

# Technology and Sustainable Solutions: An Approach for Curbing Air Pollution in India: Way Forward Lessons to Learn



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**ABSTRACT:** *Magnitude of tainting air quality has been a count of ginormous difficulty in metropolis regions and Indo Gangetic Plains during winters in India. It has detrimental impact on surroundings and human vigour. The reduction in environmental air pollution is one of the most significant and societal concern for our country. As valuable means for pollution control, minimization and mitigation remains serious approaches, we need to look at the sustainable solutions to curb this on long term. Different measures are being taken at individual level, society level and institutional level, however an effective approach that will work for everyone has to be considered. Artificial intelligence (AI), IoT's technologies, ICT Solutions, breeze Technology, Titanium Technology, automated cars, Smog towers are some of the effective approaches and technology solutions for tackling these complexities. In this study, the recent advancements of these technologies apart from the various initiatives by Indian start-ups have been highlighted and examined. Information relevant to the subject area is investigated. The study also covers some of the progressive answers from the world over to lessen the vehicular pollutants and to offer an unceasing community to converge to the dreams of sustainable development, and how countries with least air pollution can be a pioneer example to follow their footsteps to understand the smart technologies used by different Countries.*

**Keywords:** Artificial Intelligence Pollution, Sustainability, Technology,

## I. INTRODUCTION:

The continuous improvement of life quality is related directly, among others, to the improvement of environmental quality. This can be achieved by using adequate intelligent monitoring, analysis, forecasting, decision and control systems, based on intelligent tools and techniques

The persistent problem that People living in Indo-Gangetic Northern Plain areas of the country face during the month October- December is Climate quandaries. Delhi in recent times has been called for the worst air condition in the world, where it stands in 9<sup>th</sup> position in megalopolis in the world. It has made records in recent times regarding the extreme air condition in the capital .Tops the lists of worst cities in India. According to the stats, Delhi has the country's highest magnitude of PMP.

The AQI of Delhi in off seasons are usually modest around (101–200) levels from January to mid-October, and during on- seasons it declines to penurious (301–400),to severe (401–500) or precarious more than (500) levels in only matter of three months from mid-October to first week of December.

The main cause leading it to this is because of varied factors including straw burning used for shifting cultivation, and Hindu festivals like burning during Diwali which involve firecrackers and algid weather. In May 2014 WHO (World Health Organization) announced inceptive Delhi as the most befoul city in the world. Pollution, a major factor to climatic change of the country is one of the most important concern now, as around the world as well. Our country faces one of the highest burdens from this and it has been estimated that 100 per cent of the population of the country lives in area that have PM level 2.5 concentration and pollution particles 2.5 micrometres. Home to more than 18 per cent people of world, the second highest populated and population migration rate of 2 percent every year is also one of the contributors to this due to growing demand of basis needs, health and sanitary requirements and transportation an added factor to this. The Pollution control programs like NACP(National Clean Air Program) on PAN India level have increased the awareness among people apart from adopting habit of anti-pollution masks, eco-friendly festive, green environment practices , switch to eco-friendly fuel etc. The reduction in Air pollution in the Metro cities all the year round and in Northern plains especially during winters has become a national concern for societal and environmental reasons. As a viable means for pollution control, its mitigation, minimization remains a prime approach for sustainable development. However, many interactive, residual, societal, dynamic and uncertain features are associated with these approaches.

### Major Reasons of Air Pollution

- **Crop Burning:** Delhi and Northern Plains shares borders among themselves i.e. in the states of Punjab, Haryana and Uttar Pradesh, farmers burn rice stubbles in Punjab, Haryana and Uttar Pradesh. It is estimated that approximately 35 million tonnes of crop are set afire by these states. The wind carries all the pollutants and dust particles, which gets locked in the air.
- Traffic menace and industries is another reason contributing to this air pollution and smog. The air quality index reaches 'severe' levels with Low dust Particle movement due to stagnant winds,

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- Over population of the region resulting not only to air pollution but noise and water pollution as well.
- Low Investment of public Infrastructure like transport and rapid transit system. Apart from that secondary transportation is problem as well.
- Large scale construction and ever going infrastructure work

