ACTA Acta Sci. Pol., Administratio Locorum 21(3) 2022, 321–334.
https://czasopisma.uwm.edu.pl/index.php/aspal plISSN 1644-0749 eISSN 2450-0771 DOI: 10.31648/aspal.7262

ORIGINAL PAPER
Received: 30.11.2021 Accepted: 04.03.2022

INCORPORATION OF MECHANISMS FOR PROVIDING GREEN ENVIRONMENT POST COVID-19

Elliriki Mamatha[1]✉, Amardeepak Mahadikar[2]✉, Krishna Anand[3]✉, Palur V. Krupakara[4]✉, Chandra S. Reddy[5]✉

[1] ORCID: 0000-0002-1512-5063
[2] ORCID: 0000-0002-9741-7763
[3] ORCID: 0000-0001-8816-9553
[4] ORCID: 0000-0002-4265-4091
[5] ORCID: 0000-0003-3495-0103
[1] GITAM Unversity
Bengalure, **India** – 561203
[2,4,5] Cambridge Institute of Technology – NC
Bangalore, **India** – 562110
[3] Anurag University
Hyderabad, **India** – 500088

ABSTRACT

It has been observed that the damage to the environment caused has grown multi-fold in recent years especially with the exponential rise in population. The sad part of it lies with the fact that no part of earth be it the mountains or oceans or plains have been spared. In order to predict the global climate change, a number of models have been developed over the years. All reliable models clearly indicate the overall deterioration in the quality of air levels. The geographical distribution of precipitation changes at different places leading to changes in water availability. Living a healthy life in a clean environment has soon become a distant dream for the common man. To add to the same, the arrival of Corona virus in the year 2019 has put human life in the doldrums as its contagious and fast spreading nature has put day to day life on hold besides causing deaths and forcing people to throng to hospitals at a rapid rate not witnessed during the recent past. On the other hand, the outbreak of the COVID-19 Pandemic had a positive impact on the environment as most of the highly polluted cities witnessed a clear blue sky. Air Quality Index (AQI) and Particulate Matter (PM2.5) levels in all the major cities improved during the lockdown period. However, with life slowly limping back to normal, there is a dire need to ensure that humans do not go back to their old ways of polluting the environment. The way of work needs to change in each and every type of industry. This paper focuses on mechanisms for providing a green enterprise transformation for some of the commonly functioning industries post COVID-19 times. The research study focused on a specific country in Asian continent, and it can be extended to other countries/continents.

Keywords: COVID-19, air pollution, greenhouse emissions, lockdown effect

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

INTRODUCTION

When air pollutants especially carbon dioxide (CO_2) get collected in the atmosphere, they trap the sunlight and absorb a part of the solar radiation escaping into space. Apart from CO_2, the greenhouse gases include Nitrous oxide, Methane, and a few other gases. They play a detrimental role leading to global warming. Prior to 1800, global warming was more or less unheard of owing to lack of industries (Coker et al., 2020; Mathew & Madhavi, 2020; Nikzad & Sedigh, 2017). Since the advent of industrial revolution, there is an increase of 0.007°C every year. However, since 1980, this rate has more than doubled and currently the rise is close to 0.2°C every year. This rate was reduced to half during the year 2020 due to partial closure of a number of industries owing to Corona virus (Mahato et al., 2020).

COVID-19 is a Corona virus disease caused by Severe Acute Respiratory Syndrome Corona Virus-2 (SARS-COV-2), which emerged in Wuhan city, Hubei province of China.Various diseases like Corona virus, Ebola, Nipah etc. are transmitted by wild animals and bats considered as natural reservoir hosts (Cui et al., 2019; Amardeepak et al., 2021). The pathogen SARS-COV-2 is likely to have originated in bats but confirmation is required as to whether SARS-COV-2 infected pneumonia is directly transmitted through an intermediate host or from bats (Jin et al., 2020). The outbreak of the COVID-19 pandemic was declared by the World Health Organization as a public health emergency of international concern on Jan 30, 2020 (Li et al., 2020).

The total number of COVID-19 cases in India and total number of deaths has increased exponentially from 22nd Feb. 2020 onwards with total number of cases accounting to 12,684,477 and total number of deaths 165,132. However, the total number of active cases increased gradually, reached a peak value on 23rd Sep. 2020 at 967,161 which further decreased to 148,882 on 22nd Feb. 2021, and again increased to 788,855 on 5th Apr. 2021.

Ionescu (2021a) carried out an empirical study for evaluating and analysing the relationship between green financial behaviour, climate change mitigation, and environmental energy sustainability. A large sample of four thousand seven hundred data has been considered in order to assess this relationship. She focused on means of reducing carbon emissions by means of Carbon tax imposed. The effect of levying carbon tax in order to bring a behavioural change in individuals have been analysed in detail. As power sector is one of the chief contributors of Carbon emissions, levying Carbon tax on the same provides the desired impact with respect to the reduction in Carbon emissions. She also empirically examined corporate environmental performance, climate change mitigation, and green innovation behavior in sustainable finance. The survey employed statistical weighting procedures to clarify deviations in the survey sample from known population features which was instrumental in correcting for differential survey participation and random variation in samples (Ionescu, 2021b).

Nemteanu and her team (2021a) studied the impact of job satisfaction during covid periods. She observed that remote working was the new norm and found that job satisfaction levels had come down to a very large extent. Feelings of frustration, burnout and anxiety had become increasingly rampant (Saritha et al., 2022). The effects of internal marketing orientation on job satisfaction and the corresponding effect of job satisfaction had been studied in detail. Salih and Hussein (2021) in their work studied COVID-19 effect in cities by enabling social distance and proposed a new model to improve urban immunity. The proposed model is more effective in crowded cities and easy to implement.

Harrower (2020) gathered a large amount of data through an online questionnaire of three thousand eight hundred people for analysing networked and integrated urban technologies in sustainable smart energy systems. Estimates were prepared regarding organizations supporting renewables and using green energy technologies and investment strategies. Nemteanu and her team (2021b) studied the impact of job insecurity and job instability on the levels of job satisfaction. They found that the perceived job instability was found to have a serious impact on the levels of individual job satisfaction and also

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

on aspects like supervisor support and promotion opportunities. The danger of losing job post covid played a significant role in the mental wellbeing of the employees.

Pflugmann and Blasio (2020) considered renewable Hydrogen as an alternative to coal. Generation of renewable Hydrogen by electrolysis was carried out and cost of production and usage was compared to that of coal. Besides, logistic issues were also taken into consideration and the overall impact on the environment was considered. It was observed that the reductions in emissions were found to be significant. Nowak et al. (2020) addressed the green information systems and its consequences in the urban and rural areas' green spaces. It is observed that green infrastructure and National Spatial Data Infrastructure are the main important points for urban environment, and to enhance the human quality life. In this work authors are focused to address the problems in urban areas to monitor smart cities which are affected by regional projects.

In this article authors proposed to address the effect of COVID-19 in the environment and its consequences (Elliriki et al., 2021). Although it impacts adversely on human life, it helps to improve the environmental conditions, reduces the pollution effect, and reduced the ozone-holes in the atmosphere. In another point of view, it helped to cure the environmental problems. In this paper are presented, the effect and changes presented in graphical and tabular forms to understand the condition.

