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From The Desk of the Editor-in-chief...

*"Nothing in life is to be feared, it is only to be understood.
Now is the time to understand more, so that we may fear less."*

- Marie Curie

COVID-19 an infectious disease that began to spread in Wuhan, China in December 2019. is now an epidemic and taken refuge in host bodies in 210 countries around the globe infecting 42.2 million population, among which 1.14 million lost their life (as per data of WHO)?The condition is still uncontrolled and with no proven cure for the virus. Undoubtedly COVID-19 has brought a fearful devastating scourge for human being, but it has emerged as a blessing for natural environment providing it a "recovery time".

During past two decades, India has witnessed an expeditious industrial growth which has certainly improved the standard of living of its people and it is also evident from the rising vehicular fleet on roads. We have also learnt that the environmental degradation caused by humans is not totally irreversible. In a period of just 8 months, "recovery of nature" is being witnessed by everyone. The various parameters like PM10, NO2, and CO has also reduced distinctly. Carbon emissions have decreased, and the quality of air has seen an unprecedented improvement.

It is remarkable to see a reduction of 85.1% in PM_{2.5} concentration in one of the India's most polluted city in India .As Most of the human activities are restricted which has helped environment to heal itself . Several Factories, transport, vehicles and aviation have all ground to a halt. There is no doubt, because the low altitude of human feet is also healing the oceans and sea life is thriving. Again, where fish are concerned, the dropdown has seen a decline in fishing, meaning that biomass will increase after fishing, almost eliminating it. In addition, the animals have been seen roaming freely where once they would not dare to go. Even sea turtles have been seen returning to areas where they once avoided laying their eggs, all due to lack of human intervention. Plants are growing better due to clean air and water, and because there is no human intervention yet. With everything at a standstill, plants are allowed to thrive and grow and produce more coverage and oxygen.

The rivers of India like Ganga, Yamuna, and Cauvery etc. have become clean and clear and marine life is visible. The Air quality index (AQI) in all the states of India are now in two figures (indicating moderately good quality of air) .

By self-introspection it can be summarized that this is a signal for us to understand and react. Government and Policy makers should take necessary steps so that this healing process does not become a temporary thing. There is a need for rigorous study on the effect of implementation of such short-term lockdown as an alternative measure for pollution reduction and its effect on economy. Less litter also means less deposition of river systems, which is good for the environment in the long run.

In conclusion, although the lockdown due to corona pandemic has had a positive impact on the environment, there are fears that once people start traveling again or go back to normal routine, all positive effects will also disappear. **HIGH TIME TO THINK & ACT.....**

Enjoy Reading

Sanjeev Bansal

A Study on Environmental Pollution and its Effect on Society

Seema Sinha*

Pollution refers to the contamination of the earth's environment with materials that interfere with human health, quality of living or the natural functioning of the ecosystems. There are numerous ways of pollution which includes water pollution, air pollution, noise pollution and soil contamination, thermal pollution and radioactive hazards. To judge which leads to risk to health is difficult as all are harmful in one way or the other.

We cannot deny the fact that natural resources had been stored virtually untouched in the Earth for millions of years. But since the start of the industrial revolution vast amounts of these resources had been exploited within just a couple of hundred years at unimaginable rates, with all the waste from this exploitation going straight in to the environment (air, water, land) and seriously damaging its natural processes. If we carefully we can find that fundamental pollution drivers are Globalization, Industrialization and Population growth. Hence we can say that Environmental pollution is "the contamination of the physical and biological components of the earth/atmosphere system to such an extent that normal environmental processes are adversely affected". Man is causing all round damage to atmosphere, water, land, to the various elements of environment and to the ecosystem itself. There is so much man-made pollution and environmental degradation that the nightmare ahead is enough jittery to shake us all. Taking a synoptic view of the general scenario a few trends are underway. Our atmosphere on global as well as regional scale is heavily polluted. The protective ozone shield in the heavily populated latitudes of the northern hemisphere is thinning twice fast as scientists thought a few years ago. The buildup of green house gases will lead to significant changes in the weather patterns in the near future leading to global warming. The destruction of ozone layer and the further warming of the earth surface threaten catastrophic consequences such as eruption of cancerous and tropical diseases, disruption of oceans food chain, rising of sea levels, submersion of many islands, melting of small land-based glaciers, flooding in many low lying coastal areas and harvest loss etc.

It takes place when the environment cannot process and neutralize harmful by-products of human activities (for example, poisonous gas emissions) in due course without any structural or functional damage to its system. The carrying capacity of Earth is significantly smaller than the demands placed on it by large numbers of human populations and overuse of natural resources often results in nature's degradation.

This paper provides an evidence-based insight into the status of air pollution in our India and its effects on health and control measures instituted in the major metro cities of the country.

Keywords: Environmental pollution, contamination of air, natural resources, globalisation, soil contamination

INTRODUCTION

The impact of man on environment through his economic activities are varied and highly complex as the transformation or modification of the natural condition and process leads to a series of changes in the biotic and abiotic components of the environment. The impacts of man on environment fall into two categories (i) direct or intentional impacts and (ii) indirect or unintentional impacts, Direct or intentional impact of human activities are preplanned and premeditated because man is aware of the consequences, both positive and negative of any programme which is launched to change or modify the natural environment for economic development of the region concerned.

The effects of anthropogenic changes in the environment are noticeable within short period and these effects are reversible. On the other hand the indirect impacts of human activities on the environment are not premeditated and preplanned and these impacts arise from those human activities which are directed to accelerate the pace of economic growth, especially industrial development. The indirect impacts are experienced after long time when they become cumulative. These indirect effects of human economic activities may change the overall natural environmental system and the chain-effects sometimes degrade the environment to such an extent that this becomes suicidal for human beings. MAIN CAUSES OF ENVIRONMENTAL POLLUTION The problem of environmental pollution, we face today, is a complex consequence of forces connected with

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various interrelating factors. There are clearly a number of divergent and conflicting views of what could be the basic factors underlying the environmental crisis.

There can be many root cause problem due to which we are responsible directly or indirectly for spreading this pollution like

1. **Population growth** Modern thinkers consider that growth of population is the root cause for many human problems. This observation also applies to environmental degradation. Increase in the population will have a multiplier effect requiring proportionate increase in all requirements necessary for the existence of human beings. Population growth requires abnormal exploitation of natural resources to provide day-to-day essential requirements of life. It results in migration of people and growth of urban areas, thereby inviting new problems of health, ecology and human sustenance.
2. **Increased General Affluence and Economic Growth** The affluence (i.e. material aspects of per capita consumption of goods and resources) is an important factor in man-resource-environment relationship. It is the increasing per capita demand of rich which is absorbing the growth in output of goods and services in the developed and developing countries and cause misuse or overuse and pollution of resources, for the affluence unmatched to the necessary resource consumption and not motivated by human requirements produce tendency to waste matter and energy. Surprisingly, affluence factor though, having a great impact on environment, is seldom talked about. On the other hand, poor and the poverty often get blamed for the destruction of environment. The notion that poverty or the poor destroy the environment most is but partially true.
3. **Nature of Modern Technology** The nature of productive technology in recent years is closely related to the environmental crisis. Commoner maintains that sweeping transformations of productive technology since World War II productive technologies with intense impacts on environment have displaced less destructive ones. This factor has been largely responsible for the generation of synthetic and non-biodegradable

substances such as plastics, chemical nitrogen fertilizers, synthetic detergents, synthetic fibres, big cars, petrochemical and other environmentally injurious industries and 'disposable culture. Thus, environmental crisis is the inevitable result of a counter ecological pattern of productive growth. Ecologically benign technologies did and do exist but they are not utilized, for they are considered inconsistent with the short-term interests of private profit maximization.

4. **Deforestation** Forests are invaluable property of a nation because they provide raw materials to modern industries, timber for building purposes, habitats for numerous types of animals and micro-organisms. Good fertile and nutrient-rich soils having high content of organic matter, offer protection to soils by binding the soils through the network of their roots and by protecting the soils from direct impact of falling raindrops. They encourage and increase infiltration of rainwater and thus allow maximum recharge of groundwater resources, minimize surface run-off and hence reduce the frequency, intensity and dimension of floods. They help in increasing the precipitation; they are natural sink of carbon dioxide because they use carbon dioxide to prepare their food during the process of photosynthesis. They provide firewood to millions of people all over the world and food and shelter to innumerable humans and animals. In fact, forests are 'life line' of a nation because prosperity and welfare of the society directly depends on sound and healthy forest cover of a nation concerned. Forests are main component of the biotic components of the natural environmental system and the stability of the environment and ecological balance largely depend on the status of the forests of the region concerned. The list is endless

REVIEW LITERATURE

Pollutants and its many forms: Pollutants don't recognize boundaries, they are transboundary;

Many of them can't be degraded by living organisms and therefore stay in the ecosphere for many years; and They destroy biota and habitat. Biological Decomposition of Environmental Pollutants: • environmental pollutants are

biodegradable and non-biodegradable ones, •Biodegradable Pollutants are the ones that can be broken down and processed by living organisms, including organic waste products, phosphates, and inorganic salts. For example, if a pollutant is organic, it can be used by a living organism to obtain energy and other material from carbohydrates, proteins etc. •Therefore, biodegradable pollutants are only “temporary nuisances” that can be neutralised and converted into harmless compounds. However, it is important to remember that they can become serious pollutants if released in large amounts in small areas, thus exceeding the natural capacity of the environment to “assimilate” them. Non-Biodegradable Pollutants •These are the ones that cannot be decomposed by living organisms and therefore persist in the ecosphere for extremely long periods of time. •They include plastics, metal, glass, some pesticides and herbicides, and radioactive isotopes. In addition to that, fat soluble (but not water soluble) non-biodegradable pollutants, ex. mercury and some hydrocarbons, are not excreted with urine but are accumulated in the fat of living organisms and cannot be metabolised.

Generally speaking, there are many types of environmental pollution but the most important ones are: Air pollution & Water pollution, also Soil pollution (contamination). Some of the most notable air pollutants are sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, volatile organic compounds (VOCs) and airborne particles, with radioactive pollutants probably among the most destructive ones (specifically when produced by nuclear explosions). Water pollutants include insecticides and herbicides, food processing waste, pollutants from livestock operations, volatile organic compounds (VOCs), heavy metals, chemical waste and others. Some soil pollutants are: hydrocarbons, solvents and heavy metals. Combustion of fossil fuels produces extremely high levels of air pollution and is widely recognized as one of the most important “target” areas for reduction and control of environmental pollution. Fossil fuels also contribute to soil contamination and water pollution. For example, an oil leak may occur and pollute soil and subsequently groundwater / ocean water.

The use of uranium for nuclear power generation produces extremely dangerous waste that would take thousands of years to neutralize. Common

sources of fossil fuel pollution are: Industry:

- Power-generating plants , •Petroleum refineries , •Petrochemical plants , •Production and distribution of fossil fuels , •Other manufacturing facilities, Transport: •Road transport (motor vehicles) , •Shipping industry , •Aircraft . Fossil fuel combustion is also a major source of carbon dioxide (CO₂) emissions and perhaps the most important cause of global warming.

From the findings, the observation is : As per the of World Bank Development Research Group the average total suspended particulate (TSP) level in Delhi was approximately five-times the World Health Organization's annual average standard. In the metro city like Delhi It is estimated that about 3000 metric tons of air pollutants emits every day in Delhi, with a major contribution from vehicular pollution (67%), followed by coal-based thermal power plants (12%). Vehicular pollution is an important contributor to air pollution in Delhi. According to the Department of Transport, Government of National Capital Territory of Delhi, vehicular population is estimated at more than 3.4 million, reaching here at a growth rate of 7% per annum. The PM₁₀ standard is generally used to measure air quality. The PM₁₀ standard includes particles with a diameter of 10 µm or less (0.0004 inches or one-seventh the width of a human hair). These small particles are likely to be responsible for adverse health effects because of their ability to reach the lower regions of the respiratory tract. According to the Air Quality Guideline by the World Health Organization, the annual mean concentration recommended for PM₁₀ was 20 µg/m³, beyond which the risk for cardiopulmonary health effects are seen to increase Major concerns for human health from exposure to PM₁₀ include effects on breathing and respiratory systems, damage to lung tissue, cancer and premature death. Elderly persons, children and people with chronic lung disease, influenza or asthma are especially sensitive to the effects of particulate matter.

Besides these, non-respiratory effects were also seen to be more in Delhi than in rural controls. The prevalence of hypertension was 36% in Delhi against 9.5% in the controls, which was found to be positively correlated with respirable suspended particulate matter (PM₁₀) level in ambient air. Delhi had significantly higher levels of chronic headache, eye irritation and skin irritation.

Several other community-based studies have found that air pollution is associated with respiratory morbidity. Numerous studies have reported an association between indoor air pollution and respiratory morbidity. Some of these studies have concentrated on children's respiratory morbidity. Other studies in children have found similar correlations between particulate matter in ambient air and attention-deficit hyperactivity disorder between vehicular air pollution and increased blood levels of lead (a potential risk factor for abnormal mental development in children and between decreased serum concentration of vitamin D metabolites and lower mean haze score (a proxy measure for ultraviolet-B radiation reaching the ground).

Studies that have examined the compounding effect of meteorological conditions on air pollution found that winter worsened the air quality of both indoor air and outdoor air. They also found a positive correlation between the winter weather and rise in the number of patients with chronic obstructive airway disease in hospitals.

There was a relative paucity of studies that measured outdoor air pollutant levels first hand and then tried to objectively correlate them to adverse health effects. However, some studies measured air pollutant levels and found a correlation with health-related events.

HOW WE CAN MAKE A BIG DIFFERENCE

Many great scholars from Charaka to Hippocrates have stressed the importance of environment in

the health of the individual. Therefore, all those who play a role in modifying the environment in any way, for whatever reason, need to contribute to safeguard people's health by controlling all those factors which affect it. Every action or inaction of any person has an effect on the environment—be it good, neutral, or negative. By becoming aware and doing the right thing, we choose to be part of the solution. Here are some things you can do: •Stop smoking or don't throw your butts on the ground. Cigarette butts are not biodegradable and contain extremely toxic soluble chemicals. One butt thrown on the ground can remain for up to 25 years, leaking chemicals like arsenic, ammonia, acetone, benzene, cadmium, formaldehyde, lead, and toluene into the environment. •Drive an electric or hybrid car or at least one that uses unleaded gasoline. •Keep the car in good running condition to avoid emissions. •Share a ride or carpool. •Choose to walk or ride a bicycle whenever possible. •Never use open fires to dispose of waste, especially chemicals and plastic. •Adopt the 3 Rs of solid waste management: reduce, reuse, and recycle.