### Smart Technologies: The Effective Solutions

We can although regulate stop burning hydrocarbons, crops in specific part of the regions and vehicular movement up to large extent, but a sustainable solution must be investigated to control this problem in long term. The aspect that can be a thrust area to be focused can only be using smart technology solutions to mitigate pollution at a source and in wider affected area. The minimization of air pollution and environment hazard along with sustainable development of natural resources, recycling of natural resources is one of the most talked social, economic, societal, and environmental concerns. As valuable means for pollution control, minimization and mitigation remain attractive approaches, the technological evolution and data computing has played an important role here too. This evolution has led to collection, processing and forecasting of environmental data pertaining ultimately beneficial for health monitoring and environment protection.

**Titanium Dioxide Technology:** Also known as CRYSTAL ACTIVE Technology, it facilitates curbing down pollutants emitted during combustion. The system is very effective in Power Generation plants. The ultrafine titanium dioxide (TiO<sub>2</sub>) is used as a DeNO<sub>x</sub> catalyst and it removes up to 90 percent of the NO<sub>x</sub> emitted by combustion of coal, gas or any other material or fossil fuel which is used during the process of generation of electricity. In the process, Titanium Oxide acts as a catalyst to convert harmful gases and other emission into Nitrogen and water vapours which are harmless. This technology has been functional for 30 years and has proven to be one of the most effective and efficient way to minimize air pollution level. The technology is again proven to be breakthrough in those countries where the power generation is maximum based on Thermal plants, so application is not only trustworthy but a unique, easy and simpler on its own.

Apart from this, not only in power generation plants this TiO<sub>2</sub> technology can be used widely in construction materials, concrete, pavements, tile roofing, membranes, paints, glasses, coatings, hence can be said that it is part of even every local source which can cause pollution. These smart solutions are easily available and can be applicable to even lower scale thus minimizing the extent of harm wherever applicable. Here in technology, CRYSTAL ACTIVE TiO<sub>2</sub> uses sun's energy to breakdown the pollutants. The technology, since applicable at smaller scale, so actively everyone can participate towards this sustainable and a cleaner ways of pollution control. The technology, if implemented in a broader way can regulate the growing problem in cities and small towns.

**Pocket Sensors:** The user-friendly device which can fit into our pockets is one of the social and alert to individuals on personal basis. There have been different designs of these devices made by some of the brands like French Plume Lab, I-Sniff. Through this device, individuals can assess the extent of pollution they are exposed to everyday and that is

motive behind the technology is to create self-awareness among people so that suitable steps can be taken up at their end.



**Fig 1.: Air quality Pocket sensor: Source:**  
<https://www.mikroe.com/blog/air-quality-4-click-pocket-size-pollution-sensor>

The device is attached to the leather strap and can be tied anywhere like vehicle, wrist, bag etc. The precise sensor attached to device provide information on NO<sub>2</sub>, fine particles, volatile organic and in-organic compounds, humidity level of air and the ambient temperature. The device is configured with mobile and the application displays concentration level of the different pollutants to which an individual has been exposed. Each device is designed to feature not only what we are exposed to but also for how much time, when and how, So tis can generate a self-regulating mechanisms in individuals, e.g. if anyone take specific route to reach office and the exposure during the transit is measures, so to avoid it alternative Route can be planned as well.

### Artificial Intelligence and Other Disruptive Technologies:

Artificial Intelligence is an Important tool for tackling this problem as it can forecast the area, level and quantum of pollution in any area before it happens. It has been seen the remedial measures are usually taken after the problem occurs and the cause factor behind the problem is well known and repetitive every year, so why not to take the suitable steps before it starts showing its effect. The implementation of such a system can be obtained by employing artificial intelligence (AI) methods that might be combined in an optimal and hybrid manner. AI approaches that can be employed include rule-based expert systems, machine learning techniques like artificial neural networks (ANN) and inductive learning, data mining algorithms, case-based reasoning and optimization methods like genetic algorithm. Cities like Beijing which are also one of most pollution grappled city in the world has controlled it with the help of Artificial Intelligence Technologies. IBM's green horizon initiative in Beijing uses connected sensors to collect data around traffic levels, exhaust fumes, weather and humidity. This being assembled with cognitive forecasting system and historic pollution is used to forecast the pollution level in the coming days and accordingly the corrective actions are being taken. Although data captured may be too complex for human system to analyse but Artificial Intelligence system makes it easier to interpret. Sensors like that can be placed in every lamppost of Delhi and predictive analysis can be done to forecast the problem. The system works by producing microclimatic data measurements for EPA 'criteria pollutants' that include particulate matter, carbon monoxide, carbon dioxide, nitric oxide, nitrogen dioxide, sulphur dioxide and ozone.