MATERIALS AND METHODS

In the decision making, statistical tools play a vital role in the face of uncertainty. It significantly deals with many important real-life problems that arise in arts, management, science and technology (Mamatha et al., 2017; Saritha et al., 2019). A probability formal definition starts with sample space with fundamental axioms. Here, we discuss few of them used in this work.

Let X be the random variable with discrete data values x_i and its corresponding probabilities p_i where i = 1, 2, 3 … n.

Then, for the discrete data the expected/mean value is defined as:

$$\overline{x} = \sum_{i=0}^{n} x_i p_i$$

Corresponding to the discrete data, Variance is defined as:

$$Var(x) = \sum_{i=0}^{n} (x_i - \overline{x})^2 p_i$$

$$\sigma_x^2 = \sum_{i=0}^{n} {x_i}^2 p_i - \bar{x}^2$$

Here σ_x represents the standard deviation corresponding to the given experimental data.

Variance is a quantity further can be expressed in terms of expectation:

$$\sigma_x^2 = Var(X) = E\{(X - \mu_x)^2\}$$

Intuitively, Variance deals the quantity or speed of 'X' variations which holds the following axioms,

i). $Var(X) \geq 0$

ii). $Var(aX + b) = a^2 Var(X)$ and

iii). $Var(X) \leq E(X^2)$

For the two discrete random variables X and Y with corresponding means μ_x, μ_Y the Covariance is defined as:

$$Cov(X, Y) = E(X - \mu_x)^* E(Y - \mu_Y)$$

Correlation: For the two random variables X and Y, the Correlation is defined as:

$$Corr(X, Y) = \frac{Cov(X, Y)}{\sqrt{Var(X)}\sqrt{Var(Y)}}$$

Cumulative Distribution Function: Corresponding to the discrete random variable X, the cumulative distribution function is expressed as:

$$F_X(x) = P\{a: X(a) \leq x\}$$

Here $F_x(x)$ specifically intends to the cumulative distribution and $X(a)$ is the experimental random values to the outcome of 'a' in the sample space S.

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

Where the cumulative distribution function follows the given properties,

– For the discrete random variable X with independent value $x = \infty$, we have

$$F_X(x) = P\{a: X(a) \leq \infty\}$$
$$= P(S) = 1$$

This is a case of *certain event*.

– Similarly, if X is independent random variable with value $x = -\infty$ then

$$F_X(x) = P\{a: X(a) \leq -\infty\}$$
$$= P(\Phi) = 0$$

This is considered as *impossible event*.

– With the fundamental properties of probability for independent random variable X the cumulative distribution varies from 0 to 1, i.e.

$$0 \leq F_X(x) \leq 1\}$$

– If x_1, x_2 are two values for independent random variable X, where $x_1 < x_2$ then the cumulative distribution function becomes:

$$F_X(x_2) - F_X(x_1) =$$
$$= P\{a: X(a) \leq x_2\} - P\{a: X(a) \leq x_1\}$$

$$F_X(x_2) - F_X(x_1) \geq 0$$

Mortality rate during COVID period

The number of people recovered in India as on Apr. 5th, 2020, is 11,895,622 with a remarkably good recovery rate at 99% thereby giving a mortality rate of less than 1% (Ali & Islam, 2020). The total number of COVID-19 cases and deaths in India has increased exponentially from 22nd Feb. 2020 onwards with total number of cases accounting to 12,684,477 and total number of deaths 165,132. However,

Table 1. COVID-19 deaths in some Indian States as on 5th April 2021

State	Number of COVID-19 deaths
Andhra Pradesh	7,244
Delhi	11,096
Gujarat	4,580
Karnataka	12,664
Maharashtra	56,032
Punjab	7,155
Tamil Nadu	12,789
Uttar Pradesh	8,894
West Bengal	10,348

Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare –Government of India (https://www.mohfw.gov.in/).

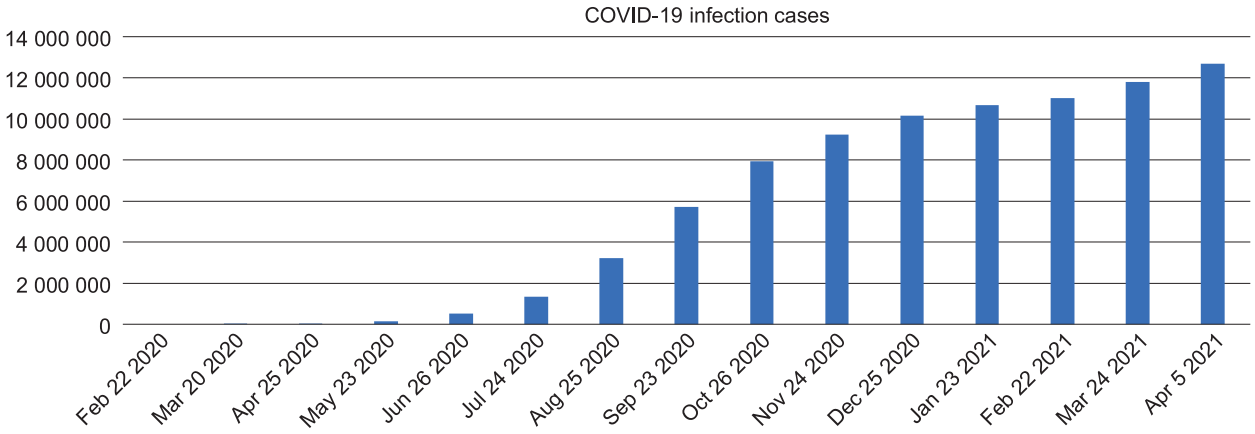

Fig. 1. Day & Year v/s Total COVID-19 infection cases

Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare – Government of India (https://www.mohfw.gov.in/).

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

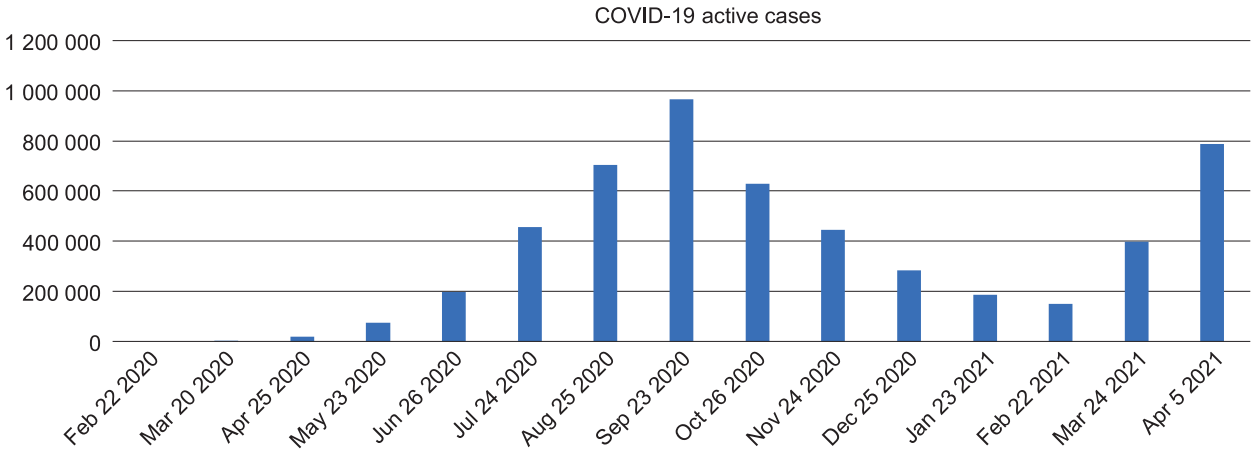

Fig. 2. Day & Year v/s Total COVID-19 active cases
Source: own preparation based on data from WHO (https://covid19.who.int/).