•Use sustainable, reclaimed, or recycled building materials. •Start composting leaves and clippings from yard and food scraps from kitchen to reduce waste while improving soil. Use the power supplied abundantly and freely by wind and sun. Hang the laundry to dry to minimize the use of gas or electricity and open a window or put on a sweater rather than turning on the air conditioner or heater. •Buy local foods and goods. In this manner, the use of fuel for transporting goods can

Study and year	Variable	Findings
Siddique <i>et al.</i> , 2011 ⁽²⁰⁾	Vehicular air pollution effects in children	Ambient PM10 level was positively correlated with ADHD in children (OR = 2.07; 95% CI, 1.08–3.99)
Rajarathnam <i>et al.</i> , 2011 ⁽²³⁾	Outdoor air	It was found that every 10 µg/m ³ change in PM ₁₀ was associated with 0.15% increase in total all-natural-cause mortality
Kumar <i>et al.</i> , 2008 ⁽¹⁵⁾	Indoor air pollution	Indoor SO ₂ , NO ₂ and suspended particulate effects in children matter levels were high in houses with family history of smoking. Indoor air pollution was associated with respiratory function of children
Kulshreshtha <i>et al.</i> , 2008 ⁽¹⁶⁾	Indoor air	High levels of indoor airborne pollutants during winter were associated with respiratory problems for women and children.
Jayaraman, 2008 ⁽¹³⁾	Outdoor air	10 µg/m ³ rise in pollutant level led to statistically significant relative risks (RR) for respiratory morbidity: 1.033 for O ₃ , 1.004 for NO ₂ , 1.006 for RSPM
Nidhi <i>et al.</i> , 2007 ⁽²⁴⁾	Outdoor air	The relative risks of hospitalization due to respiratory diseases were 1.07–2.82
Kumar, 2007 ⁽¹⁹⁾	Indoor air pollution	Indoor SPM level was also significantly effects in children higher in homes of children with a history of respiratory illness
Agarwal <i>et al.</i> , 2006 ⁽¹²⁾	Outdoor air	SPM (r = 0.474; P < 0.01) and RSPM (r = 0.353; P < 0.05) showed a significant positive correlation with the number of COPD cases. Winter months had higher risk
Pande <i>et al.</i> , 2002 ⁽²⁵⁾	Outdoor air	Emergency room visits for asthma, COAD and acute coronary events increased by 21.30%, 24.90% and 24.30%, respectively, due to higher than acceptable levels of air pollutants

Source: A possible solution

be minimized. Look around the house or place of business for ways of conserving water. Use and buy products that are eco-friendly or made with biodegradable materials. Avoid plastic. Always bring a bag to shop. Get rid of the lawn: Plant bee-friendly, drought-tolerant, native plants instead. Plant more trees. They clean the air, provide oxygen, and beautify surroundings. Take care to properly dispose of pet's waste. Do not litter. Start an anti-litter campaign to educate the community. If in a business, make sure the environmental impact of business practices are considered. If working for someone else, take the time to assess your company's environmental impact and try to implement positive change. Say a big "NO" to pesticides and GMOs (genetically modified organisms). •Join an Earth Day celebration (every April 22nd) and consider making its tenets an everyday practice.

Control measures to be taken

Shutdown of hazardous, noxious industries and hot-mix plants and brick kilns which are killing the nature, introduction of unleaded petrol (1998), catalytic converter in passenger cars construction of flyovers and subways for smooth traffic flow, Environmental awareness campaigns are also carried out at regular intervals. The Delhi Pollution Control Board conducts monthly Ambient Air Quality Monitoring at 40 locations in Delhi, and takes corrective action wherever necessary.

Industrial Policy

There are many other organizations that work synergistically with the government efforts to reduce air pollution. These include the Centre for Science and Environment and The Energy and Resources Institute, and the Indian Association for Air Pollution Control. Representatives of the industries include Confederation of Indian Industry and Society of Indian Automobile Manufacturers. Government agencies like Factories Inspectorate are also involved in the control of pollution. Research and academic institutions include National Environmental Engineering Research Institute, Indian Institute of Technology, Council of Scientific and Industrial Research institutions, Indian Agricultural Research Institute and various other academic institutions in and around Delhi. Professional organizations like the Indian National Science Academy, the Indian Institute of Chemical

Engineers and the Indian Institute of Engineers are also involved in pollution control.

Benefits Accrued as a Result of Control Measures

Since the first act on pollution was instituted, huge progress has been made in terms of human resource, infrastructure development and research capability. Some studies tried to gather evidence for the effectiveness of control measures by comparing pre- and post-intervention health status. The study conducted by the Central Pollution Control Board demonstrated that spending 8-10 h in clean indoor environment can reduce health effects of exposure to chronic air pollution. A recent study found significant improvement in the respiratory health following large-scale government initiatives to control air pollution. It was reported that use of lower-emission motor vehicles resulted in a significant gain in disability-adjusted life-years in Delhi. Another study found significant evidence for reduction in respiratory illness following introduction of control measures.

Most of the studies were ecological correlation studies, which are severely limited in their ability to draw causal inferences. But, considering the context that demanded the research, these were probably the best available designs to produce preliminary and, sometimes, policy-influencing evidences, as any other methodology would be unethical or operationally impossible.

Participation of the community is crucial in order to make a palpable effect in the reduction of pollution. The use of public transport needs to be promoted. The use of Metro rail can be encouraged by provision of an adequate number of feeder buses at Metro stations that ply with the desired frequency. More frequent checking of Pollution Under Control Certificates needs to be undertaken by the civic authorities to ensure that vehicles are emitting gases within permissible norms. People need to be educated to switch-off their vehicles when waiting at traffic intersections. Moreover, the "upstream" factors responsible for pollution also need to be addressed. The ever-increasing influx of migrants can be reduced by developing and creating job opportunities in the peripheral and suburban areas, and thus prevent further congestion of the already-choked cities like Delhi & Mumbai.

CONCLUSION

Although the earth seems to be at brink of catastrophe but still we have a possible way to minimize the degradation. The various pollutants which human activities release into the environment is growing at an alarming a rate. However, a few simple steps can be taken at an individual level to combat it. If we start from this very moment we might be able to live in harmony with mother nature, and this process needs to be started at the earliest possible.

REFERENCES

Agarwal R, Jayaraman G, Anand S, Marimuthu P. Assessing respiratory morbidity through pollution status and meteorological conditions for Delhi. *Environ Monit Assess.* 2006;114:489-504. [PubMed]

Balachandran S, Meena BR, Khillare PS. Particle size distribution and its elemental composition in the ambient air of Delhi. *Environ Int.* 2000;26:49-54. [PubMed]

Cropper Maureen L, Simon Nathalie B, Alberini Anna, Sharma P. K. The World Bank Development Research Group. 1997. Dec, [last accessed on 2011 September 20]. The Health Effects of Air Pollution in Delhi, India, Available from: http://www.airimpacts.org/documents/local/WB_WPS1860_Delhi_AQ.pdf

Chhabra SK, Chhabra P, Rajpal S, Gupta RK. Ambient air pollution and chronic respiratory morbidity in Delhi. *Arch Environ Health.* 2001;56:58-64. [PubMed]

Epidemiological Study on Effect of Air Pollution on Human Health (Adults) in Delhi, Environmental Health Series: EHS/1/2008, Central Pollution Control Board, Ministry of Environment & Forests, Govt. of India. 2008. Aug, [last accessed on 2011 September 20].

Goyal R, Khare M. Indo air quality modelling for PM 10, PM 2.5, PM 2.5, and PM 1.0 in naturally ventilated classrooms of an urban Indian school building. *Environ Monit Assess.* 2011;176:501-16.[PubMed]

Kumar A, Scott Clark C. Lead loadings in household dust in Delhi, India. *Indoor Air.* 2009;19:414-20.[PubMed]

Kumar A, Phadke KM, Tajne DS, Hasan MZ. Increase in inhalable particulates' concentration by commercial and industrial activities in the ambient air of a select Indian metropolis. *Environ Sci Technol.*2001;35:487-92. [PubMed]

Agarwal R, Jayaraman G, Anand S, Marimuthu P. Assessing respiratory morbidity through pollution status and meteorological conditions for Delhi. *Environ Monit Assess.* 2006;114:489-504. [PubMed]

Jayaraman G, Nidhi Air pollution and associated respiratory morbidity in Delhi. *Health Care Manag Sci.*2008;11:132-8. [PubMed]

Firdaus G, Ahmad A. Indoor air pollution and self-reported diseases - a case study of NCT of Delhi. *Indoor Air.* 2011;21:410-6. [PubMed]

Kumar R, Nagar JK, Kumar H, Kushwah AS, Meena M, Kumar P, et al. Indoor air pollution and respiratory function of children in Ashok Vihar, Delhi: An exposure-response study. *Asia Pac J Public Health.* 2008;20:36-48. [PubMed]

Kulshreshtha P, Khare M, Seetharaman P. Indoor air quality assessment in and around urban slums of Delhi city, India. *Indoor Air.* 2008;18:488-98. [PubMed]

Saksena S, Singh PB, Prasad RK, Prasad R, Malhotra P, Joshi V, et al. Exposure of infants to outdoor and indoor air pollution in low-income urban areas - a case study of Delhi. *J Expo Anal Environ Epidemiol.*2003;13:219-30. [PubMed]

Sharma S, Sethi GR, Rohtagi A, Chaudhary A, Shankar R, Bapna JS, et al. Indoor air quality and acute lower respiratory infection in Indian urban slums. *Environ Health Perspect.* 1998;106:291-7.[PMC free article] [PubMed]

Kumar R, Nagar JK, Kumar H, Kushwah AS, Meena M, Kumar P, et al. Association of indoor and outdoor air pollutant level with respiratory problems among children in an industrial area of Delhi, India. *Arch Environ Occup Health.* 2007;62:75-80. Summer. [PubMed]

Siddique S, Banerjee M, Ray MR, Lahiri T. Attention-deficit hyperactivity disorder in children chronically exposed to high level of vehicular pollution. *Eur J Pediatr.* 2011;170:923-9. [PubMed]

Kalra V, Chitralkha KT, Dua T, Pandey RM, Gupta Y. Blood lead levels and risk factors for lead toxicity in children from schools and an urban slum in Delhi. *J Trop Pediatr.* 2003;49:121-3. [PubMed]

Agarwal KS, Mughal MZ, Upadhyay P, Berry JL, Mawer EB, Puliye JM. The impact of atmospheric pollution on vitamin D status of infants and toddlers in Delhi, India. *Arch Dis Child.* 2002;87:111-3.[PMC free article] [PubMed]

Rajarithnam U, Sehgal M, Nairy S, Patnayak RC, Chhabra SK, Kilnani, et al. HEI health review committee. Time-series study on air pollution and mortality in Delhi. *Res Rep Health Eff Inst.* 2011;47-74.[PubMed]

Nidhi, Jayaraman G. Air quality and respiratory health in Delhi. *Environ Monit Assess.* 2007;135:313-25. [PubMed]

Pande JN, Bhatta N, Biswas D, Pandey RM, Ahluwalia G, Siddaramaiah NH, et al. Outdoor air pollution and emergency room visits at a hospital in Delhi. *Indian J Chest Dis Allied Sci.* 2002;44:13-9.[PubMed]

Foster A, Kumar N. Health effects of air quality regulations in Delhi, India. *Atmos Environ.*2011;45:1675-83. [PMC free article] [PubMed]

Woodcock J, Edwards P, Tonne C, Armstrong BG, Ashiru O, Banister D, et al. Public health benefits of strategies to reduce greenhouse-gas emissions: Urban land transport. *Lancet.* 2009;374:1930-43. [PubMed]

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- Time-series study on air pollution and mortality in Delhi.[Res Rep Health Eff Inst. 2011]
- Air quality and respiratory health in Delhi.[Environ Monit Assess. 2007]
- Outdoor air pollution and emergency room visits at a hospital in Delhi.[Indian J Chest Dis Allied Sci. 2002]
- Health Effects of Air Quality Regulations in Delhi, India.[Atmos Environ (1994). 2011]
- Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport.[Lancet. 2009]
- Air quality and respiratory health in Delhi.[Environ Monit Assess. 2007]

Microplastic in Indian River & Ocean Assessing the Hazard: Challenges & Treatment

Utkarsh Khanna*

Jyoti Pathak**

Occurrence of microplastics along the coast is a growing concern worldwide, due to increased input of discarded wastes from various sources water body waste is increasing day by day. In order to evaluate the extent of microplastic pollution on the sandy beaches along India, microplastic debris were quantified and categorized into different size classes. The beaches were classified according to potential sources of pollution i.e. riverine, tourism and fisheries. Beach samples collected from the high tide line contained significantly higher abundance of microplastic than at the low tide line. Beaches adjacent to rivers exhibited relatively higher microplastic abundance compared to those influenced by tourism and fishing activities. The results indicate that microplastics accumulation in the coastal environment, especially close to the river mouths, may be a serious concern, due to its ability to enter into the marine food web and highlights the necessity of microplastics screening from estuarine, coastal waters and other potential sources.

Keywords: L Microplastics, oceans, debris, fisheries, environmental coast

INTRODUCTION

Plastic is used in nearly every industry for distinct purposes and most accustomed to packaging as strong for their weight and cost-effective but Because of low-recycling rates, poor waste management a significant portion of the plastics produced enters and endures in oceanic ecosystems. It includes shoreline, seabed, water column and sea surface environments of the world's oceans. Plastic is a material cause of pollution and can be found in the core of the oceans to outer space. Microplastic pollution is a subdivision attached to it. Now, this scathing problem has been recognised worldwide. A considerable amount of scientific research is happening to find out more about it. The governments are designing new policy framework to restrict microplastic pollution and focusing on significant sustainable commitment.

India produces 5.6 million tons of plastic annually. Three Indian rivers fall under the top 10 rivers in Export of Plastic Debris by Rivers into the Sea. **(Indus, Brahmaputra and Ganga among the Top 10 Plastic Waste Carrying Rivers, n.d.)** India has 7500 km of coastlines boundary and home to

nearly a one-third population of the planet. It also holds a highly enriched marine environment. Despite all of this, Microplastics are less studied in India. Therefore, Microplastic pollution turns into a huge subject of concern for India. This paper will discuss how much Microplastic pollution has affected India so far. What are the steps taken by the government and Corporations and What can we do in the future.

Plastic & Microplastic -The term 'plastic', as commonly applied, refers to a group of synthetic polymers. Plastic is formed through a process called polymerisation out of natural material and fossil fuels such as coal, natural gasoline, crude oil. But mainly Biomass such as plant oil is increasingly used for the production.

There are two main classes: thermoplastic and thermoset. Thermoplastic has shortened to 'plastic' and, in lay terms, has come to be the most common use of the term. **(UNEP-Research, n.d.)**

When heated, Thermoplastic is capable of moulding or deformed plastically. Most commonly used thermoplastic are polypropylene (PP), polyvinyl chloride (PVC) and polystyrene (PS), polyethylene and polycarbonate. The other type is a thermoset plastic material which is non-mouldable. Once formed, shape can't be modified. A usual example of the thermostat is polyurethane and epoxy resins.

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The annual output of plastic in 2018 was 359 million tones which include Thermoplastics, Polyurethanes, Thermosets, Elastomers, Adhesives, Coatings and Sealants and PP-Fibers.

Not included: PET-fibres, PA-fibres and Polyacrylfibers.

The market is dominated by four main class of plastics: Polyethylene(PE), Polyethylene terephthalate(PET), polypropylene (PP) and polypropylene (PVC).

Types of Plastic -

What's Microplastic -

The term "microplastic" (MP) was formally introduced in 2004 by Thompson et al. Who alerted to the growing problem of the plastic release to the seas. (picó& Barceló, 2019) Microplastics, a form of man-made litter, have been accumulating in the oceans for at least over the last four decades (Thompson et al., 2004, 2005).