These sensors can be installed around the city to monitor air quality and capture data on pollutants on a real-time basis, thus enabling government organizations to act and apply remedial measures before the air quality index worsens. Peter Drucker said, "if you cannot measure it, you can solve it" and Artificial Intelligence can help to solve this. As per [www.igair.com/world-most-polluted-countries-report-2019](http://www.igair.com/world-most-polluted-countries-report-2019), India is the world's 5<sup>th</sup> most polluted country and 22 out of 30 most polluted cities are in India.

The integration of data from the various health and environmental ecosystems is enabling researchers to analyse and operationalize it for the future purpose. The disruptive technologies such as Artificial Intelligence, Machine Learning, Block chain Technology, Internet of Things(IoT) have proven to be very successful in controlling the pollution levels. The main AI techniques that can be applied to forecasting problems solving are ANN, fuzzy logic, case-based reasoning, Fuzzy Inference Systems (ANFIS), expert systems, adaptive neuro-fuzzy systems. Other hybrid techniques that can be used are those based on Genetic Algorithms (GA), Hidden Markov Models (HMM), Support Vector Machines (SVM).

Accurate calculation of air quality not only comprises existing air monitoring infrastructure but also monitoring human activities simultaneously such as traffic, congestion, garbage burning, Industrial sources and population density. By knowing about the sources of air pollution, Artificial Intelligence can further be used to track and predict the behaviour of increasing/decreasing trend. It can be monitored that whether Industrial production or construction or vehicular movement is causing air pollution. The data collected during different times line morning-evening traffic, crop burning season, peak construction timings can directly be related that which factor is causing the maximum level of pollution and same model can be replicated in other part of country as well. The Algorithms developed through such system can help to predict and forecast the behavioural pattern of cause factor. For example, ODD-EVEN was started in Delhi but it was seen that during the second round of this, there was very insignificant decrease in pollution level and traffic also was on the same scale. According to some research the traffic was reduced during the period of the scheme. But the speed of the car increased twice the before the orchestration period. Fascinatingly, it has been seen that tenancy in personal cars had ascended from 1.4 to 2.1 on diligent paths during the aberrant-even scheme period. To access the results of the scheme was not enough as the time period was too short to make any conclusions of prosperity or failure of the scheme. The similar pattern has also been seen in China and South America. Artificial Intelligence can help in configuring modelling for chemical reactions between pollutants. Algorithms like Atmospheric Transport Modelling System (ATMoS) helps understand PM2.5 concentrations. There are other advances algorithms that help in understanding and predicting smog, haze, visibility, and other meteorological observation which help to manage air quality better.

Artificial Intelligence works with employment of Algorithms to investigate the problem. The process by which system modelling is done to forecast its behaviour, is commonly described as Machine Learning, a subfield of AI, as it deals with the training of AI algorithms so that the latter gradually become able to describe the problem at hand. AI techniques such as Artificial Neural Networks

(ANNs), Classification and Regression Trees (CART), Wavelets and Support Vector Machines have been applied for forecasting of photochemical and particulate matter pollution in various cases. It has been proved that AI methods perform better compared to statistical methods and can be potentially very accurate in forecasting parameters of interest, depending on the quantity and quality of the data. These findings, combined with the computational efficiency of AI methods, suggest that the latter can be an excellent tool for the creation of air quality forecasting modules, which may effectively support operational air quality management on a day-to-day basis.