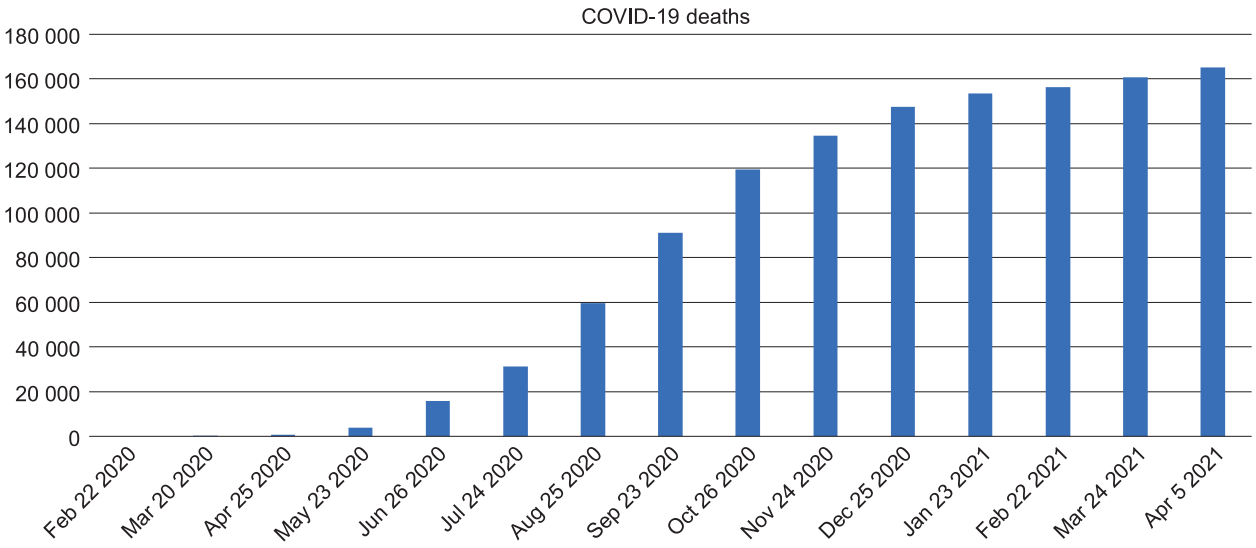

Fig. 3. Day & Year v/s Total COVID-19 deaths
Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare – Government of India (https://www.mohfw.gov.in/).

the total number of active cases increased gradually, reached a peak value on 23rd Sep. 2020 at 967,161 which further decreased to 148,882 on 22nd Feb. 2021, and again increased to 788,855 on 5th Apr. 2021. The graphical representation of the total number of cases of COVID-19 infection, total active cases and total number of deaths reported in India is shown in Figures 1, 2 and 3 (source https://covid19.who.int/).

Table 1 shows the number of COVID-19 deaths as recorded on 5th April 2021 in some Indian States.

Air Pollution

Air Pollution is a global problem due to which an estimated 7 million people die annually. AQI stands for "Air Quality Index". AQI level below 50 indicates good air quality. AQI level from 51–100 indicates satisfactory air quality. AQI level from 101–200 indicates moderate air quality. 201–300 AQI means poor and 301–400 very poor air quality. AQI level of 400 and above means the quality of air is severe.

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

As per statistical data, there was a significant reduction in AQI level in April 2020 compared to 2019 in major Indian cities. The graphical representation of AQI levels monitored in major Indian cities and is presented in Figure 4. The AQI level recorded in April 2019 & 2020 in New Delhi was 200 & 100 respectively, thereby showing a 50% reduction in AQI level. Other major cities like Mumbai, Kolkata, Chennai, Bangalore, and Hyderabad showed percentage reduction of 27%, 20%, 35%, 51% and 32% respectively. The percentage reduction of AQI levels in the year 2020 is shown in Figure 5. Figure 6 shows the AQI levels recorded in major Indian cities on April 2020 and 2021 and the graphical representation is indicated in the graph. The AQI levels slightly increased in April 2021 due to opening up of all economic activities (Kundu & Bhowmik, 2020). New Delhi recorded an increase in AQI level by (33%), Mumbai (30%),

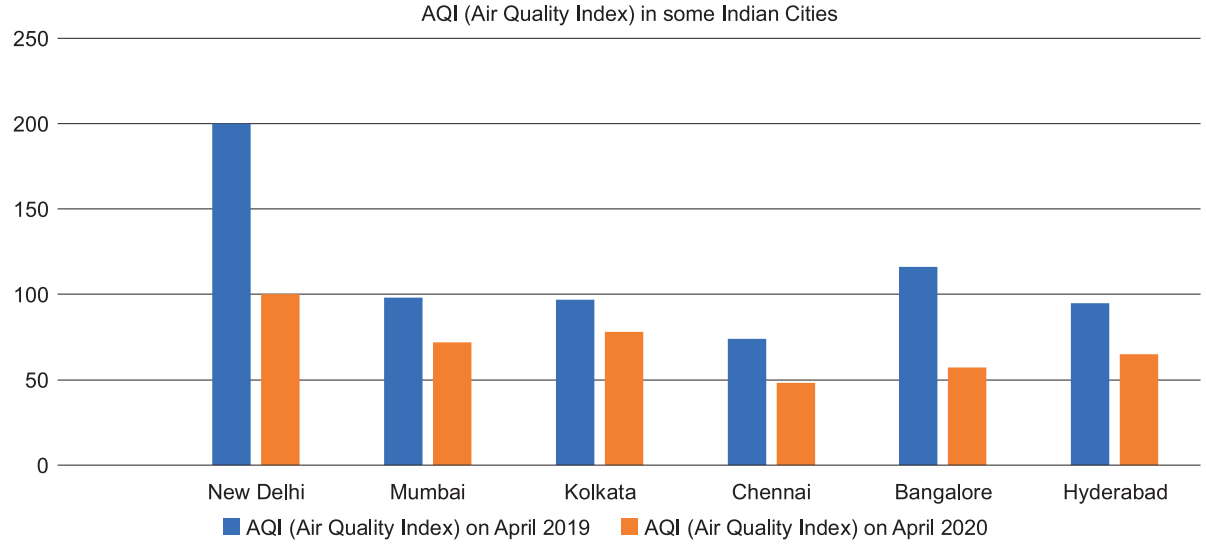

Fig. 4. Air Quality Index (AQI) recorded in major Indian cities on April 2019 & 2020
Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare – Government of India (https://www.mohfw.gov.in/).

