promoting drone manufacturing in India. At present, since the drone manufacturing ecosystems in several other countries is more developed than that of India, sometimes, people simply import finished products to sell in India. There is no local value addition or job creation. In conversation with us, Smit Shah further explains, *"To boost domestic manufacturing of drones in India, the government has introduced a drone import restriction policy, which calls for a complete ban on the import of drones as a completely built unit or a semi-built unit, or any form of built product. One can import parts, or a foreign company can bring their products."*

Smit Shah was a key presence at the Bharat Drone Mahotsav, which brought together over 1600 delegates that included government officials, foreign diplomats, armed forces, central armed police forces, public sector undertakings, private companies, and drone start-ups. More than 70 exhibitors showcased various drone use cases. At the event, India witnessed a snapshot of its potential in the drone technology space.

A wildlife conservation drone on duty
Image credit: Smit Shah

SCIENCE AND TECHNOLOGY CLUSTERS

Top (Left to Right): Gayatri Kshirsagar, Ashwini Keskar, Prachi Pasalkar, Ajit Kembhavi, Anita Kane, Rashmi Urdhwareshe, Shilpa Jain, Poornima Sangewar, Priyanki Shah, Anupama Harshal, Manjari Desai. Bottom (Left to Right): Shraddha Gargatti, Disha Sawant, Preeti Nema
Image credit: Pune Knowledge Cluster

In Conversation with Dr. Priya Nagaraj, Chief Operating Officer of the Pune Knowledge Cluster

—Adita Joshi

The Pune Knowledge Cluster, PKC in short, is one of six city clusters that are a part of the PSA Office's Science and Technology Clusters' initiative. The Pune cluster is anchored at the city-based Inter-University Centre for Astronomy and Astrophysics (IUCAA). We spoke to Dr. Priya Nagaraj, who is the first Chief Operating Officer (COO) of PKC.

During her stint with the deep-tech startup ecosystem with Venture centre, Pune, and Deshpande Startups in Hubli, Dr. Nagaraj's interactions with entrepreneurs helped her learn the nuances of multitasking, operating with minimal resources, raising and managing funds, and recruiting good human resources, all of which is in alignment with her new role. Her experiences prepared her well to handle uncertainties, be open to new ideas and be able to take constructive criticism. These, she believes, will help her sail through her new journey. In this interview, she talks about the cluster's goals, focus areas in the context of national science and technology missions, her experience of working with the local government and industry, and what it means to be a woman leader in STEM.

The five focus areas at PKC

The Pune cluster is focusing on five interlinked areas: health, sustainability and environment, sustainable mobility, big data analytics, artificial intelligence, and capacity building including that in STEM education. The needs, and existing scientific and technological capabilities, of the city went on to be PKC's guiding principles. And alignment with those priorities ensures interest and commitment from the partner organisations, and thus improves the chances of actual ground implementation. *"Thought leaders and stakeholders who have seen the city grow over the years came together to decide the areas PKC will work on,"* says Dr. Nagaraj.

"We aim to bring together local government bodies, academia, R&D institutions, and industry in Pune and surrounding areas to address challenging problems specific to the region through innovative means, using scientific knowledge and engaging highly skilled humanresources".

—Dr. Nagaraj when asked about the goals of PKC

First steps: creating a framework

PKC has analysed problems in and around the city using a data-driven approach. Dr. Nagaraj shares, *"We used available data to map and analyse why certain solutions did not work before we decided to invest time and resources in proposing and building new solutions via the cluster. We believe that this will be important for policy recommendations in the long run."*

PKC is soon to be registered as a Section 8 company to allow operational flexibility and foster smooth involvement of industries, research organisations, and industry bodies to enable a participatory approach while addressing local issues. Collaboration requires a shared understanding of issues and so, bringing multiple stakeholders on board is a challenge at times.

"Timely alignment of all partners in committing to activities for the well-being of a city in terms of time, resources, and capabilities does not necessarily always match. Managing this well can save a valuable amount of time. Working with multiple stakeholders requires patience, an open mind, and wisdom to be able to collect opinions from different partners and be able to meaningfully distil these inputs and channel them to achieve constructive outcomes."

— Dr. Nagaraj when asked about what her learnings were in her current role.

National missions at the Core of PKC activities

PKC has partnered with the Delhi science and technology cluster's Delhi Effective Education and Pedagogy Cluster (DEEP-C) to develop and implement STEM programs in alignment with the National Education Policy 2020 (NEP 2020). The goal is to create a multi-city 'Centre of Excellence' for STEM with focus areas such as augmenting digital literacy, teachers' training for digital pedagogy, gamification for learning, developing and imparting sustainability skills to students, and setting up STEM labs.