**Fuzzy Logic Technique:** The techniques works for controlling Indoor Air quality(IAQ), wherein the fuzzy logic controller is used to calculate comfort and Air quality Index by combining some air pollution benchmarks PM2.5, PM<sub>10</sub>, CO, NO<sub>2</sub>, NOP (number of passengers) and temperature. The index is used to provide users the permissible air quality with toxicity content of some of the pollutants. Apart from this the technique is also used to determine the output action of ON/OFF in terms of hot water valve, fresh air dumper, air conditioner, and DC motor control speed.

The system of Fuzzy control can be illustrated as, Fig 2.,

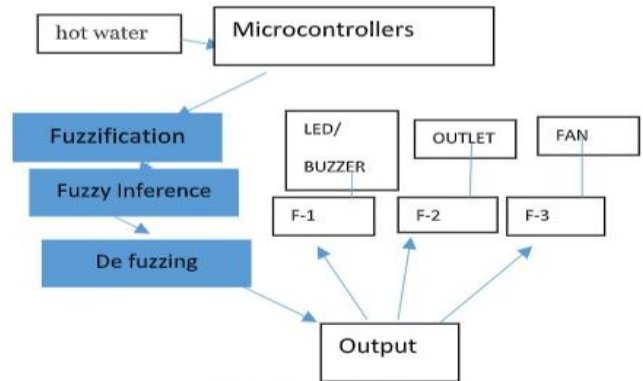


Fig 2: Fuzzy Logic Flow

**Breeze Technology:** The technology is based on development of environmental sensors., being pushed by breeze. Here the small-scale air quality sensors can measure the common pollutants like Carbon and Nitrogen Oxides, Ozone and particulate matter. Based on machine learning and big data technologies the technology uses Adaptive Cloud Calibration Engine to increase data reliability and accuracy. The Breeze cloud platform allows to achieve an arbitrarily high data resolution and can assist facility management, environmental scientists and even municipality management and governments in understanding air quality, its influences and how to improve it.

**ICT Solutions:** ICT Solutions such as Internet of Things(IoT) can be widely applicable in transportation, electricity grids, manufacturing and Agriculture use. ICT can provide a viable solution to reduce Carbon footprints, which accounts for 1.5 per cent of global CO<sub>2</sub> emission. As we are aware that for controlling air pollution, requires constant monitoring of the same. Ericsson, in association with IIT Kanpur, has deployed "Narrow Band IoT Sensor Networks at strategic location in Delhi to monitor air pollution levels.



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The real time data collected by sensors is collected, analysed with the objective of creating awareness and various Policy Interventions and Planning purpose.

**Autonomous Vehicles:** one of the mega-trends in the automotive sector is the move towards autonomous vehicles or “self-driving cars”. This could fundamentally change the way that vehicles use the road network, reducing the stop-start nature of traffic (which is partly caused by the way that we humans drive cars), and opening up the possibility of “vehicle platooning” on motorways. A range of studies have estimated that autonomous vehicles could improve fuel efficiency by 15-40%, reducing emissions of local pollutants as well as greenhouse gases, not to mention the benefits in terms of safety and congestion. Volvo has launched plans to trial driverless cars in London by 2017, whilst the 2016 Budget also contained a number of measures to promote connected and autonomous vehicles.

**Smog Free Towers:** Another initiative which can be looked at is installation of Smog Free Tower, an air purifying tower that can suck pollution and expel clean air. A 40 feet tall purifier has been designed by a Delhi-based start-up that claims could provide clean air to 75,000 people living in the three-kilometre radius around it. They have also got the patent as “World’s Largest as well as strongest air purifier”, as published in **World Intellectual Property Organization**. The purifier which is 40-feet tall and 20-feet wide, has the capacity of cleaning 32 million cubic metres of air per day. Designed on the air quality of the capital, one such purifier is able to provide clean air in the 3-km radius of its location, impacting about 75,000 lives. The purifier can take air from all angles, which in turn, will help generate 13,00,000 cubic metres of clean air per hour. The Purifier has nine stages of physical filters to clean out 99.99 per cent pollutants. Apart from the pre-filter which can remove the visible (Particulate Matter 10 & above) particles; H14 grade HEPA filter (Highly Effective Particulate Arretine) can clean out PM 2.5 particle (small particles) up to 99.99 per cent. The activated carbon filter can remove all offset, volatile organic compounds (VOCs) The tower can also be equipped with as many as 48 fans to keep the flow of clean air constant. The air-purifier can also skip the electric grid and run on solar energy, provided there is adequate space, thus making it cost-effective and environment-friendly. China has already witnessed huge success with their Smog Tower in Xian which has been successfully able to clean 10 million cubic metres of air daily. A seven-metre-high anti-smog tower, designed by Dutch designer Daan Roosegaarde, was the first to be put up in Beijing in 2016. Apart from these two other Chinese cities, South Korea, Rotterdam have also been installed with these Smog Towers. The cleaner tower launched by Indian start-up Kurian is claimed to be different as it is not based in ionisation technology as that of China. The cost of Indian air smog is estimated to be Rs. 1.75-2 crores.