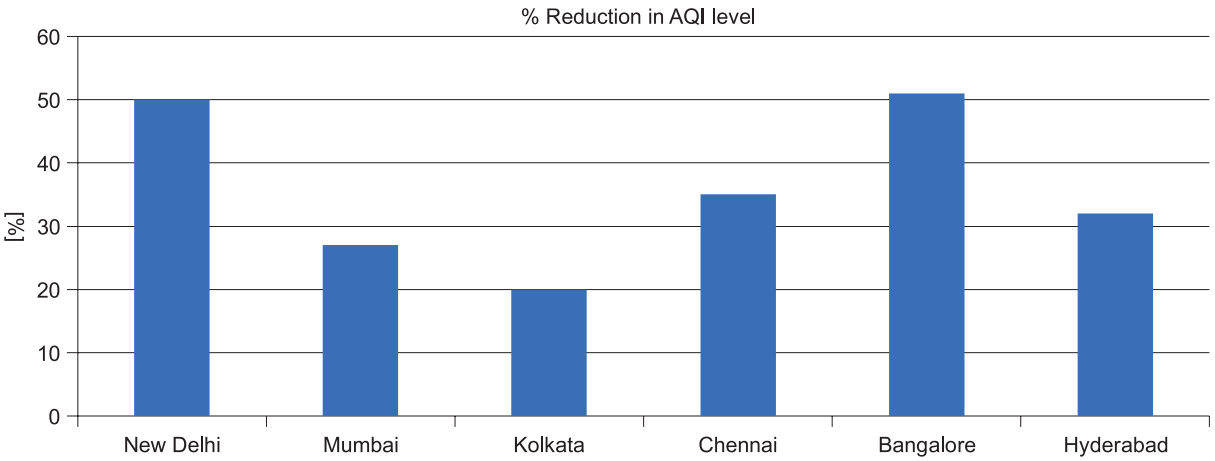

Fig. 5. Reduction in AQI levels in some Indian cities on April 2019 & 2020 (%)
Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare – Government of India (https://www.mohfw.gov.in/).

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

Kolkata (3%), Chennai (15%), Bangalore (36%) and Hyderabad (42%). The graphical representation of the same is shown in Figure 7.

Particulate matter PM2.5 is one of the major pollutants contributing to air pollution. PM2.5 refers to particulate matter having diameter less than 2.5 micrometers which can enter the lungs and even the blood stream. Prolonged exposure to PM2.5 can lead to deadly diseases including cancer and cardiac problems (Amardeepak et al., 2021). Figure 8 shows PM2.5 level recorded in some major Indian cities and graphical representation. The PM2.5 concentration in New Delhi decreased from 71.4μg/m^3 in April 2019 to 53.6μg/m^3 in April 2020 giving a significant reduction of (24.9%). The percentage reduction of PM2.5 concentration in other cities was Mumbai (22.9%), Kolkata (20.4%), Chennai (37.4%), Bangalore (34.3%) and Hyderabad (12.6%). The results indicate

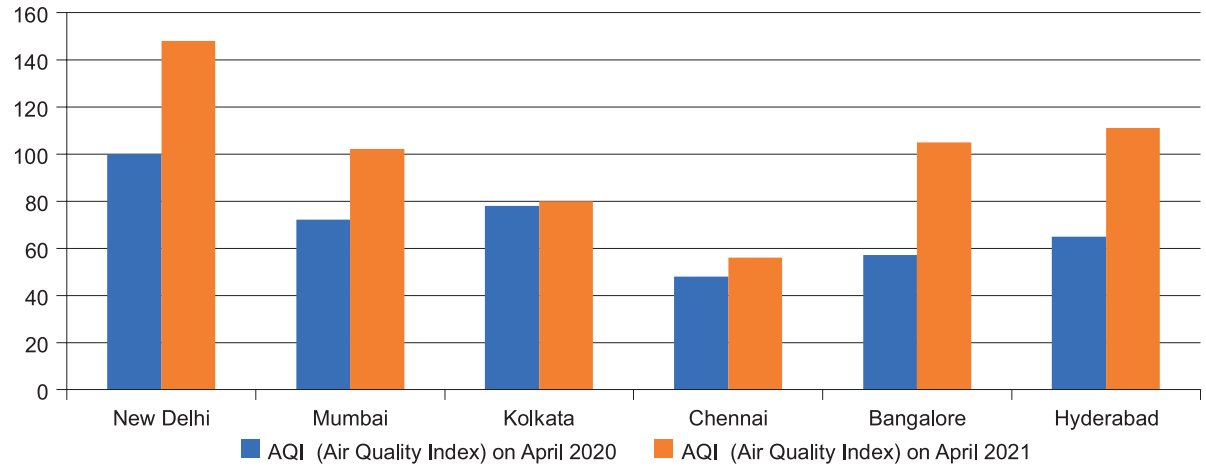

Fig. 6. AQI levels in some Indian cities on April 2020 & 2021
Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare – Government of India (https://www.mohfw.gov.in/).

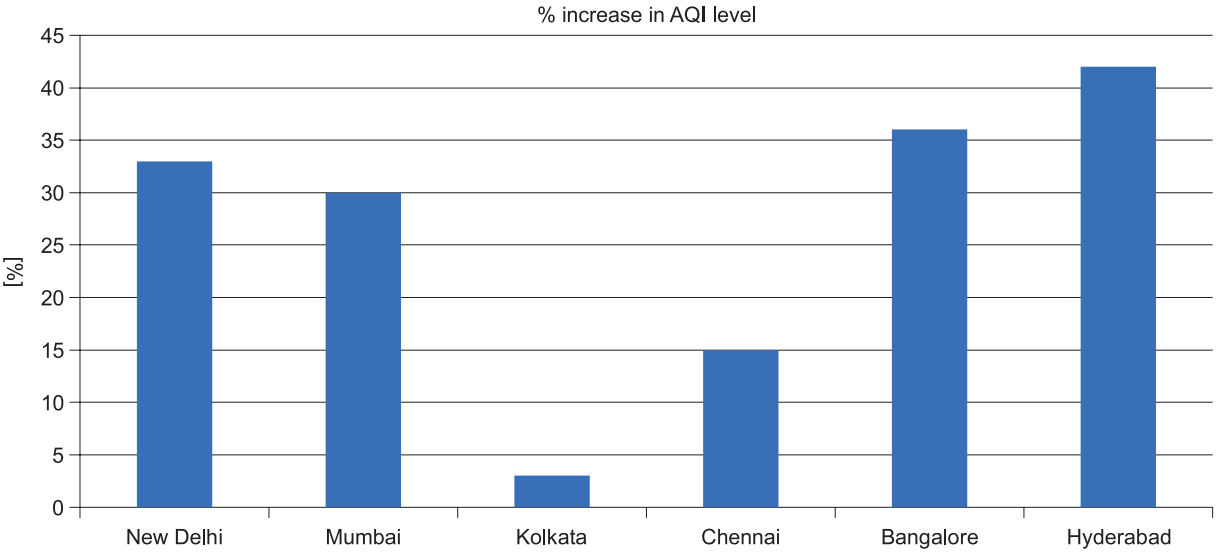

Fig. 7. Air Quality Index (AQI) increase in some Indian cities in April 2020 & 2021 (%)
Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare – Government of India (https://www.mohfw.gov.in/).