Talking about the initiatives concerning the Green India Mission, National Biodiversity Mission, and nationally-determined contributions to the United Nations Framework Convention on Climate Change (UNFCC), Dr. Nagaraj says, *"We want to build climate resilience for the city of Pune through our sustainability and environment vertical. We have programmes for increasing the vegetation cover by developing sustainable plantation models based on vegetation interactions studied in natural forests."* The resultant increase in vegetation cover will not be random but will contribute to carbon sequestration, biodiversity, and increased livelihoods.

Working with the local government and industry

Dr. Nagaraj mentions that local bodies have data, but it is not adequately organised for appropriate utilization in decision-making. PKC started working with the Pune Municipal Corporation (PMC) for Pune Smart City on digitising tree census' The census is currently done manually without much technology intervention. PKC is helping the municipal corporation organise and collect data in a faster and more efficient way to create a digital resource that would enable analytics to understand historic changes in tree populations and enable predictions on achieving the current goals of carbon sequestration.

Industries are increasingly seeing value in funding technology development, piloting, and deployment, which is 'kind of the second generation of CSR thinking'. Dr. Nagaraj feels that the role of the PSA Office in providing insights on industry philosophies for CSR funding and access to relevant networks to explore various funding opportunities has been crucial.

On career shifts, women leadership, and professional experiences

Dr. Nagaraj agrees that woman leaders have to put in extra effort to get the desired recognition and acknowledgement. She feels women must not underestimate their capabilities and play down their knowledge and skills. Further, the number of good mentors who promote and support women leaders is low; Dr. Nagaraj admits how she missed having a good mentor for getting guidance and support.

> *"The journey should not be lonely; it should be supportive and we have to make a conscious effort as a community to make sure that this happens"*
>
> —Dr. Nagaraj on support for women in industry

Dr. Nagaraj is optimistic about the future of women leaders and shares, "*Recently both the private and government sectors have embraced policies to increase women's representation in senior management and decision-making bodies".*

She mentions the STIP policy recommendations on supporting women by giving dual recruitment policies, flexible working hours, adequate parental leave, and childcare support. She is positive that if such transformation happens in a top-down manner, it will trickle down and result in a significant transformative change.

Dr. Nagaraj has had an interesting career trajectory, from being a researcher, to joining the pharma industry, moving on to a startup ecosystem, and building and harnessing capacities in science and technology. Dr. Nagaraj feels that for a researcher to change career trajectories, building diverse and versatile skillsets is extremely important. She emphasizes that skills in management, communication, financial management, and networking impart confidence and can ensure success. *"It takes time to find something that you enjoy doing. Very often, the only way to find out is to hold your breath, take the plunge and find that you can swim."*

You can read more about the Pune Knowledge Cluster and their work at https://pkc.org.in/

ABOUT THE AUTHOR

Adita Joshi is a science education and communication consultant, and a freelance science writer

INDUSTRY–ACADEMIA ENGAGEMENT

The Marut Drones team with one of their key innovations, the Hepicopter.
Image credit: Marut Drones

When Sky is not the Limit: Meet Marut Drones, a Startup in the Drone Sector Making India Greener and Healthier

—Aarti Kumar

Five years ago, Prem Kumar and his batchmates from IIT Guwahati, Sai Kumar and Suraj Peddi, started their company, Marut Drones, which had but one mission: solve what has thus far seemed unsolvable. *"We see problems around us every day, from diseases like malaria and dengue to the lack of healthcare access in deep, rural areas. And we thought, we have drone technology now; why can't we find their solutions?"* says founder and innovator Prem Kumar. From planting forests to delivering medicines, Kumar's startup Marut Drones is pioneering technology in the drone space in India and providing solutions for many of the environmental and social problems affecting us today.

How the fire to solve a 70-year-old problem led to creation of Marut Drones

The journey towards building Marut Drones began in 2017, when Kumar wanted a solution to the swarms of mosquitoes breeding in the water body near his parents' house. *"The approach back then was to ask people to wade into the water to apply larvicides. This was difficult and inefficient, and the municipality seemed reluctant to undertake this activity when we wrote to them. So, one day, the idea struck us: Can't we use a drone to do this,"* Kumar recollects. The team did not register as a company right away. Instead, they started working on the drone that would become one of Marut's strongest offerings—the Marut Zap.

The Marut Zap spraying a water body.
Image credit: Marut Drones

One of the biggest challenges the team faced was that they were all engineers and needed subject-matter experts to collaborate with. This is where the Research and Innovation Circle of Hyderabad (RICH) came in. The team spoke with Ajit Rangnekar, the Director General at RICH, who put them in touch with CSIR's Indian Institute of Chemical Technology (IICT) as well as experts in public health and entomology. *"RICH has supported our journey since the very beginning, even before we were a company,"* says Kumar. *"When everyone else was telling us we should give it up because our goal is impossible to achieve, RICH had the vision to believe in us and encouraged us to move forward. Without them, it would have been much more difficult for us to make it this far,"* he added.