Fig 3: Smog Tower in Beijing

## II. WHAT INDIA CAN LEARN FROM OTHER COUNTRIES TO BEAT AIR POLLUTION

**Singapore:** Here the air pollution and related health costs are particularly high, so a team of researchers a team of researchers identified the possibility of combine power sensor technologies with IoT and Artificial Intelligence As identified through the computation of real-time IoT sensor data measuring spatial and temporal pollutants, user-friendly air quality heat maps and executive dashboards can be created, and the most severe pollution hotspots can be determined with the help of machine learning algorithms for predictive modelling. This is the first step to take proactive actions towards further decarbonizing the economy, including incentives for virtuous businesses, the development of wiser land use plans, the revitalization of urban precincts, and more Confronted by danger of declining air condition. Countries dealing with the same problem as India, where currently China has made progress with tailored new technology and techniques to overcome this catastrophe. Which includes energy groundwork boosting, managing coal pollutants, and toxic emission controls.

**Germany: Breeze Technology-Microsoft:** Guided by Microsoft as part of AI for Earth commitment, five projects were set up by the Breeze Technology in Germany. in the areas of environmental protection, biodiversity and sustainability. Measuring and improving sustainable air quality in cities with the company had developed small, low-cost sensors that were installed in many locations, measuring pollutants such as soot, nitrogen oxides, ammonia, ozone or particulate matter, while also identifying their sources. A local portal was deployed to collect and publishes Breeze’s collected data in real time, so that affected people can learn about the prevailing scenario at any given moment. In addition, the company had developed a comprehensive Brochure of measures that helped cities and communities specifically improve the situation on the ground. From the beginning, Breeze started processing the data of its fully networked sensors in the Azure cloud. The company has also set up own AI experimental laboratory to test how AI can support them even better in the added value, **China:** To drastically lower pollution levels, Chinese Government partnered with IBM in 2014, as a part of company’s Green Horizon Initiative, which helps improving relationships between energy, utility, environment and Government in supporting cleaner air and using renewable energy.



As a part of this venture Beijing is using advanced technologies like AI and IoT's to predict, identify and track sources of probable pollution. The numerous factors that contribute to increasing level of pollution are analysed through Artificial Intelligence to find the current chaotic situation and reasons thereof. The same data predicts the forecasting for next 10 days and though this IBM could provide high resolution pollution level to Beijing for next 72 hours, hence providing people and businesses caution about the pollution level. Apart from applying technology solutions, China has also taken a creative approach which is creative approach has been taken into account by building a forest path being planted in Nanjing, jap

China, which is a very good antidote for the disasters happening because of pollution but through this forest creation they are built to take in 25 tonnes of carbon dioxide emitted in the atmosphere give at least 60 kegs of oxygen in return. Any other intervention inside the shape of an experimental over-one hundred-metres-excessive affected areas in north side of the country has delivered major development in air first-rate, consistent with researchers from the Chinese language which has immensely helped the country and a project named Bhavik Bakshi was undertaken talked about numerous countries going through the same crisis of air pollution can refer the project taken by the chines authorities. As such India can follow through the policies that restriction the quantity of pollution that directs the origin along with what influences can an industries have and able to emit in the atmosphere, and needs an era in non-factor sources like main head to transform in vehicles.