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

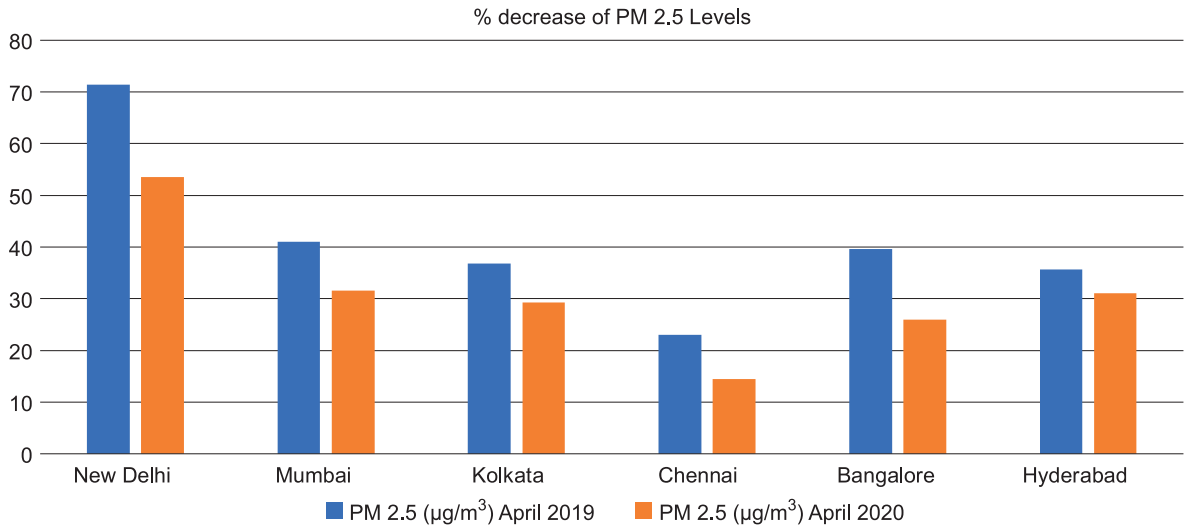

Fig. 8. PM 2.5 levels in some Indian cities on April 2019 & 2020
Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare – Government of India (https://www.mohfw.gov.in/).

that there is a significant improvement in Air Quality of all the major industrial cities due to lockdown. The graphical representation of the same is shown in Figure 9. Due to relaxation of lockdown in the last quarter of the year 2020, subsequently followed by restarting of industrial and transportation activities resulted in increase in PM2.5 concentration. Figure 10 shows PM2.5 levels in major Indian cities recorded in April 2020 and 2021 and the graphical representation. A change in PM2.5 level from 53.6 µg/m^{3}in April 2020 to 76.3 µg/m^3 in April 2021 was observed in the national capital, New Delhi, thereby giving a (29.8%) increase in PM2.5 level. The percentage increase in PM2.5 levels in other cities was Mumbai (15.1%), Kolkata (9.6%), Chennai (44.8%), Bangalore (52.1%) and Hyderabad (43.7%). The graphical representation of the results is shown in Figure 11.

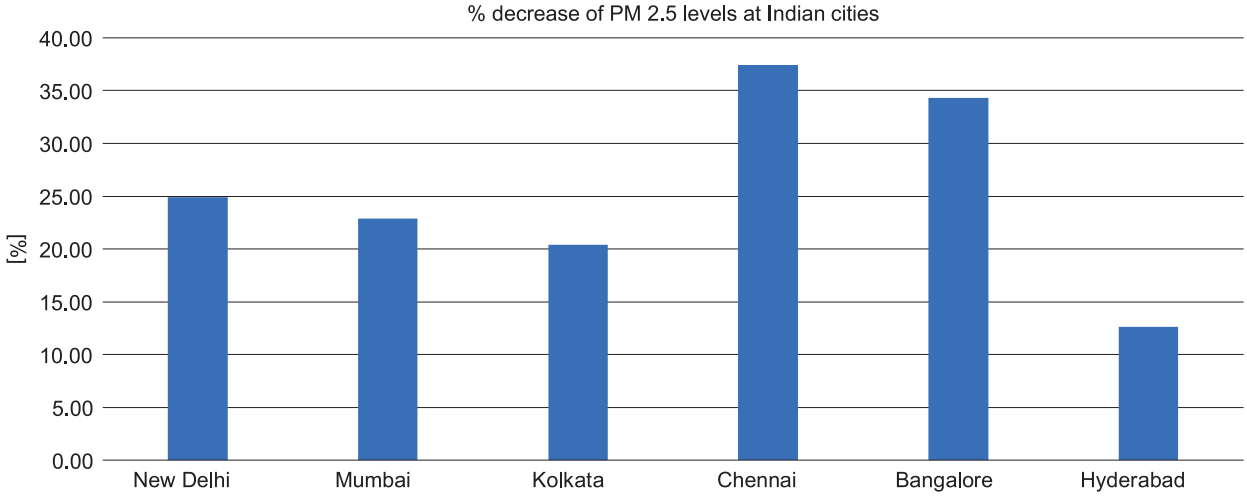

Fig. 9. Reduction of PM 2.5 levels in some Indian cities on April 2019 & 2020 (%)
Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare – Government of India (https://www.mohfw.gov.in/).

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

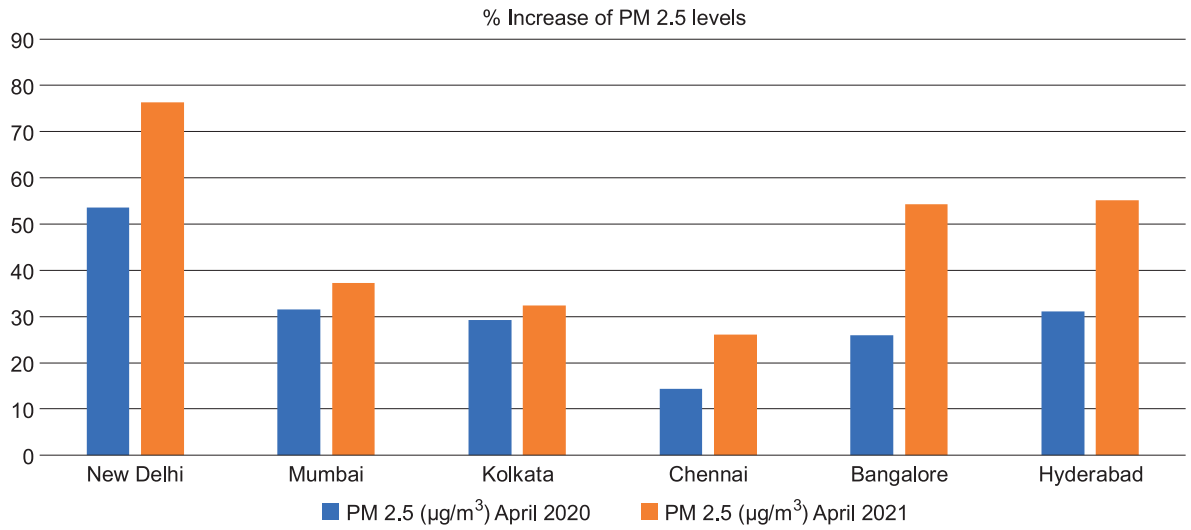

Fig. 10. PM 2.5 levels in some Indian cities on April 2020 & 2021
Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare – Government of India (https://www.mohfw.gov.in/).