Microplastics are high polymer plastic particles of a size range below 5 mm can be used as a raw

NAME	USE
Biodegradable plastics	<ul style="list-style-type: none"> • Agricultural and horticultural sectors • Food packaging
Engineering plastics	<ul style="list-style-type: none"> • Automotive. • Electrical and electronics. • Building and construction.
Epoxy resins	<ul style="list-style-type: none"> • Paints and coatings. • Adhesives.
Expanded polystyrene	<ul style="list-style-type: none"> • Thermal insulation in buildings. • Road construction. • Sound insulation. • Packaging.
Fluoropolymers	<ul style="list-style-type: none"> • Coating on cookware • A Soil and stain repellent for fabrics • Textile products
Polyolefins	<ul style="list-style-type: none"> • Electrical cable coating • Bottles • Food containers and toys
Polystyrene	<ul style="list-style-type: none"> • Packaging. • Household appliances. • Consumer. • Electronics products.
Polyurethane (PUR)	<ul style="list-style-type: none"> • Building insulation. • Refrigerators and freezers. • Furniture and bedding. • Footwear.
Polyvinyl chloride (PVC)	<ul style="list-style-type: none"> • Building products • Piping • Pharmaceuticals, food and confectionery • Automotive applications
Thermoplastics	<ul style="list-style-type: none"> • Sports equipment • Toys (for example LEGO® blocks) • Various automotive parts
Bio-based	<ul style="list-style-type: none"> • mostly used in packaging applications

material for many products and can be generated from the degradation of plastic products. Microplastics are non-biodegradable thus endures in ocean and freshwater. MP's can be solid or water-insoluble they can pass through wastewater treatment plants as small in size and can reach to Oceans via rivers and water bodies.

Types of Microplastics -

Microplastics can be categorised into two sections - primary and Secondary microplastic.

Primary microplastic- Particles manufactured for carrying specific purposes of a particular size are known as Primary microplastic.

These include:

- A. Nurdles: small pellets that put together, melted and moulded to make larger plastic shapes;
- B. Microbeads: which are used in personal care products to help scrub off dead skin;
Fibres: many clothes today are made of synthetic plastic fibres like nylon and polyethylene terephthalate (PET) that once washed get loose from clothes and pass through sewage treatment plants until they reach the ocean.

Secondary microplastic- When larger pieces of plastic exposed to sunlight. The plastic begins to weather and fragment as the result of which it breaks down into smaller pieces and known as Secondary microplastic. It can also be generated from radiation, physical abrasion (waves, rocks), and microbial processes.

Source & Contributors of Microplastic in Rivers & Oceans -

Microplastic is now widespread in almost all the water resources on this planet either it is a small pond or an ocean. Land and sea are the only sources where plastic can originate. Most microplastics found in the ocean is Secondary microplastic means the minor pieces of large plastic trash, which includes several types of plastics from single-use to bags and bottle caps.

Which Plastics Are The Major Contributors To Plastic Pollution?

To understand the magnitude of input of plastics to the natural environment and To find out the solution, it becomes important to understand the various elements of plastics which are Mostly contributing to the pollution.

Plastics and polystyrene foam (Styrofoam) comprise 90% of all marine debris, with single-use food and beverage containers being one of the most common items found in the ocean and coastal surveys.(Plastic Pollution Causes, Facts & Figures, n.d.)

Microfibres from clothing and textiles are another key source of microplastics in our oceans. When we wash our clothes, fibres are shed into the washing water. Due to their minute size, these fibres pass through wastewater treatment plants and end up in the ocean.(Plastic Pollution Causes, Facts & Figures, n.d.)

According to a report in The Overtake "The International Union for Conservation of Nature (IUCN) estimates that 35% of all primary plastics which end up in our oceans have come from textiles, making it the largest source of microplastics, followed by those which come from the degradation of car tyres (28%)." (Washing Your Clothes Could Be Putting More Plastic in the Sea than Microbeads ~ The Overtake [Beta], n.d.)

It's not just important to only understand the problem but also Classification helps in several ways -

1. Makes it easier for policymakers to design the specific policies to reduce the plastic which can result finally into the reduction of microplastic from the oceans
2. The search for alternatives can be dedicated to specific fields
3. Helpful for people in knowing how much a person is contributing to the microplastic pollution which enhance the awareness

The graph below describes the paths from where the plastic enters into the ocean water -

The pathway by which plastic enters the world's oceans

Estimates of global plastics entering the oceans from land-based sources in 2010 based on the pathway from primary production through to marine plastic inputs.



Global primary plastic production:
270 million tonnes per year

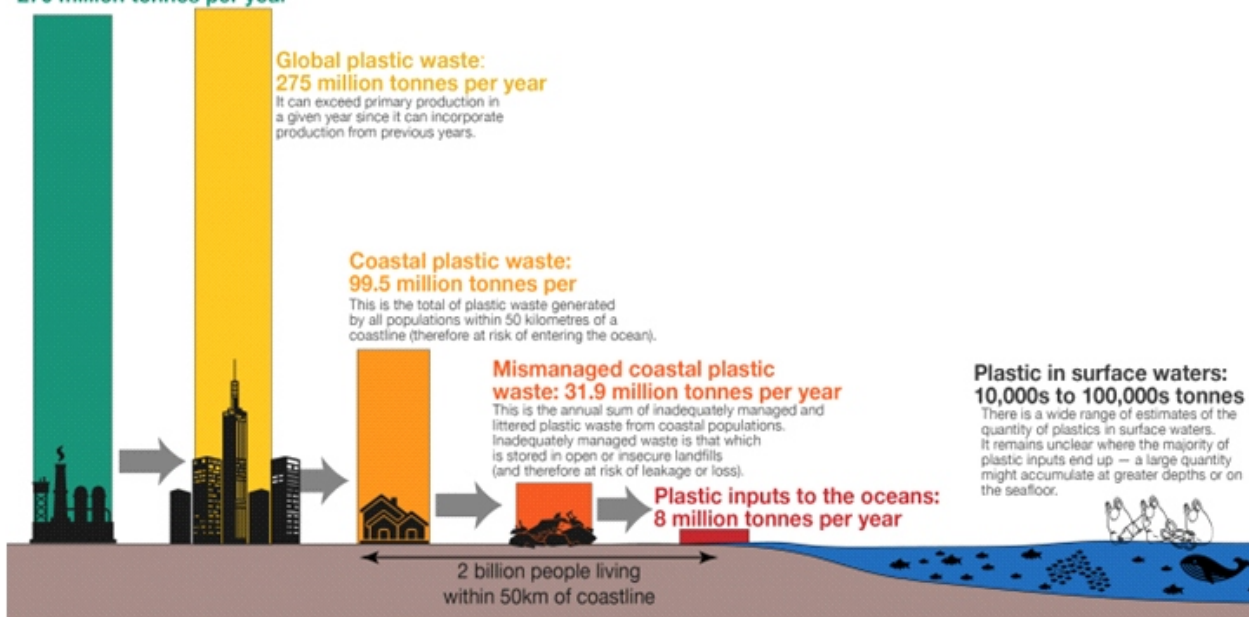
Global plastic waste:
275 million tonnes per year
It can exceed primary production in a given year since it can incorporate production from previous years.

Coastal plastic waste:
99.5 million tonnes per year
This is the total of plastic waste generated by all populations within 50 kilometres of a coastline (therefore at risk of entering the ocean).

Mismanaged coastal plastic waste:
31.9 million tonnes per year
This is the annual sum of inadequately managed and littered plastic waste from coastal populations. Inadequately managed waste is that which is stored in open or insecure landfills (and therefore at risk of leakage or loss).

Plastic inputs to the oceans:
8 million tonnes per year

Plastic in surface waters:
10,000s to 100,000s tonnes
There is a wide range of estimates of the quantity of plastics in surface waters. It remains unclear where the majority of plastic inputs end up – a large quantity might accumulate at greater depths or on the seafloor.



Source: based on Jambeck et al. (2015) and Eriksen et al. (2014). Icon graphics from Noun Project.

Data is based on global estimates from Jambeck et al. (2015) based on plastic waste generation rates, coastal population sizes, and waste management practices by country.

This is a visualization from OurWorldinData.org, where you will find data and research on how the world is changing.

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{{(Plastic Pollution - Our World in Data, n.d.-a)}

In 2010, Total production of plastic was 270 million tons per year and plastic waste was 275 million tonnes per year - which states that plastic waste done by the industries and people are way higher than even the production which also points out the carelessness and unawareness among the masses.

- 99.5 million tonnes of plastic waste was generated by the population who is living within the 50 km of coastline.
- 31.9 million tonnes of plastic waste mismanaged by the coastal population that means almost 1/3rd of the waste generated by coastal population is stored in open and on the verge of going into the ocean.
- 8 million tonnes of plastic per year went inside the ocean.

Source of Microplastic in oceans -

Domestic runoff is the first (or most important) cause of microplastic in the ocean, which contain microplastic particles and microbes used in the cosmetic products or personal care products and the microparticles created from the breaking (up) of the large plastic trash.

'Plastic materials are either originated on land or the ocean. Estimates suggest around 70-80% of

ocean plastics have land-based sources, while 20-30% of plastics come from marine sources. On what concerns plastic materials coming from marine sources, half is estimated to be caused by fishing fleets that leave behind fishing nets, lines, ropes, and sometimes abandoned vessels'. (McKinsey Center for Business and Environment, n.d.) Land-based sources widely believed to consist of beach litter, sewage waste and waste blown to the river by wind and finally, river falls in the ocean.

Low residual value plastic has higher chances to leak in the ocean than high-value plastic - In India, approximately around 1.5 million to 4 million ragpickers collect the garbage from landfills and houses and mostly collect the plastic which has reselling value and leaves the plastic such as plastic bags or cups (mostly single-use plastic) thus most of the plastic which left uncollected or loosen on the landfills contain single-use plastics which are highly harmful and only a tiny portion of which can be recycled and leaves a huge carbon footprint.

'A paper published in early 2015 in Science estimates that approximately 8 million metric tons of plastic leak out of the global economy and into the ocean each year. This suggests that in the

absence of meaningful interventions, the world's ocean will contain nearly 250 million metric tons of plastic by 2025. But like an iceberg, the visible manifestation of the plastic problem is very small. Both the vast quantities of waste such as the North Pacific gyre—sometimes referred to as the “Great Pacific Garbage Patch”—and the considerable quantities of waste routinely found during annual beach clean-ups around the world are likely less than 5 per cent of the plastic that enters the ocean every year. The remaining 95 per cent is not at the surface and is essentially impossible to extract at scale once it has entered the ocean, which suggests that efforts to control this issue must address the land-based sources of waste, rather than symptoms of pollution once it reaches the ocean’. (McKinsey Center for Business and Environment, n.d.)

In Indian context - Source and Contributors

According to the reports for the year 2017-18, Central Pollution Control Board (CPCB) has estimated that -

- India generates approximately 9.4 Million tonnes per annum plastic waste, (which amounts to 26,000 tonnes of waste per day)
- Approximately million tonnes per annum plastic waste is recycled out of 9.4 Million tonnes (i.e. 15,600 tonnes of waste per day)
- 3.8 million tonnes per annum plastic waste is left uncollected or littered (9,400 tonnes of waste per day)
- Per capita, plastic waste in India is 11 kg.

Out of the 60% of recycled plastic:

- 70% is recycled at registered facilities
- 20% is recycled by Unorganized Sector
- 10% of the plastic is recycled at home.

While these stats are 38% higher than the global average of 20%, there are no comprehensive methods in place for plastic waste management. Additionally, there is a constant increase in plastics waste generation. One of the major reasons for this is that 50% of plastic is discarded as waste after a single-use. This also adds to an increase in the carbon footprint since the single-use of plastic products increase the demand for virgin plastic products. (Plastic Waste

Management Issues, Solutions & Case Studies, 2019)

What makes Microplastic a major threat - Impact on Marine environment and organisms -

Interactions between marine organisms and persistent litter were first recorded in the scientific literature in the late 1960s when Kenyon and Kridler (1969) reported the ingestion of plastic items by Laysan Albatrosses (*Phoebastria immutabilis*) on the northwest Hawaiian Islands. They found plastic in the stomachs of 74 of 100 albatross chicks that died before fledging in 1966, with up to 8 items and an average of 2 g plastic per bird. (Ryan, 2015)

After almost 50 years, The risk assessment of microplastics in the marine environment is still in the hazard characterisation phase due to limited information on exposure levels and established effect levels. Rational policy measures are difficult to develop given the current incomplete and uncertain risk analysis, and priority must be given to systematically improving assessment of the risk of microplastics in the world's ocean.

The most worrying problem is that till now there is no such technology or solution that exists which can filter the microplastic particles from the water bodies. The size of the microplastic is so small that it is ingested by even the microscopic marine biota.

Around 88% of the ocean surface is contaminated with microplastic, The impact of microplastic is a serious matter of concern. It leads to ingestion even in the microscopic biota. Microplastic is a micron-size particle in nature (below 5 mm), thus their fragments are ingested by various marine biota which includes zooplanktons, phytoplanktons, lobsters, fish etc.

Ecotoxicological effects on marine organisms -

A study about the ecotoxic effect of microplastics on marine organisms remains a great deal of research. The first study was conducted on the ecotoxicological impact of MPs on aquatic organisms by Browne et al. (2008), observations made - The translocation of MP particles from the gut to the circulatory system of *Mytilus edulis*.

Since then, the total number of field and laboratory studies involving MPs and their interactions and effects on aquatic organisms has grown significantly, especially after 2012.

Among the reports of MPs in marine organisms, fish are the most commonly studied group (25%), followed by molluscs (15%), small crustacea (11%), large crustacea (8%), annelid worms (6%), mammals and echinoderms (both 3%), birds and cnidaria (both 2%), Porifera, reptiles and rotifers (all < 1%). Multiple freshwater studies only exist for fish (13% overall, 56% of the freshwater studies) and small crustacea (8% overall, 35% of the freshwater studies). (de Sá et al., 2018)

Impact on Deep-sea Ecosystem (Microplastic hotspots) -

Microplastic found in the ocean mostly contains microfibers from textiles, these microfibers enter the ocean through rivers. These wastes are generated by households and industries which then dumped in the landfills or directly in the rivers. These Microplastics are entering the ocean in huge amount and causing damage to the marine ecosystem.

Further, studies revealed that Microplastics are effecting the bio-diversity hotspots in the ocean, as

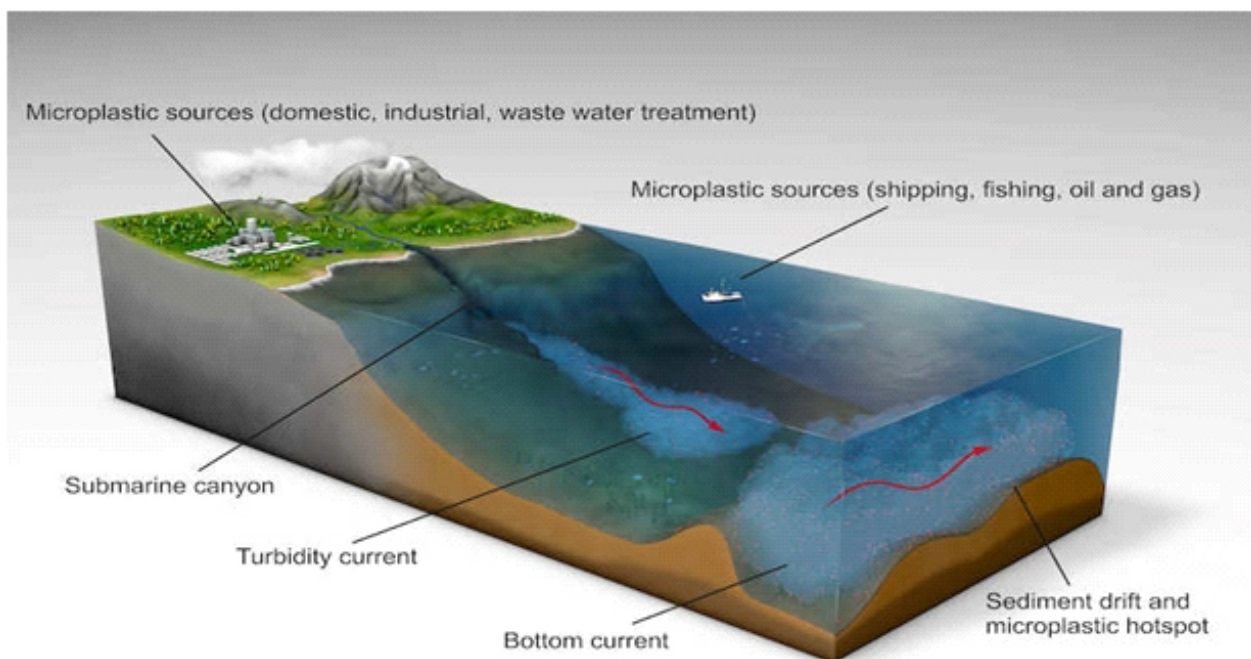
well as these particles, accumulate toxins which are harmful to any organism that consumes it and can even persist after the death of the organism as they don't break down quickly.