After fifteen years coming out of crisis the capital city planned and executed a series of steps mainly infected in strength groundwork optimisation and reduce other reason for the cause as well. , degrees of air condition started improving and the pollutants stated reducing, pollutants like carbon monoxide and sulphur dioxides which met the criteria listed by UN. Research has been done on the same. China is trying to curb pollution which is taking more time to get a successful result whereas other counties suffering from the same issues has got short cuts or short plans to get their desired result of curbing their own countries pollution

**Europe:** Paris has taken initiative to reduce the traffic of cars on some days here which is weekends. Where the country has placed regulations regarding banning of cars in central districts. Same as Delhi on ODD-EVEN bans on vehicles, makes unfasten public mobility and encourages programs to share more. Plans are made by the Gov. of Amsterdam to ban pollution creating-fuelled vehicles and bikes from 2030. A place called Copenhagen prefers clean vehicle like cycles and it is estimated that it has more cycles than humans. The Danish capital wants to finish their carbon footprint. Jambi metropolis in Indonesia has assented an emissions diminution plan which involves of lowering and encapsulate methane from waste, and the general norm that ban waste igniting and encourage sow for trees.

Zurich has a limited range of parking pull up areas in the city, handiest let's in a range of automobiles to layer on a time and are aimed more on constructing areas with less two-wheelers and building lines for tram. . Air pollution is giant environmental threats to human health. According to (WHO), awful air condition has led to 37lks untimely deaths every 12 months. Metropolis, mobility through use of vehicles, industrialisation, power plants, and cultivation

activities are the root cause of air pollutants through poisonous emissions in the atmosphere.

Technology can help India in overcoming the crisis. But technology can be useful for factor resources (point sources) of pollution which include production and industrialisation enterprise. It can be used in manage the toxic emissions from the non-Factor resources inclusive of cars," But it is said that most of the pollution is created from non-Factor resources – which means cultivation practices like burning straws in farms and burning of strong waste.to manage this types of extreme pollution there should be regulation in place to guide the activities, or an exchange in subculture who looks down the participants. Ultimately it all mellows down to political conditioning and public pressure, for which the regulation will be placed to control the activities of people involved in creating the extreme air condition in the country, which need serious business and coordination and enforcing the system in place.

**The countries with most clean air uses expedient ways to curb air polution like smart bike –sharing systems in urban mobility.**

**Table1: Most/Lease Polluted Countries**

NO.	MOST POLLUTED	LEAST POLLUTED
1.	BANGLADESH	AUSTRALIA
2.	PAKISTAN	BRUNEI
3.	INDIA	NEW ZEALAND
4.	AFGHANISTAN	ESTONIA
5.	BAHRAIN	FINLAND
6.	MONGOLIA	CANADA
7.	KUWAIT	ICELAND
8.	NEPAL	SWEDEN
9.	UAE	IRELAND
10.	NIGERIA	LIBERIA

Source <https://images.app.goo.gl/zTLgLNHRHQoBQ7NCD8>

As we can see from the above table1, one of most and least countries affected with Air pollution. Most of the countries with clean air are from Western Europe, as technology advent in those countries has been used to a greater extent to protect the climate which is at risk due to increasing discharge of carbon dioxide emissions in the air which can be reduced by changing the way of living or life style which is inherited by people from Western Europe. In the most convenient way, which is the use of basic non-hazardous schemes like vehicles with no emissions which in this case is **BIKES-SHARING** Systems taken place in some countries in Western Europe which can have sustainable impact in their Air hygiene. These decisions to put a system of this scale can be implemented by India in wage of protecting disoriented polluted cities.

The main motto of this initiative to bring this system in city's public transport format is a way to promote more sustainable ways to protect the environment especially Air pollution. They are not time consuming and expensive but is easily available and operates fast, and easy use through the age of fast technology where smart phone is only needed to access the service.



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It is coined for one aim that is sustainable mobility. But they are different from other more conventional ways, provided 24 x7 and available throughout the city,

- Rent from one place and give it back in the same location or other location, easily available like near shopping mall, public infrastructures, convenient
- Use of Smart technology as a core backup tool to avail the service.
- Some of the Smart technologies are (smart cards and use of smart phones), they can avail the information from internet, regarding the availability of bikes near the pickup point. It can be used as a core part of the entire Public transport system.
- Rental system is time-based and accordingly payments are made (except the first half hour can be free.)