After understanding the science behind the issue, the team developed a drone capable of spraying larvicides, equipped with an Internet-of-Things (IoT) device that can identify the population, species, and other information on mosquito populations. *"Next, we thought of how we can scale this solution. Starting our own company seemed the obvious step,"* says Kumar. Today, Marut Zap, India's first mosquito eradication drone, has already covered over 1 lakh acres around 150 lakes and impacted more than one million lives.

Planting one billion trees by 2030

Another interesting project at Marut Drones is the Seedcopter. This drone has already planted over 50 lakh trees in 30+ districts in the past year across Telangana and Arunachal Pradesh. *"This year, we are aiming to target deforested areas and areas prone to forest fires across seven states, which is going to impact 900 forests and empower 1400 districts,"* says Kumar.

The Seedcopter dispersing seeds.
Image credit: Marut Drones

As part of their afforestation initiative, the team at Marut Drones works with the State Forest Departments and the Principal Conservation Officer to draw up a list of areas that are most in need of afforestation. Local tribal groups and self-help groups prepare seed balls that are then dispersed by the Seedcopter drone. *"We have roped in many pre-eminent environmentalists and Padmashri winners like Jadav Payeng (Forest Man of India), Daripalli Ramaiah, and Saalumarada Thimakka. We are all part of the largest afforestation campaign in the country, Hara Bahara, which aims to plant 1 billion trees by 2030."*

Bringing healthcare to rural India

Another problem that Kumar is working on at Marut Drones is the lack of access to healthcare in the deep, rural pockets of India. To find a solution to this issue, the team had to expand the types of drones they manufactured to include 'beyond the visual line-of-sight' drones, BVLOS in short, which can travel long distances. BVLOS drones are much talked about in the drone space and will play a major role in the next era in drone technology. *"We started BVLOS drone operations in Vikarabad for medicine and vaccine delivery, in collaboration with the World Economic Forum, and with RICH as our consortium partner in Telangana,"* explains Kumar. These drones played a crucial role during the COVID-19 pandemic, for delivering both vaccines and medicines against the disease, by safely transporting about 5000 doses of vaccines at 2–8°C in one trip. So far, the drone, Hepicopter, has made over 1000 deliveries across four states.

Kumar is optimistic, enthusiastic, and excited about how the drone industry will evolve in the future. *"The drone industry, right now, is like the internet was in the 1990s. Nobody back then could imagine that the internet would become so deeply entangled with our daily lives. I believe the drone industry will grow in the same way."* When asked if he has advice for budding entrepreneurs, Kumar is firm, *"It is time for us all to get down to solving our societal problems. Money is merely a by-product of doing good. Let's set a great example to the world on how we can solve problems through technology."*

The Hepicopter in flight, carrying medicines, diagnostic kits, and vaccines.
Image credit: Marut Drones

ABOUT THE AUTHOR

Aarti Kumar is a writer, conceptualiser, and creative machine, who is currently devoted to making science more accessible to everyday audiences

EVENT

The committee behind the National Air Quality Resource Framework of India

Kickstarting the National Air Quality Resource Framework of India

—PSA Content Desk

On 22nd June 2022, a Brainstorming Workshop was held at the India International Centre, New Delhi, to kickstart the national mission on the National Air Quality Resource Framework of India (NAFRI). The workshop was inaugurated by Prof. Ajay Kumar Sood, Principal Scientific Adviser to the Government of India, who talked about the complex and multidimensional nature of the pollution problem and emphasised the need for multi-sectoral collaboration among the government, industry, and the citizens, to tackle the challenge.

NAFRI, developed by the National Institute of Advanced Studies (NIAS) with support from the O/o PSA, is a step in this direction. It is a comprehensive guide to collecting air quality data, analyzing the data for an understanding of its impact, and implementing scientific solutions. It is meant to help decision-makers in governments, municipalities, start-ups, and the private sector to address air quality issues in the various climatic zones of our country.

The Brainstorming Workshop conducted to get NAFRI going was attended by delegates from government and non-governmental organisations, scientists, and industry and start-up representatives. These included Dr. Shailesh Nayak, Director, NIAS, and former Secretary, Ministry of Earth Sciences, Government of India; Dr. (Mrs.) Parvinder Maini, Scientific Secretary, O/o PSA; Dr. Randeep Guleria, Director, AIIMS, New Delhi; and Prof. Gufran Beig and Dr. M. Mohanty, Project Coordinators of NARFI.

Adventures of Dadu, Mitti, and Samosa

— Concept and story: Ipsa Jain; Illustration: CrazzyPixels

To learn more about
- Various butterfly species in India, visit the Butterflies of India website

www.psa.gov.in

ABOUT THE AUTHOR

Ipsa Jain is a scientist turned illustrator. She makes zines, books, stories, and images to share her love and joy for science.