Only 1% of the plastic accumulates on the sea surface. The rest remaining 99% ends up in the deep-sea. A major portion of which includes fibres and fragments of synthetic textiles, either these particles are manufactured or breaks down from the large plastic materials.

The microplastic submerged in the ocean then picked up by the deep-sea currents, which further deposits in the areas of high sediment creating "the microplastic hotspots".

Deep-sea currents are also responsible for the movement of oxygen and nutrients, which suggests that plastic ending up in the bio-diversity hotspots in the ocean, where it can cause the most damage.

This study revealed that a microplastic hot-spot can contain up to 1.9 million pieces per square metre, which is the highest in all the studies done to date on microplastic hotspots. The samples collected from the seafloor in the Tyrrhenian Sea in the Mediterranean. Microplastic hot-spot found at the depth of about 2000 to 3000 feet.(Kane et al., 2020)



Why matter of grave concern for India -

Research in the field of microplastic pollution is mostly associated with oceans but as Research findings are increasing now it's taking a new leap to lakes, rivers and tap water as well. New research findings have shown that a high amount of microplastic is present in the tap water, rivers and lakes as well.

In India, there is a lack of research and published work concerning microplastic in the Indian ocean and rivers. To know the accurate estimates of different types of microplastics in the Indian ocean and rivers, a lot of research still needs to be done.

Though the available data and research show that Deep Indian Ocean flooring is already loaded heavily with 4 billion fibres per km. It is sufficient to point out that it's a worrying issue and needs to be addressed by the authorities as earliest. Collective efforts need to be made to

contain the issue of microplastic pollution in the oceans.

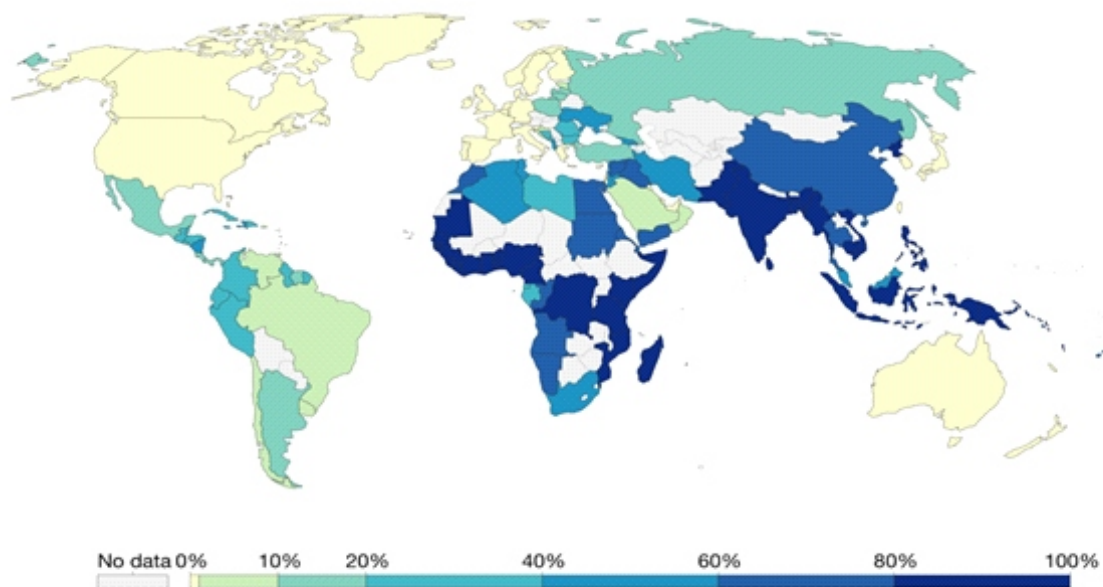
Mismanaged plastic waste -

Material with the high risk of entering the ocean via wind or the inland waterways is known as mismanaged waste. It includes the Inadequately disposed and littered waste.

Inadequately disposed waste means the waste left open in the landfills and can be lost to the environment It creates the risk of leakage this waste in the ocean whereas littered waste is left or dropped at an inappropriate place without consent.

Countries with the high mismanaged waste and Reason behind the high amount of microplastic in the Indian Ocean is explained with the help of graphs given below -

Figure – 1: Countries with mismanaged plastic waste –



Source: Jambeck et al. (2015)

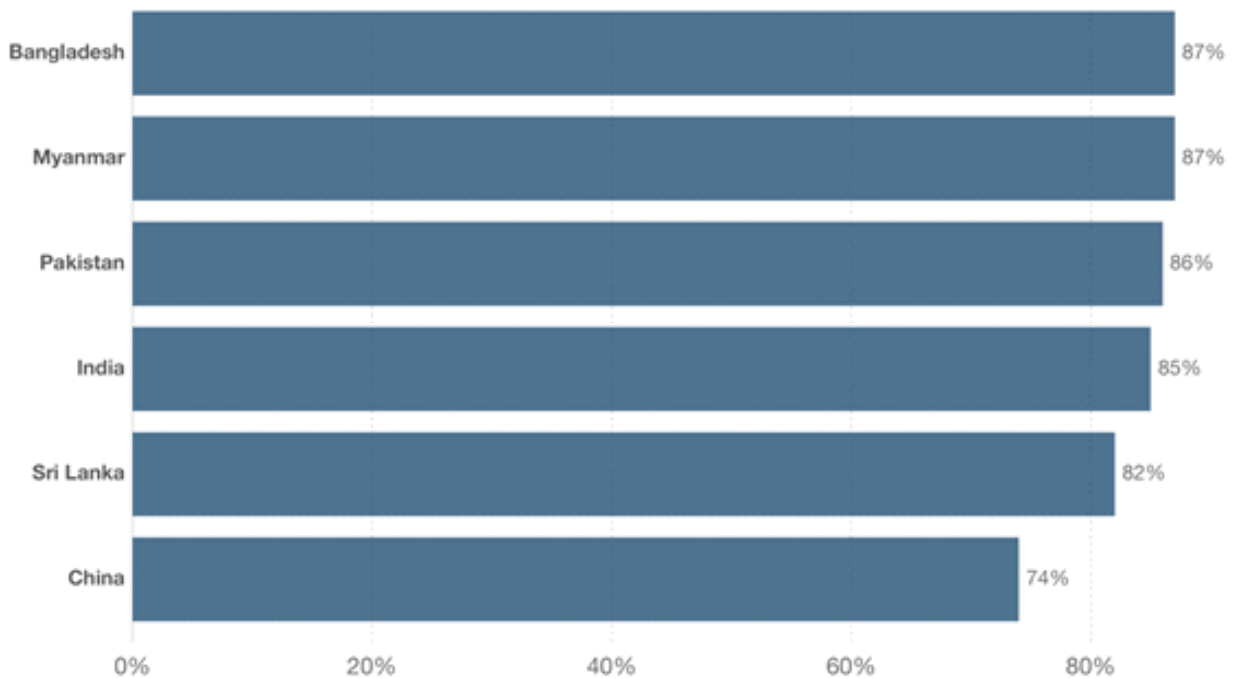
Note: This does not include 'littered' plastic waste, which is approximately 2% of total waste.

OurWorldInData.org/plastic-pollution • CC BY

(Plastic Pollution - Our World in Data, n.d.-b)

- Generally, inadequately disposed waste can be high in the countries with low to middle-class income countries.
- In India, due to lack of proper waste management infrastructure, 85% of plastic waste is inadequately disposed

Figure – 2: Share of plastic waste that is inadequately disposed



Source: Jambeck et al. (2015)

Note: This does not include 'littered' plastic waste, which is approximately 2% of total waste.

OurWorldInData.org/plastic-pollution • CC BY

(Plastic Pollution - Our World in Data, n.d.-b)

With the above graph, it is evident why the amount of microplastic in the deep Indian ocean has reached 4 billion fibres per square km which are second highest in the world.

Asia is the largest continent in terms of land. India and neighbouring countries like China, Pakistan, Bangladesh, Myanmar, Sri Lanka together form almost 70% of Asia and all the countries have a huge coastline. India alone has 7,500 km of coastline and the amount of mismanaged plastic waste in these countries is huge and that's why the amount of microplastic in the Indian ocean is very high.

The projected future share of mismanaged plastic waste estimates that by 2025, India will account for 4.17 % of global mismanaged plastic waste which is currently at 1.88% which can be seen from the graph above.

Microplastic in tap water (Case of India)

–

Microplastics are omnipresent in the environment. The large concentrations of microplastic are present in the freshwater, marine water and drinking water (bottled and tap).

The data is limited regarding the presence of

microplastic in the tap water as there are only a few fully reliable studies have taken place.

A study has been taken out by Orb media recently which states that 83% of the tap water samples collected from across the world were contaminated with microplastic.

India ranks 3rd in the list with 82.4% water samples were contaminated. Out of 17 water samples collected from new Delhi 14 samples found to be contaminated with microplastic.

Combined sewer overflows, industrial untreated effluent, surface runoff are recognised as the resource of microplastic in the tap water, but for a more picture of the estimates of microplastic in the ocean, we need better data to quantify.

As per WHO – Microplastic in the tap water does not pose a significant threat to human life for now but it does not mean that in the coming future the situation will remain the same. (Progress on Drinking Water, Sanitation and Hygiene Update and SDG Baselines, 2017)

Research and their findings (India) –

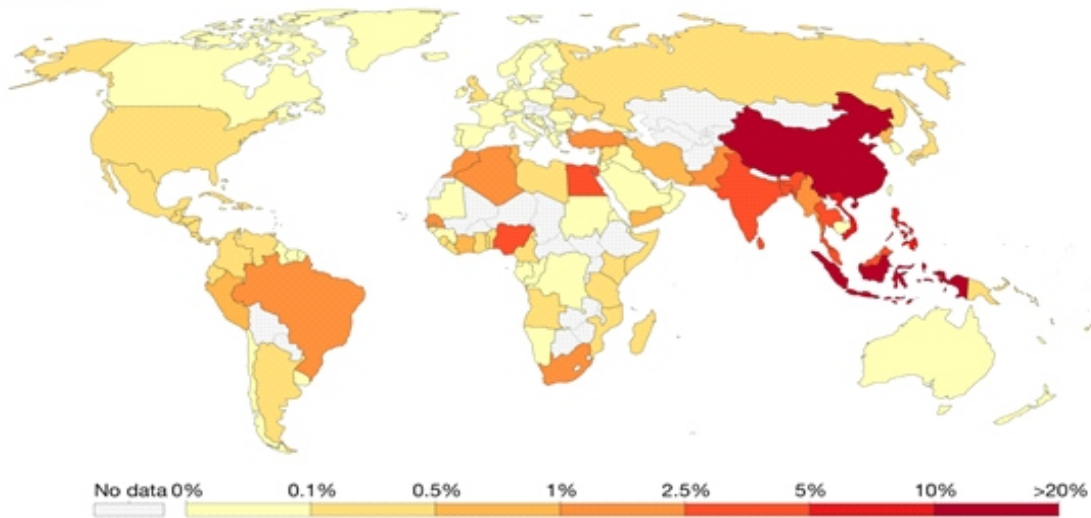
To understand the magnitude of the issue, Examples of few published research paper outcomes are mentioned below-

Figure – 3: Projected share of global mismanaged plastic waste in 2025

Projected share of global mismanaged plastic waste in 2025



Projected share of global mismanaged waste produced in 2025. This is measured as the total mismanaged waste by populations within 50km of the coastline, and therefore defined as high risk of entering the oceans. Mismanaged plastic waste is defined as "plastic that is either littered or inadequately disposed. Inadequately disposed waste is not formally managed and includes disposal in dumps or open, uncontrolled landfills, where it is not fully contained. Mismanaged waste could eventually enter the ocean via inland waterways, wastewater outflows, and transport by wind or tides."

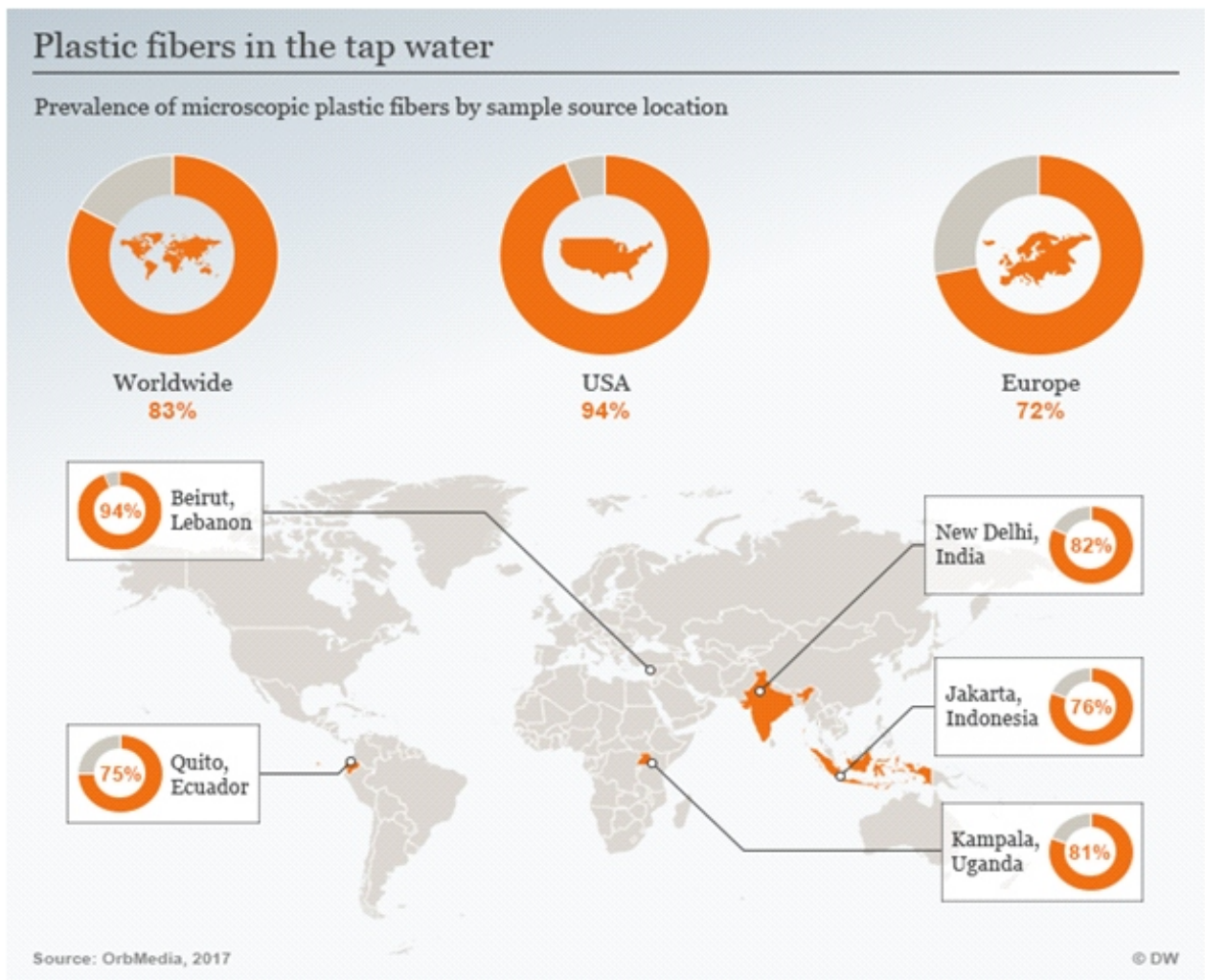


Source: Jambeck et al. (2015)

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(Plastic Pollution - Our World in Data, n.d.-c)

Figure – 4: Plastic fibres in the tap water –



(Invisibles - Data | Orb, n.d.)