The main objective of Bike –sharing systems was to improve air quality and which could be achieved by increasing sustainable transportation choices which can ultimately improve the congestions as well as air pollution in the city.

Australia, Canada, China, Washington D.C. has initiated this scheme as well in their own countries. The Caen, Copenhagen, Dijon, Lyon and Paris has the highest traffic caught on the systems, with a mean of 200 persons per bike.

**Table 2: BIKE SHARING SCHEMES BY COUNTRIES**

COUNTRY	SYSTEMS	BIKE FLEET	BIKE STATIONS
Australia	1	N/A	N/A
Austria	1	1,540	58
Belgium	1	250	23
Canada	1	2,400	300
China	2	200	2
Denmark	2	2,400	167
France	26	39,798	2,643
Germany	6	5,800	N/A
Italy	19	2,563	246
Luxembourg	1	250	25
Norway	3	1,575	153
Portugal	1	350	33
Spain	6	9,689	720
Sweden	2	2,125	191
UK	5	198	59
USA	1	100	10

Source: TAKEN FROM SECONDARY DATA. (Peter MINDFLEY)

### Outcomes -Bike Sharing

**Table 3: SUCESSFUL SCHEME IMPLIMENTED IN COUNTRIES BY BIKE- SHARING SCHEMES**

COUNTRIES	CITY POPULATION	EFFECTS
PARIS, FRANCE	2.15 M	<ul style="list-style-type: none"> <li>▪ LEAD TO 20% REDUCTION IN DRIVING</li> </ul>
LA ROCHELLE, FRANCE	80K	<ul style="list-style-type: none"> <li>▪ CHANGE IN TREND FROM DRIVING TO USING BIKES FOR LONG DISTANCES BY OFFICE AVAILORS</li> </ul>
BARCELONA, SPAIN	1.5 M	<ul style="list-style-type: none"> <li>▪ BIKE TRIPS REPLACED BY CAR TRIPS.</li> <li>▪ LOCAL RESIDENTS PREFER BIKES THEN CARS. (30 % USE SYSTEM FOR FASTER MODE, 37% USE IT FOR HEALTHY CHOICES, 22% USES IT FOR</li> </ul>

		ENVIRONMENTAL ISSUES.
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**Figure 4: SMART BIKES**

### III. SUSTAINABLE APPROACH FOR FUTRE

ICT can genuinely help the world with their sustainable approach to redeem the extreme air pollution crisis occurring in the whole wide world. As there will be more inventions and developments in technological areas, the ability of ICT will be more efficient with their work. But pollution should be managed and it needs constant attention and observation, it even needs imaginative and prescient, constant look over and constant look out for readjusting of critical factors together with relocation, business regulations and the preparedness of people to deal with CO2 emissions. Spotting the essential social ameliorations required - and via concerning our groups in defining the paths for future - we could influence these precise technological assets in the direction of a higher destiny. We can really help the world breathe well. The onus is on all and sundry.

### IV. GREEN IS CLEAN

We all know and are conscious enough and acknowledge that green is clean, however apart from the new age tech being developed to make a green space. But how much do people realize what going green approach means.

#### i. CLEAN INDUSTRY

As we know industries have a big role in air pollution in India as well as in other countries. The process goes through discharge of large amount of fossil fuel which releases various gases that include carbon dioxide, methane and nitrous oxide.

Here the cause is different, the discharges from the industries lead to dwindling of ozone layer, haze rain and of course temperatures change in the ecosystem. The businesses should look forward to reducing their carbon footprint in the environment.

There are sustainable ways to use the energy to run the world and their industries, but they are not that reliable as it doesn't create the level of energy as fossil fuel does. But it hurts the earth in a bad way.

#### ii. POLLUTION CONTROL STRUCTURES

Control system groups are massively helping in reducing the air pollution levels. Companies are trying as well to create the systems to keep the air pollutants under the radar by the industries. It can be in the form of malodour control, dispersible debase capture and recuperation. Technology has a huge role in reducing the air pollution through the control systems.