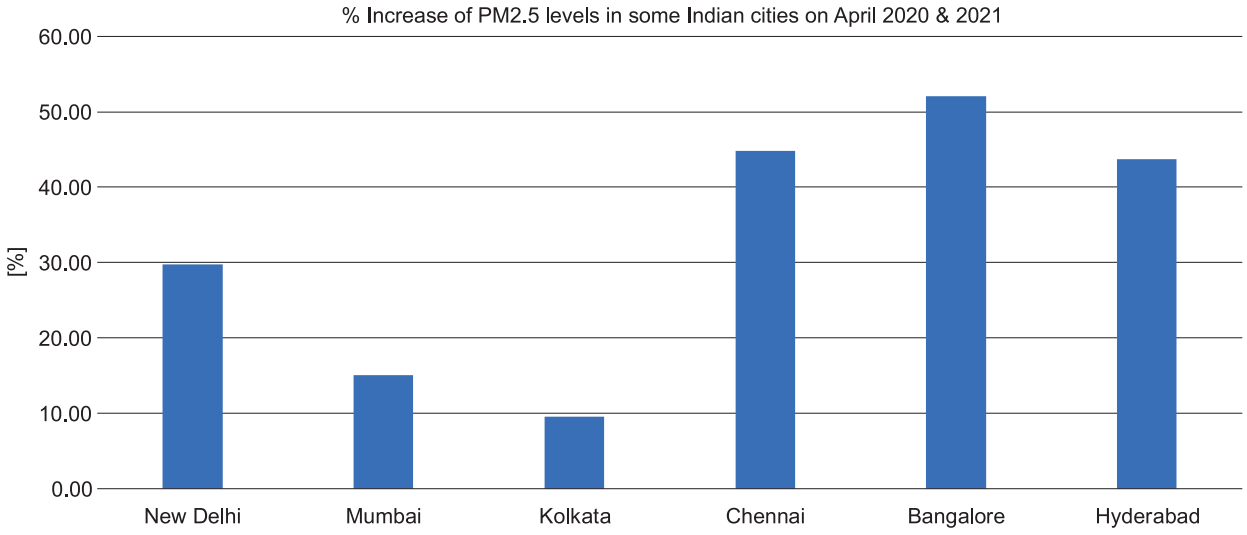

Fig. 11. Increase of PM2.5 levels in some Indian cities on April 2020 & 2021 (%)
Source: own preparation based on data from WHO (https://covid19.who.int/) and Ministry of Health and Family Welfare – Government of India (https://www.mohfw.gov.in/).

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

EMISSIONS BY DIFFERENT SECTORS

Various sectors that emit greenhouse gases have been identified and depicted in the Figure 13.

Green Enterprise Transformation

With the passage of time, the world is expected to recover from the adverse effects of the COVID-19 pandemic. But the impact on the environment would likely become more adverse especially with the fully functional industry coupled with the fact that the growth of industry is also likely to be much faster (Malik et al., 2020; Unhelkar, 2016; Anand et al., 2019). A series of mechanisms need to be put in place at the onset in order to make life of the common man worth living. One thing that needs to be kept in mind is that the actions carried out must be beneficial to both the industry and the environment. If the actions lead to heavy expenses, there is a likelihood of industries closing down due to lack of profits. On the other hand, if the growth of the industry has adverse effects on the environment, an emergency situation would arise where the government agencies would serve notice to the industry thereby forcing its closure.

Formulation of green policies may arise due to internal or external pressure.

Internal pressure on green policies may arise due to the fact that the organization has to reduce energy consumption as well as cost. The apparent increase in cost of the green initiatives may act as a deterrent. External pressure may arise due to government rules and regulations or pressure from society.

Other aspects which need to be taken into consideration include self interest and image of the organization. All these aspects have been picturized and shown in Figure 14.

Measurements

Each organization must procure and install a CEMS for measurement and reporting. Smart meters at the end of CEMS can help in automation. A well designed CEMS can also be subjected to auditing processes thereby leading to certification. Besides, the context sensitive nature of the application gives rise to challenges in automation. Care is to be taken to ensure that Green washing is avoided under all circumstances. Green washing refers to the practice of organizations exaggerating their green credentials

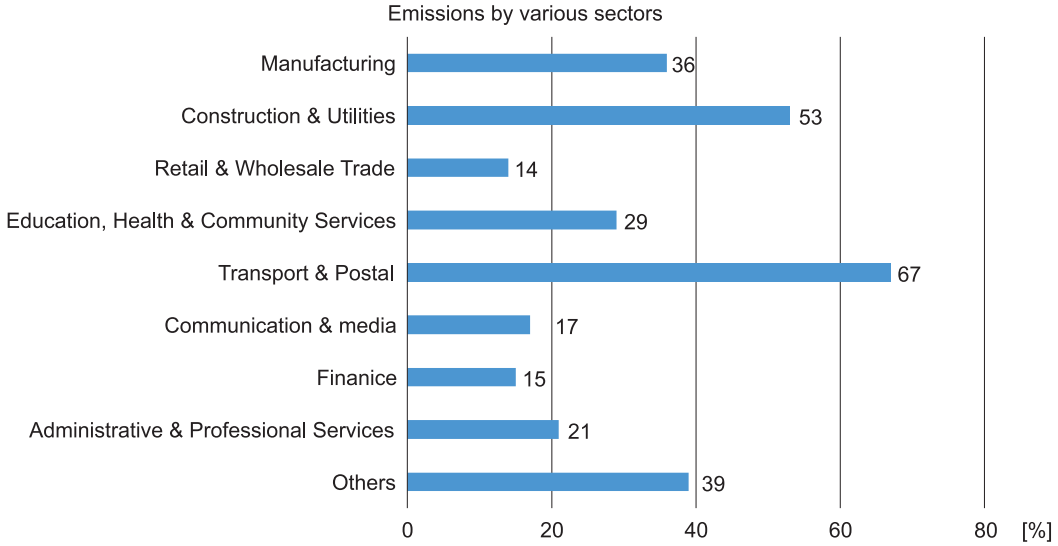

Fig. 12. Different industry sectors that monitors emissions on regular basis
Source: own preparation based on data from World Resources Institute (https://www.wri.org/).

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

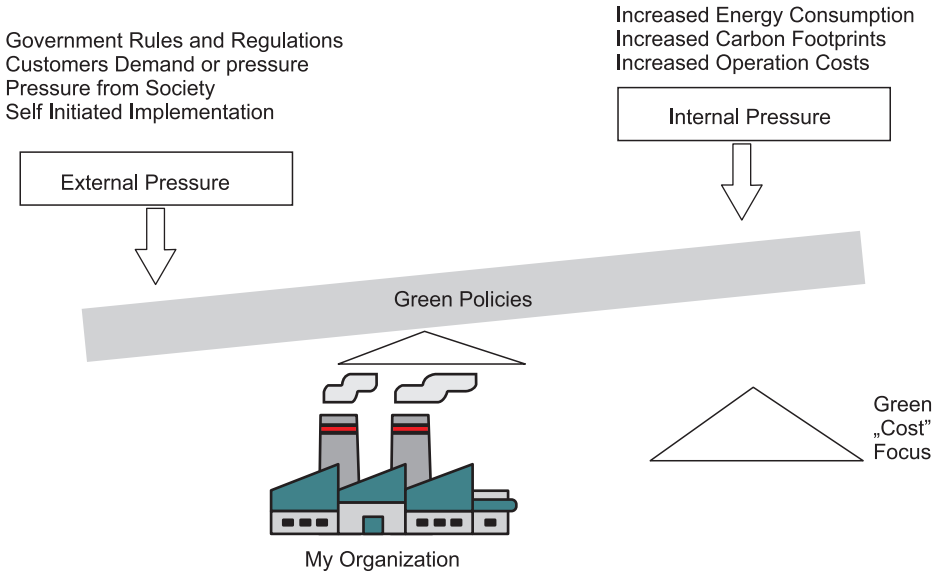

Fig. 13. Formulation of Green Policies
Source: own preparation.