Case - 1: Microplastic loading in the sediments of the river Ganga -

- To quantify the MP across the river Ganga. This is the first-ever study done for MP quantification across the entire length of river Ganga and we conducted it in sediments. Sediment samples were collected from 30 sites (5 states) during Nov-March, 2017 at every 75Kms, within a 5km stretch in replicates.
- Outcome - 72% of the sediment samples from river Ganga were found to contain microplastics. Polypropylene was the most abundant polymer type followed by polyethylene and polyvinyl aldehyde. (Baroth et al., 2019)

Case - 2: Microplastic pollution in Vembanad Lake, Kerala -

In this research, two sediment samples were collected one place, 20 total samples were collected from the lake

- Microplastic particles were recovered from all sediment samples with a mean abundance of 252.80 ± 25.76 (96e496 items) m², indicating their extensive dispersion in the lake sediment.
- Low-density polyethene was the most abundant polymer found in this study representing a range of 26e91% of the plastic particles.

Preventive measures recommended -

Plastic has become the indispensable part of humans life. The presence of plastic can be found

everywhere, but this has also led to a serious problem of plastic pollution due to irresponsible human behaviour. To curb the microplastic pollution new possible and feasible actions needs to be introduced. The sufficient number of research needs to be done to understand the problem in a broader sense. The ocean covers more than 70 per cent of the surface of our planet and it does not fall under the control of any single state

Thus, Pollution can't be controlled by exploiting the legal instruments only or by the NGO's single-handed. Collective and planned efforts need to be made to curb the plastic pollution from all the corners. It is not a responsibility of any single government or group of people. Governments of different countries need to come together for better implementation only, then the favourable outcomes can be imagined.

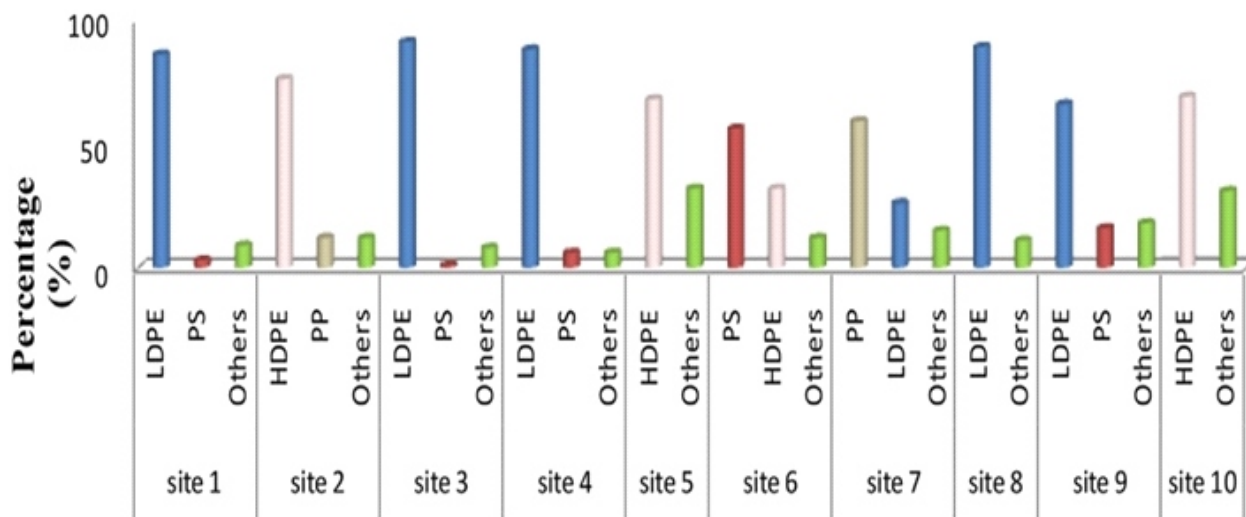
By Society -

I. Recycle Properly -

Single-use plastic is the most common source of plastic pollution. At present, only 9% of the total plastic is recycled worldwide. Individually, when anyone uses single-use plastic that is recyclable, it must be recycled. This habit not just reduce the amount of plastic pollution but also reduces the amount of new plastic in circulation.

II. Reduce Your Use of Single-Use Plastics -

Reducing the use of single-use plastic is an effective method which not just reduce the use of plastics but when the demand will fall then manufacturers will automatically try to find



(Sruthy & Ramasamy, 2017)

out an alternative which can be recycled. Single-use plastics include plastic bags, bottles, straws, cups, take-out containers, etc.

III. Avoid Products Containing Microbeads -

Microbeads are the source of primary microplastic and also the largest contributor in primary microplastic. Microbeads are harmful to the marine environment, so people should avoid using such products which contain ingredients such as "polyethylene" and "polypropylene". Avoiding the usage of such products will reduce the demand of such products in the market and compel the manufacturers to produce organic products which are not harmful to the environment. (7 Ways To Reduce Ocean Plastic Pollution Today - Oceanic Society, n.d.)

By Governments -

(1) Awareness -

Spreading awareness among people are one of the important tasks to curb microplastic pollution. People should have proper knowledge that how even a single plastic bag dumped carelessly affects the environment. Government and NGOs must take steps in this regard. In countries like India, awareness campaigns should be done to aware the citizens, especially in the coastal areas as mismanaged waste in the coastal areas have higher chances to leak in the ocean.

(2) Improve waste management infrastructure -

Alone, Urban India generates 62 million tonnes of waste annually

Only 43 million tonnes of waste is collected by the municipal, out of which 31 million is dumped in landfill sites and 11.9 million is treated only.

A sufficient number of bins with the covered lid on the streets, a Large number of covered waste collection vehicles are required. Proper waste segregation and recycling plants are required to manage and recycle plastic waste.

(3) Legislative measures -

Source control is important and can be achieved by legislative measure. Important efforts required to restrict the sale of single-use plastics. Many countries restricted the use of single-use plastic material. Public

participation and involvement are necessary for the measures to be effective.

Example of a few legislative measures taken by Indian states -

Sikkim - Ban on use of plastics bottles & disposable foam PRODUCTS -

Sikkim is one of the cleanest states in India and now became the first state to ban the use of plastic bottles and foam products. Sikkim has continuously taken such measures for reducing the use of plastic. It has already banned the use of the plastic bag in 1998

Maharashtra - Maharashtra is the 18th state in India to ban the single-use disposable plastic. The ban also carries the penalties in the case of violation up to 25000 rupees and 3-month imprisonment. Women in Self-help groups are looking to make jute and cotton bags as a major source of income. (Plastic Waste Management Issues, Solutions & Case Studies, 2019)

Himachal Pradesh- sustainable plastic waste management Plan -

The Government of Himachal Pradesh introduced the Sustainable Plastic Waste Management Plan in 2009. The Plan focuses on controlling the use of plastic and developing a systematic disposal mechanism. To achieve the objectives of its Clean Himachal and Healthy Himachal drive, the Government also prohibited the use of plastic cups and plates in 2011; conducted Information, Education and Communication (IEC) activities to generate awareness about the harmful impact of plastic waste, and encouraged citizens to stop using plastic products. (Plastic Waste Management Issues, Solutions & Case Studies, 2019)

By Industries -

i. Choose materials wisely -

Choosing correct Materials in packaging can reduce the risk of pollution and toxicity in the environment. Manufacturers can explore new alternatives to plastic, several biodegradable alternatives are available already.

ii. Use recycled content and ocean plastic -

Incorporating recycled content into packaging supports and strengthens recycling programs that are critical to the circular economy. Recycling relies on strong end markets where

there are steady demand and value for recycled materials. There are numerous industry associations and available resources that can help engage packaging producers in establishing stronger end markets and reprocessing infrastructure, such as the Association of Plastic Recyclers' Recycling Demand Champions campaign.

iii. Drive closed-loop systems -

Find a way to ensure that packaging can work in current collection systems. If the packaging cannot be collected, it will not be recycled or reused. While there is a variety of collection systems (e.g., depot, curbside recycling, bottle return programs, in-store drop-offs, mail-in incentives), it is important to ensure that each package works in an available collection system.

CONCLUSION

One of the earliest examples of plastic was invented in 1855 by alexander Parkes, but our irresponsible behaviour has turned down this invention as a major threat to the environment. Use of plastic can't be eliminated, but proper management of the plastic can reduce the risk significantly. It will also control the source and further reduce the microplastic in the ocean. To combat the danger, everybody needs to come together and take the responsibility to reduce reuse and recycle. The public should understand that government and NGOs can't cure this problem alone, rather public participation is the most important tool to curb the issue. It is our responsibility that we provide a safe and better future for our coming generation.

REFERENCES

- 7 Ways To Reduce Ocean Plastic Pollution Today - Oceanic Society. (n.d.). Retrieved August 26, 2020, from <https://www.oceanicsociety.org/blog/1720/7-ways-to-reduce-ocean-plastic-pollution-today>
- Baroth, A., Pant, A., Sah, R., Hussain, S. A., & Chaudhary, P. (2019). Spatiotemporal Trends of Microplastics Loading in the Sediments of River Ganga: First Observation on Occurrence, Identification and Quantification.
- de Sá, L. C., Oliveira, M., Ribeiro, F., Rocha, T. L., & Futter, M. N. (2018). Studies of the effects of microplastics on aquatic organisms: what do we know and where should we focus our efforts in the future? *Science of the Total Environment*, 645, 1029–1039.
- Indus, Brahmaputra and Ganga among the top 10 plastic waste carrying rivers. (n.d.). Retrieved August 26, 2020, from <https://india.mongabay.com/2018/01/indus-brahmaputra-and-ganga-among-the-top-10-plastic-waste-carrying-rivers/>
- Invisibles - Data | Orb. (n.d.). Retrieved August 26, 2020, from https://orbmedia.org/stories/Invisibles_plastics/data
- Kane, I. A., Clare, M. A., Miramontes, E., Wogelius, R., Rothwell, J. J., Garreau, P., & Pohl, F. (2020). Seafloor microplastic hotspots controlled by deep-sea circulation. *Science*, 368(6495), 1140–1145. <https://doi.org/10.1126/science.aba5899>
- McKinsey Center for Business and Environment. (n.d.).
- Picó, Y., & Barceló, D. (2019). Analysis and prevention of microplastics pollution in water: Current perspectives and future directions. *ACS Omega*, 4(4), 6709–6719. <https://doi.org/10.1021/acsomega.9b00222>
- Plastic Pollution - Our World in Data. (n.d.-a). Retrieved August 25, 2020, from <https://ourworldindata.org/plastic-pollution#how-much-plastic-enters-the-world-s-oceans>
- Plastic Pollution - Our World in Data. (n.d.-b). Retrieved August 26, 2020, from <https://ourworldindata.org/plastic-pollution#share-of-global-total-mismanaged-plastic-waste>
- Plastic Pollution - Our World in Data. (n.d.-c). Retrieved August 26, 2020, from <https://ourworldindata.org/plastic-pollution#future-mismanaged-plastic>
- Plastic Pollution Causes, Facts & Figures. (n.d.).
- Plastic Waste Management issues, solutions & case studies. (2019). www.mohua.gov.in
- Progress on Drinking Water, Sanitation and Hygiene Update and SDG Baselines. (2017). <http://apps.who.int/bookorders>.
- Ryan, P. G. (2015). A Brief History of Marine Litter Research. In M. Bergmann, L. Gutow, & M. Klages (Eds.), *Marine Anthropogenic Litter* (pp. 1–25). Springer International Publishing. https://doi.org/10.1007/978-3-319-16510-3_1
- Sruthy, S., & Ramasamy, E. v. (2017). Microplastic pollution in Vembanad Lake, Kerala, India: The first report of microplastics in lake and estuarine sediments in India. *Environmental Pollution*, 222 (December), 315–322. <https://doi.org/10.1016/j.envpol.2016.12.038>
- UNEP-research. (n.d.).
- Washing your clothes could be putting more plastic in the sea than microbeads ~ The Overtake [beta]. (n.d.). Retrieved August 25, 2020, from <https://theovertake.com/~earth-week/washing-your-clothes-could-be-putting-more-plastic-in-the-sea-than-microbeads/>

Investors' Behavior during Disruptive Business Environment

Mayank Jain*

An investment is typically a vehicle in which funds/money is placed with the view that it will in turn produce positive income or increase the present value of the funds. Factors like age, income, percentage of income invested, the ongoing economic policies, social circumstances and various others determine the investment choice of an investor.

This study aims to understand majorly two things. Firstly, it analyses various such factors which may influence an investor's perception towards various investment avenues. Secondly and with major focus, it analyses how do these factors observe a change in investors' perception when business environments change due to economic, political, or social changes in the external environment. Such changes in environment are called disruptions in the business environment and this study attempts to analyse the change in investors' behavior and sentiments due to such disruption in business environment. This study was done during the CO-VID 19 lockdown to analyze the change in investing pattern of investors during this global pandemic giving special focus to coronavirus pandemic as a major disruptive business environment.

A two-fold approach has been chosen to go ahead to prove the hypothesis and get a holistic idea of the factors influencing investor's perception. Primary data was collected by using a questionnaire and secondary data in the form of journal articles, research papers and other available platform was also used. Hypothesis testing were used to prove whether there is a significance difference in investor's behavior before and after the corona virus pandemic. A paired t-test for two sample mean is used to calculate the test statistic with the help of MS Excel.

Keywords: Investor's perception, investment avenues, disruption, disruptive business environment, corona virus, COVID-19, pandemic, lockdown.

INTRODUCTION AND CONCEPTUAL FRAMEWORK

In our modern world, there are only two ways to make money or create wealth: by working, for yourself or by working for someone else as an employee, and/or by having your assets work for you. If a person just preserves his/her life savings in their back pocket for future use or inside a vault in their house, instead of investing, the money doesn't multiply or increases in value and one will never have more than what he/she saves or receives through inheritance. Conversely, investors earn money and generate wealth by earning interest on the money they invest in the various avenues of investment available to them or by buying assets that increase in value.

An Indian investor has a number of investment options to choose from. Some are traditional investments that have been used across generations, while some are relatively newer options that have become popular in recent years. Some provide high return with high risk while others are more stable and provide lower returns

with lower risk. The investment options available to investors includes mutual funds, debentures, bonds, equity share market, bank accounts, FOREX market, property, gold, silver, hedge funds, private equity etc. There are also various factors which influence the perception of an investor towards the investment options available to him. Some of these factors include age, income, risk aversion, and source of investment advice. Finally, an ideal investment would be the one which satisfies the investment objectives of the investors.