### iii. AUTHORITIES AND ENVIRONMENTAL SCHEMES

There must be organisations funded by government or by private enterprises to investigate critical things related to air pollution in India. Control of fossil fuel and enforcing more creative way to generating new energy through new smart technologies. Or through renewable resources to create an environmentally friendly operations to maintain sustainability in future

### iv. VOLUNTARY HOUSES

People should be self-aware and act in certain ways to reduce their own carbon-footprint. There are little things that people can afford to do in order to make this world more liveable. Like for example their own current living situation-use of smart technology to reduce their own emissions in domestic lives. This way they can be an active contributor in reducing the air pollution and environmental issues. The Indian government as well is trying to influence people to be more aware of their situation and act responsibly. As well as non-profit organisations are trying to find a way to reduce this chaotic situation taking place in New-Delhi.

Daily habits must be implemented to get a sustainable output out of it. Using fewer emitting substances and use less-energy items. Little practices like- using one car for the entire family members in stand of individual cars empty.

## V. INITIATIVES TAKEN BY STARTUPS.

### 1. FITT Incubated start-up:

- a) **Nano clean Global Pt. Ltd.** – the company has created an advanced precautionary measure for fighting polluted air. The group has created a Naso-filter out that can persist with the nostril opening and does not cowl the face as an everyday masks, it is very convenient as it doesn't cover your entire mouth, and enables you to talk to people freely. The company has created an advanced merchandise like AC hooked up strainer to transform ACs into air refinery and restricts from pollutants to enter the human body. As show in Fig.3



**Figure 5: NANOCLEAN GLOBAL PVT, LTD (NASO-FILLER)**

Source:- (IIT DELHI WEBSITE)

- b.) **Aerogram Pvt. Ltd** - The Ezio air pollutants screen is a smart hand-held tool which can detect the magnitude of pollution in our nearby locality like inner home, vehicles, or outside the house. The records from those monitors also can assist to get a comprehensive route of complete towns and parent out the stages of pollutions in different regions. This may assist in planning our schedules and stopping windswept to excessive stages of particulate count number. As shown in Fig.4.



**Figure 6: AEROGTAM PVT.LTD**

Source:- IIT DELHI WEBSITE

- c.) **ShudhVayu Innovations:** This company product is a USP product which claims to cast off PM10 in mass by means of installing the layout entered air refinery device on a host of automobiles. As shown in Fig.4



**Figure 7: SHUDHVAYU INNOVATIONS**

Source:- IIT DELHI WEBSITE

- a.) **Chakr innovations:** Chakr protect is the first evocative suitable device that gathers and stores the discharge which is in matter form from the exhausts machines and turns it into ink. The technology can be fully utilised as its outcome is very successful and its helps in reducing the pollution level as well. It lower downs the PM pollution which is the result of diesels. As shown in Fig.5



**Figure 8: CHAKR INNOVATIONS**

Source: (IIT DELHI WEBSITE)

## VI. CONCLUSION

Air pollution has become critical matter of concern not only in India but around the world. People and businesses must change their ways to operate in this world with more inclination towards sustenance. Government and support control groups has a major role as well to keep this under Rader.

## Technology and Sustainable Solutions: An Approach for Curbing Air Pollution in India: Way Forward Lessons to Learn

As such of the factors which are merely affecting the air quality, among them are more vehicles which releases toxic matter into the atmosphere leading to disasters effects in human lives as well for the planet. Where each year tons of Ice are melting away making this planet warmer and extinction of aboriginal animals because of the extreme temperature. In contrast with other countries, India has a management crisis where infrastructure is lagging regarding managing and controlling large number of personal vehicles leading to more emission from the diesel and petrol-based vehicles. To limit the congestions and more emission the Indian Government has taken a good initiative called 'ODD-EVEN' in capital city but it is believed that it can only works well on times of peak traffic as the numbers of cars are not out in the road as compared to before. We should look forward for more sustainable approach and technology here can play here a vital role to regulate it on long term basis and improvement year after year with its advancement. India can even look into other countries who are able to manage their air quality through simplest effort by the people of their country and building a good infrastructure to connect his bikes to their entire public transport system. Using smart technology enabling this system to control its operations as well as their emissions where bikes comes in. Which releases zero-level of output into the atmosphere. Detailed information regarding initiatives taken by companies and start-ups- to reduce the air pollution can also be considered.

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