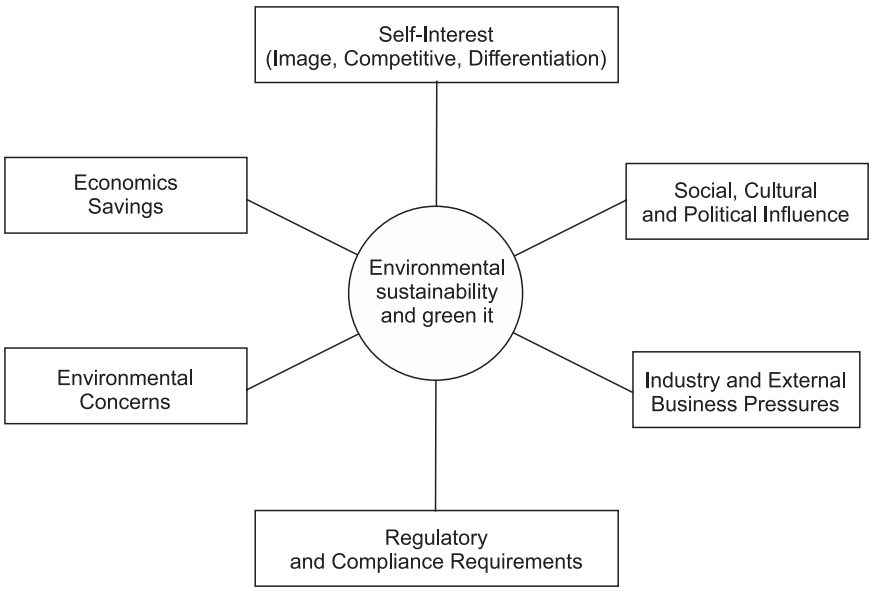

Fig. 14. Aspects to be taken into consideration
Source: own preparation.

and environmental sustainability attributes and making false claims (Leonhard & Murray, 2009). This socially irresponsible and unethical practice misleads customers and the public regarding the company's environmental practices or the environmental benefits of its product or services.

Transformational aspects

Carbon Emissions Management Software (CEMS) is a category of software that helps organizations to manage and report their CO_2 along with other greenhouse gas (GHG) emissions. A collaborative

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

effort that integrates all existing packages along with CEMS software is needed. Organizations need to strategize for new CEMS that is exclusively dedicated for storage, analysis and reporting of Carbon data. Based on the same, some key performance indicators have to be checked.

Sample case studies with descriptions and conclusions

CS 1:

There are 20 Air Conditioners each of 1.5 TR rating in a small office complex

Temperature is initially at 20 Deg C

Proposed to reset the temperature of the Air Conditioners at 24 Deg C [4 Deg C temperature increase]

- Avg. power reqd.: 1W/TR
- Electricity Power Saving estimated: 20 * 1.5 TR * 1 W * 24% = 7 W
- Electricity Power Saving = 7 W * 10 hours/day = 70 units every day.
- With the office working for 6 days /week, it would work out to 26 days in a month
- Hence Monthly Electricity Bill saving =70 * 26 = 1820 units
- Carbon Emission reduction = 1820/1000 * 0.84 = 1.5 tons CO_2e/month

CS 2:

A bigger challenge comes in the telecom sector. Here, the end users are not visible. So, collecting data from them is an arduous job. Specific issues related to the telecom industry have to be taken into consideration. A big business will have substantially large numbers of data servers, communication switches and related networking equipment. Besides, it will have large physical buildings spread across the region and multiple communications towers (Krishna et al., 2015a; 2015b). The carbon produced by the organization is primarily through its infrastructure platform and related services. These are large-scale communications services across the region consumed by corporate customers and content providers. Therefore, strategies for carbon measurement, reporting and control need to focus directly on these large-scale infrastructures such as communication towers, telecom switches, wired and wireless relaying equipment's, associated routers, data servers and many IT supporting hardware. In such companies, both the IT systems as well as the data centre needs to be optimized (Datta, 2017). Total Carbon cost of Ownership (TCCO) is an important parameter that needs to be calculated assessed and reduced using green transformational initiatives. Besides, some of the initiatives may be short term while others long term. All these aspects must be taken into consideration.

CHALLENGES AND RECOMMENDATIONS

Enough emphasis has been given on providing a healthy environment for life to carry on without hassles post COVID-19. In order to efficiently incorporate the same, a large number of challenges have to be tackled. A vast majority of the same have been identified. They include the need for formal metrics and associated measurements related to carbon performance of an organization. Besides, the organization must ensure to have the necessary expertise for putting together a measurement and optimization program. Mechanisms must be formulated as to what needs to be done when real time data is insufficient or unavailable. Conflicts may also arise between organizations with respect to agreement over a specific set of standards and regulations. There may be differences in calculations of carbon emissions based on electricity consumed from different sources. The viewpoints of the participating members of the organization must be clearly understood. Problems may also arise with respect to the choice of assumptions being made while carrying out analysis.

CONCLUSIONS

Two areas of concern have been addressed in this paper. The first one deals with the impact of COVID-19 on health of an individual. The effect it has on humans has been statistically dealt with. The statistical results for various parameters such as mortality rate and

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

air pollution in India have been presented in tabular and graphical forms. The second one deals with the damage caused to the environment as a result of human attitude. Mechanisms have been designed to ensure that the world is a better place to live post COVID-19 pandemic. There are plenty of diseases with no medicines even in the highly developed present scientific world. The outbreak of the COVID-19 disease has resulted in a severe disaster to human life. The study reveals that the numbers of cases of infection and deaths have grown exponentially during first and second wave and may further increase with the possible occurrence of a third wave as predicted by some medical experts. It is observed that as a consequence of lockdown, industries were shutdown, complete halt to construction and commercial activities. Also due to very little traffic on the roads, AQI and PM2.5 levels improved significantly in all major cities. This was a blessing in disguise to Mother-Nature as people of New Delhi after many decades breathed clean air, witnessed improved visibility with no fog. It can be concluded from this study that the economic growth is required for the prosperity of the nation. At the same time there is a need for enactment of proper legislation for safe guarding the environment.

REFERENCES

Ali, N., & Islam, F. (2020). The effects of air pollution on COVID-19 infection and mortality – A review on recent evidence. *Frontiers in Public Health*, *779*. https://doi.org/10.3389/fpubh.2020.580057.

Amardeepak, M., Mamatha, E., Kiran, S., Manjunath, S., & Reddy, C.S. (2021). Case study on ncov-19 pandemic effect on Indian economy and geographic impact. *Indian Journal of Ecology*, *48* (Spl.), 45–48.