Disruptive events typically mean disturbance or problems which interrupt an event, activity, or process. It is a break or interruption in the normal course or continuation of some activity, process, or event. This change can be caused due to various economic, political, social, legal or environmental instability. In this paper, we will try to analyse how such disruptive business events affect an investor's pattern of investment. As this study was done during the COVID-19 global pandemic, the corona virus lockdown is assumed to be a major disruptive environment for investors and try to analyse how has working in this pandemic crisis changed their views about the future of their investment corpus.

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This study aims to understand majorly two things. Firstly, it analyses various such factors which may influence an investor's perception towards various investment avenues. Secondly and with major focus, it analyses how do these factors observe a change in investors' perception when business environments change due to economic, political, or social changes in the external environment. Such changes in environment are called disruptions in the business environment and this study attempts to analyse the change in investors' behavior and sentiments due to such disruption in business environment. This study was done during the CO-VID 19 lockdown to analyze the change in investing pattern of investors during this global pandemic giving special focus to corona virus pandemic as a major disruptive business environment.

According to Economic Times, in just a few weeks, the corona virus pandemic has trimmed off more than one-third of the global market cap. The equity market of India has also taken a major hit, the Sensex closed 20% below the high that was achieved two months ago. The rapid spreads of corona virus has instilled panic sentiments across the world and has weakened the confidence of investors. On March 23, 2020, the Indian stock markets faced worst losses in their history. SENSEX took a dip of 4000 points and NSE NIFTY also took a dip of 1150 points.

CO VID-19 has impacted the stock market. In India more than 50% of industries have had a major impact of shutdowns caused due to COVID-19 on their day to day operations (FICCI survey). Different industries like hotels and airlines are slashing salaries and laying off employees. By 24 April the rate of unemployment increased by 19% within a month's period, and peaked at 26% across India. More than 14 crores Indian common men lost employment in the lockdown. Around 48% households in India have accounted significant decrease in income compared to previous year. This has led to withdrawing money from investment and keeping liquidity (cash) in hand for dealing with circumstances during the lockdown.

These major impacts on the Indian stock market have been analysed on a micro level through this study by studying the behavior of 104 investors in north and central India by enquiring them about their behavior pre and post the COVID 19 crisis.

RESEARCH METHODOLOGY

Research Problem

Investors have a wide range of investment options to park their surplus funds. The risk and return objectives of individual investors differ from one another. The risk and returns of these investment avenues also differ from each other. Finally, the objective of an investor decides his/her investment choice.

The research problem focuses on identifying and studying the factors that influence an investor's investment decision and behavior. Also their day to day purview of investing must have changed due to negative sentiments in the markets due to the corona virus pandemic. Thus I will analyse how have their perception changed.

Research Objectives

- 1) To study the various factors influencing the investment decision of investors.
- 2) To study how does a global pandemic affects investor sentiments
- 3) To study how investors have been changing their investment corpus due to COVID 19 pandemic and lockdown.

Research Design

The design of basic research has been used to carry out this study as the basic concern of the study is generalization and the formulation of theory concerning the investor behavior. Under the basic research, an exploratory research design was adopted to understand the research problem in a better way and to get good insights into the topic. This was done with the help of secondary resource analysis wherein various research papers and news articles related to factors influencing investment decision were studied. This research design helped understand the research problem in a better way.

A correlational research design is being undertaken to examine the various factors that may influence the perception of an investor towards various investment avenues.

Survey Method: A questionnaire was formulated to study the investors risk and return objective and its impact on investors' investment decision among other things order to generate this report. It was ensured that the questionnaire suited the respondent's understanding and language command. It was a formalized and unconcealed questionnaire which was self-explanatory with

the response categories being pre-defined.
 Method of collection: Online questionnaire.

Sample Selection

The sample was collected using non-probability sampling under which convenience sampling was used. Since the research would only generate relevant and accurate results when a sample consisting of people who really makes investment is studied, thus an effort was made to get the response only from the active investors.

The sample has been questioned on online modes.

A sample of 104 respondents was used for the purpose of this study.

Data Collection

A two-fold approach was used to collect the various data required for this research.

A questionnaire was used to collect the responses of the sample regarding their risk and return objectives, source of investment advice among other factors to form an opinion about influence of such factors on their perception towards an investment option.

Already published articles and other available platforms were also used to collect required data

HYPOTHESIS DEVELOPEMENT

1) AGE

Step I: Formulation of Hypotheses

- Null Hypothesis: Age has no effect on the investment decision of an investor.

$H_0 \leq 30$

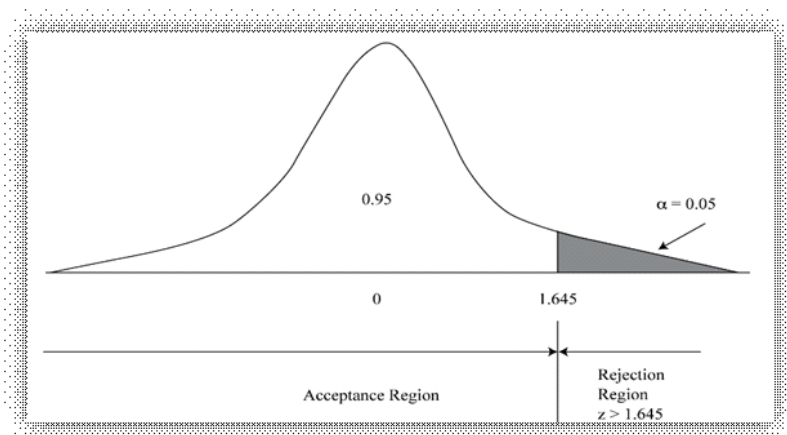
- Alternate Hypothesis: Age has a great impact on the investment decision of an investor.

$H_a > 30$

This is a one- tailed hypothesis test wherein hypothesized value of the age is taken as 30 years. Since, age falls under the ratio scale and the sample size is 105 for the purpose of this study, a z-test will be performed here.

Step II: Defining the significance level

The significance level for this test is assumed to be 5% which will be used as criterion to accept or reject the null hypothesis.



Rejection Point, 0.05 Significance Level, One-tailed test using a z-test

Step III: Definition of test statistic

To calculate the test statistic, mean and standard deviation needs to be calculated.

TABLE 2: Calculation of mean and standard deviation for hypotheses testing of Age						
A	B	C (n)	D	E	F	G
Age	Age (considered for test)	Response Total	$B \cdot C$	$B - 40$	$(B - 40)^2$	$F \cdot C$
0-18	9	0	0	-31	961	0
18-35	26.5	36	954	-13.5	182.25	6561
35-55	45	62	2790	5	25	1550
55 and above	60	7	420	20	400	2800
TOTAL		105	4164			10911

Mean = Total of column D/ Total of column C
 = 4164/ 105
 = 39.657

Mean age is considered to be 40 here for simplicity here.

Variance= Total of column G/ Total of column C
 = 10911/ 105
 = 103.914286

Therefore, standard deviation= Variance^{^(1/2)}
 SD = 103.914286^{^(1/2)}
 = 10.19

Now, test statistic = (Mean- Hypothesized value)/
 [SD/ (n^{^0.5})]

So, value of test statistic = (40-30)/ (10.19/10.247)
 = 10/0.9948
 = 10.0522

Step IV: Accepting or rejecting null hypothesis

In this case, test statistic is greater than the critical value, i.e., 10.0522>1.645.

This value falls in the rejection region.

Thus, we reject the null hypothesis here.

2) INCOME

Step I: Formulation of Hypotheses

- Null Hypothesis: Income has no effect on the investment decision of an investor.

Ho <= 50,000

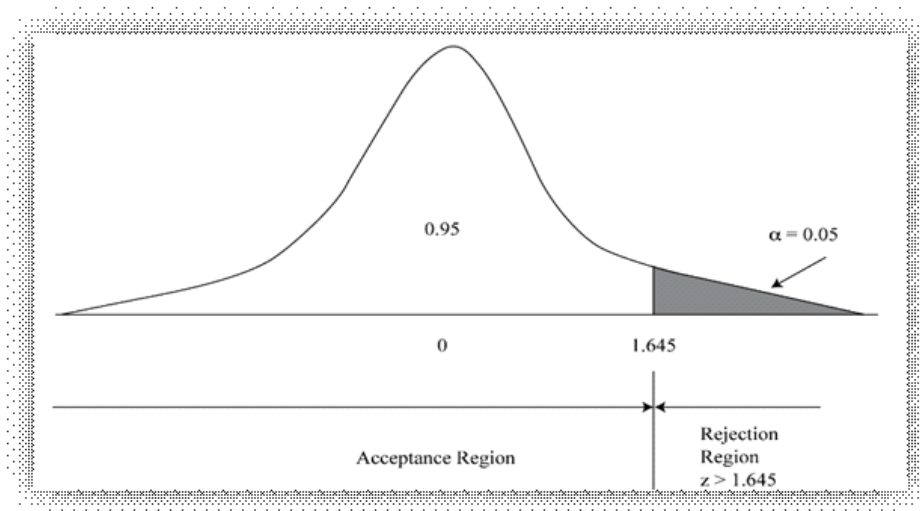
- Alternate Hypothesis: Income has a great impact on the investment decision of an investor.

Ha > 50,0000

This is a one-tailed hypothesis test wherein hypothesized value of the income is taken as Rs 50,000. Since, income falls under the ratio scale and the sample size is 105 for the purpose of this study, a z-test will be performed here.

Step II: Defining the significance level

The significance level for this test is assumed to be 5% which will be used as criterion to accept or reject the null hypothesis.



Rejection Point, 0.05 Significance Level, One-tailed test using a z-test

Step III: Definition of test statistic

To calculate the test statistic, mean and standard deviation needs to be calculated.

[Rs in '000]

TABLE 3: Calculation of mean and standard deviation for hypotheses testing of Income						
A	B	C (n)	D	E	F	G
Income	Income (considered for test)	Response Total	B*C	B-93.5	(B-93.5) ²	F*C
0-25,000	12.5	7	87.5	-81	6561	45927
25,000-50,000	37.5	6	225	-56	3136	18816
50,000-1,00,000	75	40	3000	-18.5	342.25	13690
1,00,000 and above	125	52	6500	31.5	992.25	51597
TOTAL		105	9812.5			1,30,030

$$\begin{aligned} \text{Mean} &= \text{Total of column D} / \text{Total of column C} \\ &= 9812.5 / 105 \\ &= 93.452381 \end{aligned}$$

Mean income is considered to be 93,500 here for simplicity here.

$$\begin{aligned} \text{Variance} &= \text{Total of column G} / \text{Total of column C} \\ &= 1,30,030 / 105 \\ &= 1238.38095 \end{aligned}$$

$$\begin{aligned} \text{Therefore, standard deviation} &= \text{Variance}^{(1/2)} \\ \text{SD} &= 1238.38095^{(1/2)} \\ &= 35.1906 \end{aligned}$$

$$\text{Now, test statistic} = (\text{Mean} - \text{Hypothesized value}) / [\text{SD} / (n^{0.5})]$$

$$\begin{aligned} \text{So, value of test statistic} &= (93.5 - 50) / (35.1906 / 10.247) \\ &= 43.5 / 3.434 \\ &= 12.667 \end{aligned}$$

Step IV: Accepting or rejecting null hypothesis

In this case, test statistic is greater than the critical value, i.e., $12.667 > 1.645$.

This value falls in the rejection region.

Thus, we reject the null hypothesis here.

The results from the hypotheses testing can be concluded as follows:

- Age has a great impact on the investment decision of an investor.
- Income of an investor has a great impact on his/her investment decision.

DETERMINING THE DIFFERENCE IN PREFERENCE OF INVESTMENT AVENUES BEFORE AND AFTER THE CORONA VIRUS PANDEMIC

Now, to analyse the difference in preference of an investment avenue before and after the corona virus pandemic I used the paired t test in MS Excel. Paired t-tests assess paired observations, which are two measurements on the same person or item. Paired t-test can be used to determine whether the difference between the means of the two sets of scores is statistically significant.

To achieve the research objectives, I will form hypothesis on whether there is significant difference between the preference of the listed investment avenues before and after the corona virus pandemic. The list of the investment avenues include

- Mutual Funds

- Equity Shares
- Gold/ Silver
- Debt instruments
- Private Equity
- Real Estate
- ETFs/ MCX

According to the survey conducted, there was a likert scale rating from Most preferred, Preferred, Neutral, Not preferred and Least preferred for each of the above listed investment avenues for preference before and after the corona virus pandemic. The likert scale rating scores are 5, 4, 3, 2, 1 for Most preferred, Preferred, Neutral, Not preferred and Least preferred respectively.

A “paired two sample t-test for means” was conducted on MS Excel on the primary data collected from investors. The following assumptions have been taken for the calculation of t test statistic

- Rankings for conversion of qualitative data into quantitative data for numerical testing is as follows
 - ✓ Most preferred- 5
 - ✓ Preferred-4
 - ✓ Neutral-3
 - ✓ Not preferred-2
 - ✓ Least preferred-1
- Significance level or α (alpha) has been taken as 5% or 0.05
- All the hypothesis formed are two tailed since the test compares difference between two situations.

1) MUTUAL FUNDS

Step I: Formulation of Hypotheses

- Null Hypothesis:

H_0 = There is no difference in the behavior of investors before and after the corona virus pandemic with regard to Mutual Funds

- Alternate Hypothesis:

H_a = There is a significant difference in the behavior of investors before and after the corona virus pandemic with regard to Mutual Funds

This is a two- tailed hypothesis test since the differences between two events is being compared.

Step II: Calculation of p-value through MS Excel

The correlation coefficient for mutual funds is -0.21558861 which depicts negative correlation between Pre- corona virus and Post corona virus events, thus it can be implied that the mutual funds have become less preferred after corona virus due to market crashes.

Step III: Accepting or rejecting the null hypothesis

In this case, test statistic (p-value) for two tail is 1.81979E-50, which is an extremely small value, We know $P(T \leq t) < \alpha (0.05)$.

Thus we reject the null hypothesis and conclude that there is a significant difference in the behavior of investors before and after the corona virus pandemic with regard to Mutual Fund

Similarly, we can make a similar analysis for all the investment avenues based on the p-values calculated through MS Excel 't-Test: Paired Two Sample for Means'

In all the cases the calculated p value is extremely small, $[P(T \leq t) < \alpha (0.05)]$, the p value in all cases being lesser than the significance level ($\alpha = 0.05$) leads to the rejection of null hypothesis.

This leads us to the conclusion that the investing preference of sample investors has significantly changed the way they invest in all the chosen investment avenues. This is a depiction of how disruptive environment can lead to humongous changes in investors' behavior.

t-Test: Paired Two Sample for Means (Mutual Funds)		
	Pre Corona virus	Post Corona virus
Mean(s)	4.561904762	1.8
Variances	0.344688645	0.488461538
Observations	105	105
Pearson Correlation	-0.21558861	
Df	104	
t Stat	28.15962787	
P(T<=t) one-tail	9.09895E-51	
t Critical one-tail	1.659637437	
P(T<=t) two-tail	1.81979E-50	
t Critical two-tail	1.983037471	

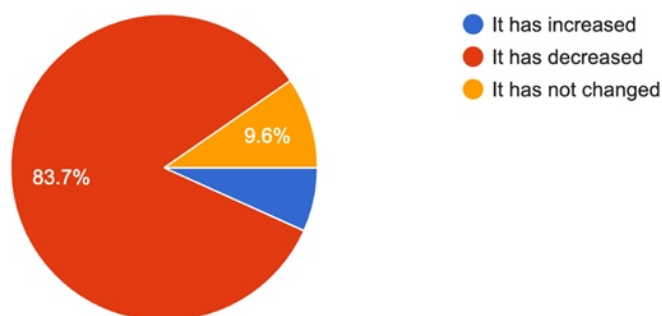
Investment avenue	P-value (two tailed)	Significance level(α)	Accept/ Reject
Mutual Funds	1.81979E-50	0.05	Reject Ho
Equity Shares	2.17637E-55	0.05	Reject Ho
Gold/ Silver	7.47801E-44	0.05	Reject Ho
Debt Instruments	1.05254E-42	0.05	Reject Ho
Private Equity	4.64221E-30	0.05	Reject Ho
Real Estate	1.84523E-46	0.05	Reject Ho
ETFs/MCX	6.64662E-22	0.05	Reject Ho

[All these results are calculated on MS Excel 't-Test: Paired Two Sample for Means' based on likert rating scale]

DATA ANALYSIS AND RESULTS

How has the corona virus (COVID 19) pandemic affected your investment corpus?

104 responses



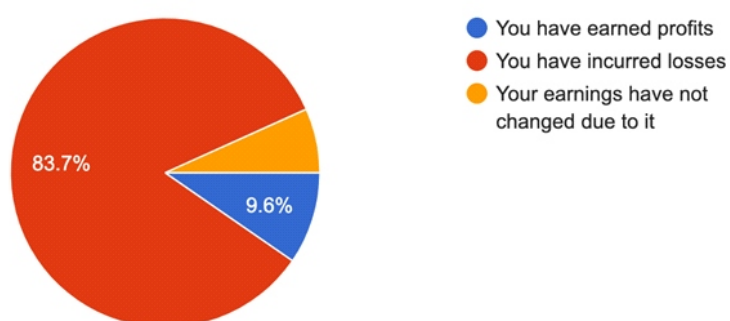
CO VID-19 has led to a huge economic and social impact on Indian economy as well as on the global economy. India's growth rate has been lowered to 2.3% compared to 8.3% in the last year. This impact has affected almost all the sectors of the economy including manufacturing, energy, agriculture, e-commerce and all most all the industries of the nation.

The stock markets have taken a major hit too. On March 23' 2020, the Indian stock markets faced worst losses in their history. SENSEX took a fall of 4000 points (13.15%) and NSE NIFTY also took a fall of 1150 points (12.98%).

This tension among investors has led to investors selling off and shorting their investments and keeping high liquidity in form of cash in hand with them, due to this major investors (83.7%) have decreased their investment corpus to avoid any stock crashing risks.

Since the pandemic has started which is the most relevant?

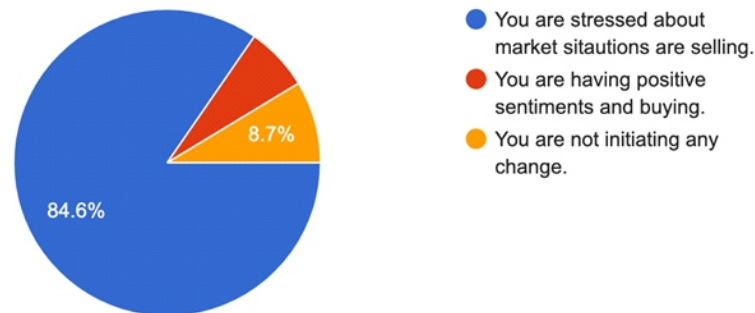
104 responses



Most investors (83.7%) have faced losses as they have sold off their shares at low prices to avoid getting into circuit traps in investments. The SENSEX plunge between mid-February and mid-March was in sync with the fall in other global indices in the US, Europe, Asia and other emerging economies. SENSEX accounted a fall of 4000 points and NSE NIFTY too accounted a fall of 1150 points. This has led to small investors taking huge losses and also big investment firms registering huge losses due to worldwide market crash.

In the current situation which of the following suits your investment behavior?

104 responses



Market tensions have led to investors disposing off their investments and increasing their in hand liquidity. The COVID 19 crisis caused a global shutting down of jobs, more than 60 million employees in India lost jobs due to corona virus and a lot of employees are working on half salaries, tis created a liquidity crunch in the market and led to investors withdrawing money from the market

Also, the recent down crash of SENSEX and reports of incoming recession has instilled a fear among investors and are having negative sentiments about the future of the capital as well as money market.

FINDINGS

The results from the hypotheses testing can be concluded as follows:

- Age and income has a great impact on the investment decision of an investor.
- There is a significant difference in the behavior of investors before and after the corona virus pandemic with regard to all the listed investment avenues which includes
 - Mutual Funds
 - Equity Shares
 - Gold/Silver
 - Debt Instruments
 - Private Equity
 - Real Estate
 - ETFs/MCX

Following conclusions could be drawn from the survey questionnaire-

- The survey was distributed among investors, and 60.6% of the responses of the sample were made by male investors. This leads to the discovery that the males invest much more pro-actively than women. This could be due to some reasons like-

1. In India, predominantly males have the responsibility of being the bread earners of the family.
 2. Also in Indian families, the husband has more power with regard to decisions like investments, while the wife takes household related financial decisions.
- Most of the people who invest are of the age 35 years to 55 years. This is due to the fact that at this range of age people have a stable stream of income which they are willing to invest.
 - Most of the people invest 30% to 50% of their income. The investors that became my respondents were primarily wealthy businessmen having a large chunk of disposable income which is not consumed thus, all that income goes into investment purpose.
 - The most preferred avenue of investment among the sample investors before the corona virus pandemic has been mutual funds. It may be due to reasons like-
 1. Simplicity: Mutual Funds are simple to comprehend.
 2. Accessibility: Mutual Funds are simple to purchase.

3. Diversification: Mutual Funds have broad market exposure.
 4. Variety: Mutual Funds come in a wide range of options for users to choose from.
 5. Affordability: Mutual Funds have low minimum cost.
 6. Frugality: Mutual Funds vary from cheap to expensive for user preference.
 7. Professional Management: Mutual Funds are managed by a team of professional experts who help maximize the returns of investors who do not have much knowledge of the market.
- Also equity shares have been widely preferred by investors before the pandemic as they are high return instruments and are easily tradeable and transferable. They do not require large investments and can provide quick profits to investors.
 - While the least preferred investment avenue before corona virus has been Real estate due to large capital requirements and unaffordability.
 - Mutual Funds and Equity Shares have taken a huge dip after the corona virus pandemic as they are extremely risky since global markets have crashed in lieu of the upcoming recession due to the industry wide lockdown throughout the world.
 - Investors have shown more preference to secure and risk free investment avenues after the pandemic has affected the global markets. Due to this situation the preference of traditional investment avenues like gold/silver, real estate have risen manifold.
 - Also the preference of debt instruments have increased since they are zero risk and low returns equities, investors are satisfied with low level of returns to maintain the safety of their investment money.
 - Market trends and Return on investment have been chosen to be the most important factor for the investors. While government policies, investment objectives and company profile have also been marked as quite important factors that affect investment decisions. Due to the corona virus pandemic, factors like government policies and market trend are a major indicator of what is going to be the future of market, thus these two are marked as most important by investors.
 - The least important factors has been marked as professional advice as Indian investors do not have a very big investment corpus, that can be handled by individuals themselves and do not require professional advice. Also the professional advice is expensive which can be replaced by self knowledge of individuals too.
 - CO VID-19 has led to a huge economic and social impact on Indian economy as well as as global economy, India's growth rate has been lowered to 2.3% compared to 8.3% in the last year. This impact has affected almost all the sectors of the economy including manufacturing, energy, agriculture, e-commerce and almost all the industries of the nation.
 - The stock markets have taken a major hit too. On March 23' 2020, the Indian stock markets faced worst losses in their history. SENSEX took a fall of 4000 points (13.15%) and NSE NIFTY also took a fall of 1150 points (12.98%). This tension among investors have led to investors selling off and shorting their investments and keeping high liquidity in form of cash in hand with them, due to this major investors (83.7%) have decreased their investment corpus to avoid any stock crashing risks.
 - Most investors (83.7%) have faced losses as they have sold off their shares at low prices to avoid getting into circuit traps in investments. The SENSEX plunge between mid-February and mid-March was in sync with the fall in other global indices in the US, Europe, Asia and other emerging economies. SENSEX accounted a fall of 4000 points and NSE NIFTY too accounted a fall of 1150 points. This has led to small investors taking huge losses and also big investment firms registering huge losses due to worldwide market crash.
 - Market tensions have led to investors disposing off their investments and increasing their in hand liquidity. The COVID 19 crisis caused a global shutting down of jobs, more than 60 million employees in India lost jobs due to corona virus and a lot of employees are working on half salaries, this created a liquidity crunch in the market and led to

investors withdrawing money from the market.

- Also, the recent down crash of SENSEX and reports of incoming recession has instilled a fear among investors and are having negative sentiments about the future of the capital as well as money market.
- On analyzing individual responses, it was discovered that financial planners are generally preferred for High Net worth Individuals (HNI) for the management and safety of their funds. Financial planners are rarely preferred by people who have income less than 100000 per month as they won't be able to afford their services. Such people rely heavily on the internet, family or peer opinions, and news channels for their investment knowledge and information.
- The key objective of investments is wealth creation. Survey results showed that equity market is the most preferred investment avenue followed by mutual funds. Value investing in equity markets and mutual funds can lead to great wealth creation for investors.

DISCUSSIONS AND CONCLUSION

- Instead of panicking and selling their investments at losses, investors should wait for the market to stabilize or it would create bearish sentiments in stock market and would lead to further fall in the value of investments.
- This research paper will help investors looking for any suggestion for investment during COVID 19 lockdown to make correct investment decisions as it provides a comprehensive view of the situation.
- The source of information is very important for investing. Investor can sometimes lose money by following the tips from brokers who themselves invest in the investment avenues. Thus, investors should themselves conduct a proper research before making any investment decision.
- The survey shows that majority of investors are of age 35 years to 55 years. The young

population doesn't invest much. Therefore, they should be encouraged to invest from an early age by educating them about importance of investment and different investment options available

- Investors must keep good faith in the government of the country as it is trying hard to make sure the market can revive and the investors who lost previously can benefit from their initiative.

REFERENCES

- Lokhande, M. A. (2015), A study of investment awareness and patterns of savings and investments by rural investors. *Indian Journal of Finance*, 9(7), 22- 31.
- GnaniDharmaja V, Ganesh J, Dr. Santhi V (2012), A Study on the Individual Investor Behavior with Special Reference to GeojitBNP Paribas Financial Service Ltd, Coimbatore.
- Anitha, M., & Bhargavi, D. P. (2014). Investors' Perception Towards Investment. *Global Journal of Finance and Management*, 6(2), 185-190.
- Naveed M, SarwarZahid, Bashir T. How Corporate Environmental Ethics (Non-Financial Information) influence Individual Investor's Trading Behavior? Mediating Role of Corporate Reputation and Corporate Social Responsibility Belief. *Journal of Managerial Sciences*. 2019
- Walia, N., & Kiran, R. (2009). An analysis of investor's risk perception towards mutual funds services. *International Journal of business and Management*, 4(5), 106
- Vasagadekar, P. (2014). A research paper on investment awareness among Indian working women with reference to Pune region. *International Journal of Scientific & Engineering Research*, 5(6), 18
- Kumar S, Kumar P. Factors Influencing the Investment Behavior of Women Investors: An Empirical Investigation. *IUP Journal of Financial Risk Management*. 2019;16(4):30-50.
- Yang, H., Ahn, H.-J., Kim, M. H., & Ryu, D. (2017). Information asymmetry and investor trading behavior around bond rating change announcements. *Emerging Markets Review*, 32, 38-51.
- Gao, B., & Yang, C. (2018). Investor Trading Behavior and Sentiment in Futures Markets. *Emerging Markets Finance & Trade*, 54(3), 707-720.
- Tiwari, S. K., Bansal, P. K., & Maheshwari, A. (2019). An Empirical Study of Determinants of Investors' Behaviour in Stock Market. *Mudra: Journal of Finance & Accounting*, 6(2), 44-59.
- Sharma, Aprajit (April, 2020) Coronavirus impact: India worst hit stock market; China least-affected. Database: Business today article.
- Mehta, Riju. Bharadwaj, Sameer (March 2020) How the coronavirus has hit Indian and global markets. Database: Economic Times article.

Oil Spills-A Side Effect of Transportation or Risk for Lives

Jyoti Pathak*

Utkarsh Khanna**

In recent years the lives of human beings have changed a lot. they have seen a great shift in technology and resources after the industrial boom and this industrial boom, not any affected humans but have also seriously affected the environment. Pollutions caused are continuously affecting the ecosystem, and one such serious pollution is oil spills. Oil spills are the result of human errors or accidents which have a serious effect on the marine ecosystem. Oil floating on the surface of the water is harmful to both marine animals as it causes serious health problems like gastrointestinal infections, eye irritations, etc, but also affects sea birds which are dependent on fishes. oil is absorbed by feathers of birds and badly affects the kidney and liver causing serious problems. The measures have been taken to control this problem but still, they are not precise enough to get rid of this problem completely as a result problem continues to persist and affects the marine ecosystem.

Keywords: Oil spills, bird feathers ,harmful chemicals, accidents, oil spills

INTRODUCTION

The world has seen a boom in globalization after the introduction of industrialization. the marketers are making constant efforts to sustain competition and globalization is serving an effective way in this. Globalization refers to the flow of technology, services, goods, and people and thus helping marketers in making a global presence. "Globalization is the spread of products, technology, information, and jobs across national borders and cultures."(Globalization Definition, n.d.) Due to increasing demand and entering new markets globally, industries can make huge profits and thus also helping customers with a wide variety of choices. In this process of reaching new customer bases, petroleum is playing an important role in international trade.

Petroleum is a naturally occurring hydrocarbon, commonly used as fuel. petroleum is a fossil fuel formed due to organic decomposition in intense pressure and temperature. Petroleum is used as fuel to power vehicles, heating units, and

machines, as well as it can be converted into plastics and other materials. The extraction and processing of petroleum, and thus, its availability, is a major driver of the world's economy and global politics.

Oil spills are commonly referred to as marine oil spills. It is the release of petroleum into the marine ecosystem due to human activities like transportation and thus polluting it. Petroleum being hydrocarbon has hydrophilic nature and low density, it keeps floating on the water surface of oceans, rivers, and other water bodies and thus affecting aquatic lives. Petroleum contains harmful toxic hydrocarbons which can affect the health of living beings, during oil spills, petroleum was in taken by marine animal and thus affects their health and in severe conditions results in death "Gasoline contain relatively high proportions of toxic and volatile hydrocarbons, such as benzene, which is known to cause cancer in humans, and hexane, which can affect the nervous system. Gasoline and kerosene releases are exceptionally hazardous due to their high flammability." (Types of Petroleum Oils | US Environmental Protection Agency, n.d.).

Oil spills have environmental as well as economical effect, oil spills lead to loss of tons of petroleum, "Oil spills have huge and immediate economic, social, and environmental impacts."(Shipping Problems: Oil Spills | WWF, n.d.)