Anand, K., Mamatha, E., Reddy, C.S., & Prabha, M. (2019). Design of neural network based expert system for automated lime kiln system. *Journal Européen des Systèmes Automatisés*, *52*(4), 369–376. https://doi.org/10.18280/jesa.520406.

Coker, E.S., Cavalli, L., Fabrizi, E., Guastella, G., Lippo, E., Parisi, M.L., Pontarollo, N., Rizzati, M., Varacca, A., & Vergalli, S. (2020). The effects of air pollution on COVID-19 related mortality in northern Italy. *Environmental and Resource Economics*, *76*(4), 611––634. https://doi.org/10.1007/s10640-020-00486-1.

Cui, J., Li, F., & Shi, Z.L. (2019). Origin and evolution of pathogenic coronaviruses. *Nature Reviews Microbiology*, *17*(3), 181–192. https://doi.org/10.1038/s41579-018-0118-9.

Datta, T.K. (2017). Effect of green technology investment on a production-inventory system with carbon tax. *Advances in operations research*, 1–12. https://doi.org/10.1155/2017/4834839.

Elliriki, M., Reddy, C.S., Anand, K., & Saritha, S. (2021). Multi server queuing system with crashes and alternative repair strategies. *Communications in Statistics – Theory and Methods*, 1–13.

Harrower, K. (2020). Networked and Integrated Urban Technologies in Sustainable Smart Energy Systems. *Geopolitics, History, and International Relations*, *12*(1), 45–51.

Ionescu, L. (2020). The economics of the carbon tax: environmental performance, sustainable energy, and green financial behavior. *Geopolitics, History, and International Relations*, *12*(1), 101–107.

Ionescu, L. (2021a). Corporate Environmental Performance, Climate Change Mitigation, and Green Innovation Behavior in Sustainable Finance. *Economics, Management, and Financial Markets*, *16*(3), 94–106.

Ionescu, L. (2021b). Transitioning to a low-carbon economy: Green financial behavior, climate change mitigation, and environmental energy sustainability. *Geopolitics, History, and International Relations*, *13*(1), 86–96.

Jin, Y.H., Cai, L., Cheng, Z.S., Cheng, H., Deng, T., Fan, Y.P., ... & Wang, X.H. (2020). A rapid advice guideline for the diagnosis and treatment of 2019 novel coronavirus (2019-nCoV) infected pneumonia (standard version). *Military Medical Research*, *7*(1), 1–23. https://doi.org/10.1186/s40779-020-0233-6.

Krishna Anand, S., Manogna, K., & Tharunisri, V. (2015a). A detailed study and analysis of Earthquake prediction and prevention. *Unique Journal of Engineering and Advanced Sciences*, *03*(01), 1–5.

Krishna Anand, S., Priya, V., & Sagambari Devi, G. (2015b). Assessing Impact of Climate Change through Design of a Fuzzy Expert System. *ARPN Journal of Engineering and Applied Sciences*, *10*(1), 193–201.

Kundu, B., & Bhowmik, D. (2020). *Societal impact of novel corona virus (COVID–19 pandemic) in India*, 1–14. doi: 10.31235/osf.io/vm5rz.

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com

Leonhard, W., & Murray, K. (2009). *Green home computing for dummies*. John Wiley & Sons.

Li, X., Wang, W., Zhao, X., Zai, J., Zhao, Q., Li, Y., & Chaillon, A. (2020). Transmission dynamics and evolutionary history of 2019-nCoV. *Journal of Medical Virology*, *92*(5), 501–511. https://doi.org/10.1002/jmv.25701.

Mahato, S., Pal, S., & Ghosh, K.G. (2020). Effect of lockdown amid COVID-19 pandemic on air quality of the megacity Delhi, India. *Science of The Total Environment*, *730*, 139086. https://doi.org/10.1016/j.scitotenv.2020.139086.

Malik, Y.S., Sircar, S., Bhat, S., Sharun, K., Dhama, K., Dadar, M., Tiwari, R., & Chaicumpa, W. (2020). Emerging novel coronavirus (2019-nCoV) – current scenario, evolutionary perspective based on genome analysis and recent developments. *Veterinary Quarterly*, *40*(1), 68–76. https://doi.org/10.1080/01652176.2020.1727993.

Mamatha, E., Sasritha, S., & Reddy, C.S. (2017). Expert system and heuristics algorithm for cloud resource scheduling. *Romanian Statistical Review*, *65*(1), 3–18.

Mathew, T., & Madhavi, N. (2020). Air Quality During COVID-19: Analysis of Particulate Matter for a Coastal Urban Station Visakhapatnam (India). *Letters in Applied Nano Bioscience*, *10*(1), 1925–1935. https://doi.org/10.33263/LIANBS101.19251935.

Ministry of Health and Family Welfare – Government of India. (2022). Retrieved from: https://www.mohfw.gov.in/.

Nemteanu, M.S., & Dabija, D.-C. (2021a). The Influence of Internal Marketing and Job Satisfaction on Task Performance and Counterproductive Work Behavior in an Emerging Marketing during the COVID-19 Pandemic. *International Journal of Environmental Research and Public Health*, *18*(7), 3670. https://doi.org/10.3390/ijerph18073670.

Nemteanu, M.-S., Dinu, V., & Dabija, D.-C. (2021b). Job Insecurity, Job Instability, and Job Satisfaction in the Context of the COVID-19 Pandemic. *Journal of Competitiveness*, *13*(2), 65–82. https://doi.org/10.7441/joc.2021.02.04.

Nikzad, R., & Sedigh, G. (2017). Greenhouse gas emissions and green technologies in Canada. *Environmental Development*, *24*, 99–108. https://doi.org/10.1016/j.envdev.2017.01.001.

Nowak, M., Dawidowicz, A., Źróbek, R., & Do Thi Tuyet, M. (2020). Identification of development determinants of green information systems for urban areas – Polish case study. *Acta Scientiarum Polonorum. Administratio Locorum*, *19*(1), 45–60. https://doi.org/10.31648/aspal.4456.

Pflugmann, F., & De Blasio, N. (2020). The Geopolitics of Renewable Hydrogen in Low-Carbon Energy Markets. *Geopolitics, History, and International Relations*, *12*(1), 9–44.

Salih, N.M.M., & Hussein, S.H. (2021). Cities after pandemic: enabling social distancing as a new design standard to achieve urban immunity. *Acta Scientiarum Polonorum. Administratio Locorum*, *20*(4), 345–360. https://doi.org/10.31648/aspal.6825.

Saritha, S., Mamatha, E., & Reddy, C.S. (2019). Performance measures of online warehouse service system with replenishment policy. *Journal Europeen Des Systemes Automatises*, *52*(6), 631–638.

Saritha, S., Mamatha, E., Reddy, C.S., & Rajadurai, P. (2022). A model for overflow queuing network with two-station heterogeneous system. *International Journal of Process Management and Benchmarking*, *12*(2), 147–158.

Unhelkar, B. (2016). *Green IT strategies and applications: using environmental intelligence*. CRC Press.

WHO. (2022). Retrieved from: https://covid19.who.int/.

World Resources Institute. (2022). Retrieved from: https://www.wri.org/.

✉sricsrmax@gmail.com, ✉amardeepakm1@gmail.com, ✉skanand86@gmail.com, ✉drkrupakara@gmail.com, ✉saisrimax@gmail.com