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The effect of oil spills on marine life is directly related to the toxicity of petroleum released. Oil toxicity depends upon various factors such as: -

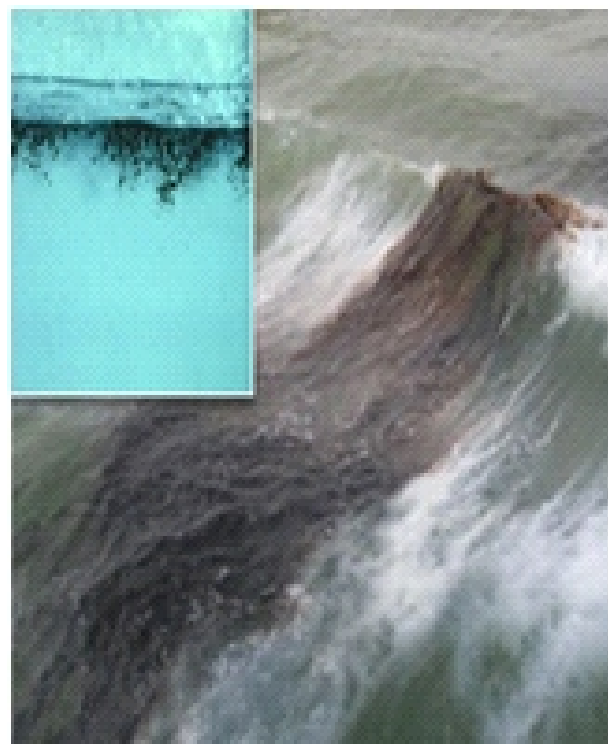
- Oil composition – Oil composition refers to the relative content of Kerosene, Naphtha, and gasoline. Based on these content, crude oil is further divided into two category –
 - i) Sweet crude oil – High fraction of – Kerosene, Naphtha, and Gasoline
 - ii) Sour crude oil – Low fraction of – Kerosene, Naphtha, and Gasoline
 - Characteristics of oil – Physical and Chemical
 - i) Physical – Molecular Weight, Vapour Pressure, and Water Solubility
 - ii) Chemical- Volatility, Viscosity, and Surface Tension
 - Condition - Weathered Condition
 - Bioavailability of oil- bioavailability is defined as “the fraction of an ingested nutrient that is available for utilization in normal physiological functions or for storage” Rangaswamy Lakshminarayana and Vallikannan Baskaran (Influence of olive oil on the bioavailability of carotenoids)
- Evaporation- The rate of evaporation of oil is dependent on the viscosity of the oil. Fluids with low viscosity like- gasoline, kerosene, and diesel than to evaporate completely within a few days of the spill. The rate of evaporation tends to increase with oil spread. Oil spread tends to spread oil over the surface of the liquid in the form of a thin layer, this increases surface area for evaporation.
 - Spreading – spreading of oil on the surface of the water is dependent on the viscosity of the oil. Oils with low viscosity tend to spread more. the viscosity of the oil is dependent on the ambient temperature and composition of the oil. The viscosity of oil and temperature are inversely proportional as a result oil still in cool places have high viscosity, as a result, they tend to spread with a lower rate as compared to places with high temperature. “
 - Dispersion- waves, turbulence, and water current can cause some or all of the slick to break in the form of droplets of variable sizes. Maximum droplets mix with the upper thin layer of water and spread out to form a thin layer while the larger one tends to rise back to the surface. “The speed at which an oil disperses is largely dependent upon the nature of the oil and the sea state. Dispersion occurs most quickly

WHAT ARE OIL SPILLS?

Oil spills can be defined as the discharge of liquid petroleum hydrocarbon onto the surface of a large waterbody caused by an accident or human error. Oil spills lead to water contamination and affect the lives of marine animals. “30%-50% of oil spills are either directly or indirectly caused by human error, with 20%-40% of all spills caused by equipment failure or malfunction. Emerging spill risks include increased maritime activity in the Arctic, deepwater exploration and development, and the rapid expansion of rail transport of crude oil.” (Michel & Fingas, 2016)

During Oil Spills petroleum hydrocarbons stick with the surface of water due to low solubility. The oil stick with the surface of water move and spread over a large area due to the effect of wind, water current, and waves. Oil leaked into the waterbodies, initially move into the water due to gravitational force, contaminating thinner layers of water.

Weathering of oil can be defined as the movement of oil on the water surface. Weathering includes 8 processes-

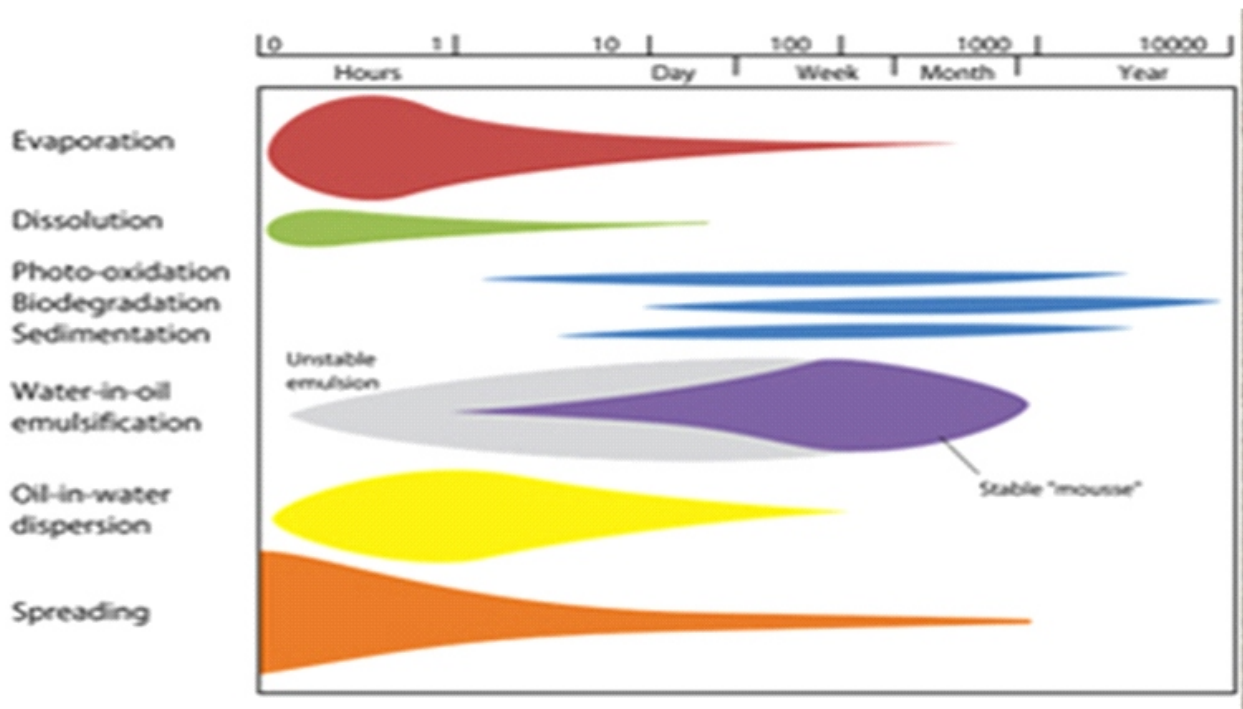
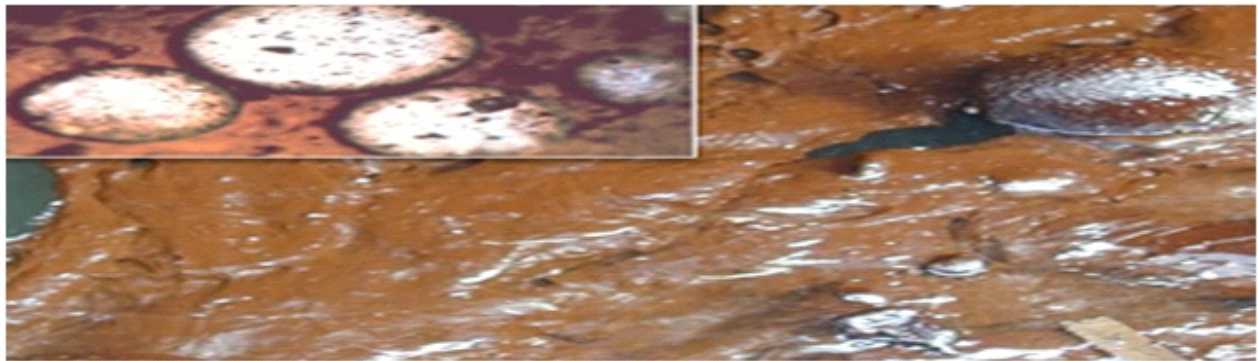


- if the oil is light and of low viscosity and if the sea is very rough”(Weathering - ITOFF, n.d.)

Dispersion of Oil Spills

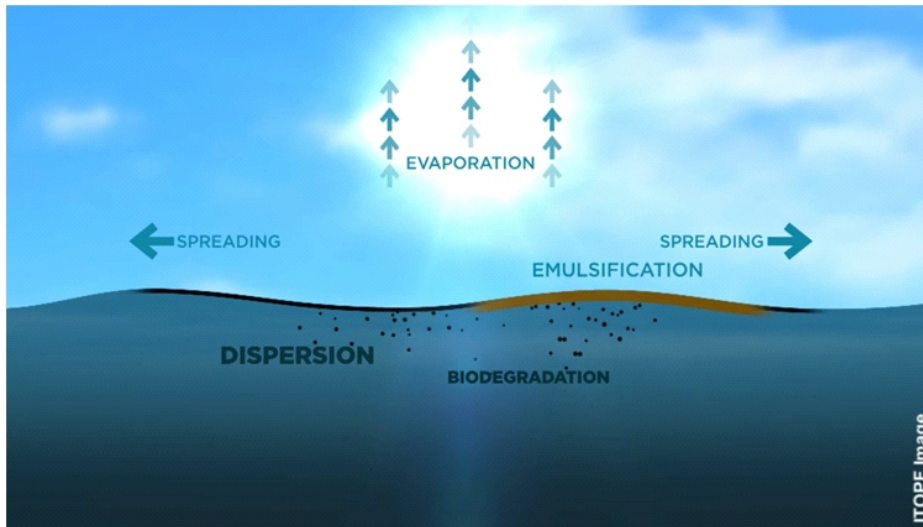
- Emulsification- emulsification is formed when two fluids mix. In the case of oil spills seawater and oil mix and form water-in-oil emulsification. The emulsion formed is

usually very viscous and more persistent than the original oil and is sometimes referred to as chocolate mousse because of its appearance. Emulsification formed due to mixing of oil and seawater cause 3-4 times to increase in the volume of pollutants, as a result, it slows and delays the process of weathering.



The diagram above shows the effect of processes in weathering of oil after spills.

- Dissolution- light aromatic compounds in a hydrocarbon like benzene are soluble in seawater.
- Oxidation- oil react chemically with oxygen in presence of sunlight resulting in the break down into soluble compound or a persistent compound called tars. Tars have high viscosity thus result in increased persistence of oil.
- Sedimentation- a few amounts of oil sink down in the seashore, this oil mix with sand and other sediments present in the marine environment results in sedimentation of oil.
- Biodegradation- Seawater contains a wide range of micro-organisms that use hydrocarbons as a source of energy and can partially or completely degrade oil to water-soluble compounds and eventually to carbon dioxide and water.



Each process can be chronologically placed in two broad categories.

- Early oil spills- the chronological order are is - spreading, evaporation, dispersion, emulsification, and dissolution (for initial hours)
- Late-stage oil spills -oxidation, sedimentation, and biodegradation. These are longer-term processes that will determine the ultimate fate of the oil spill.

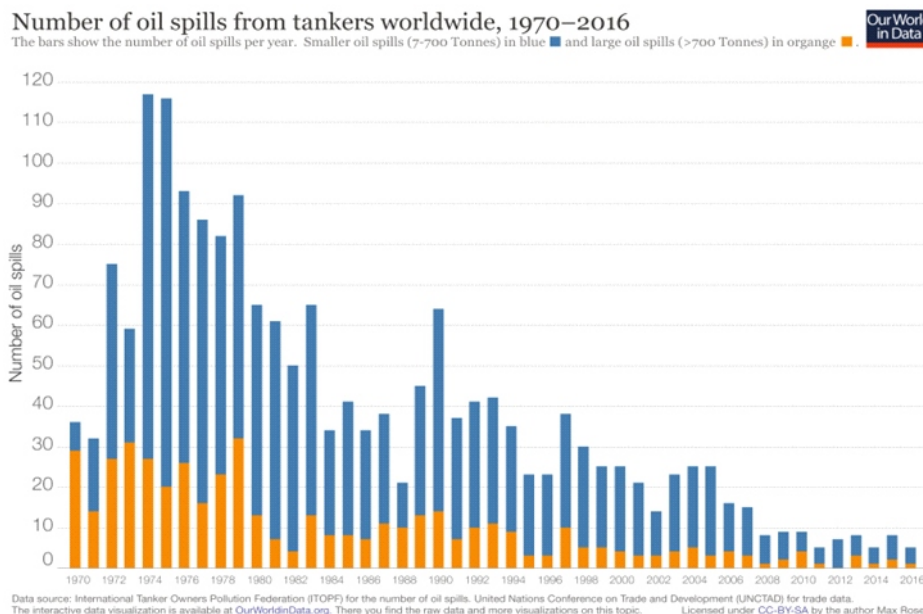
The major dependent onthe weathering of oil is viscosity and temperature.

Viscosity and temperature directly affect the spread of oil on the surface of the water body. "The viscosity of the spilled oil will, to some extent, influence the rate of spreading, and, as viscosity is temperature dependent, the water temperature will also influence the area covered by a surface slick."(Bartha & Atlas, 1977)

Viscosity is defined as a measure of fluid resistance to flow. During Oil Spill, the viscosity of oils defines its ability to spread on the surface of the fluid. Temperature also plays an important role in the weathering of oil – Ambient temperature affects the viscosity of the oil, as a result, affects the rate of weathering. "The speed at which this takes place largely depends upon the viscosity of the oil, which in turn depends both on the oil composition and the ambient temperature. Fluid, low viscosity oils spread more quickly than those with a high viscosity. At low temperature, the oil will tend to be more viscous than at higher temperature as viscosity is inversely proportional to temperature."

PAST TRENDS OF OIL SPILLS

The problem of oil spills has decreased in the past few years but it is still affecting the aquatic ecosystem (9 of the Biggest Oil Spills in History | Britannica, n.d.)



As the above graph suggests, the incidents of oil spills have decreased in the past years. The incidents of large oil spills are less than smaller oil spills, the overall cases were highest during 1972-1990, as major wars and accidents took place in these years. Some of them are as follows (in increasing order of the number of oil spills) (Roser, 2013)

“While in the 1970s there were 24.5 large (> 700 tonnes) oil spills per year, in the 2010s the average number of large oil spills decreased to 1.7 oil spills per year.” (Saadoun, 2015)

EFFECT OF OIL SPILLS ON MARINE ENVIRONMENT

Oil spills are the result of human errors and accidents but the effect of this mistake is harming the marine ecosystem. Oils are composed of hydrocarbons which results in its hydrophilic nature. The components of oil act as a poison for the marine ecosystem. The animals living or depending on the marine ecosystem are direct sufferers of this human mistake.

Oil due to its hydrophilic nature and low density as compared to seawater keeps floating on the surface of the water. This thin layer of oil on the surface of water affects marine animals and plants. Oils have a chemical composition which acts as a poison to the animals. The oil affects these animals both internally and externally. Internally when this oil is consumed by animals or by inhalation and externally by exposure to skin and eyes, it results in eye and skin irritation.

Oil directly affects marine life by mainly 3 pathways -

- In gestation
- Absorption
- Inhalation

In gestation - Oil released forms a thin layer on the surface of water due to low density, but some parts of this oil sink down into the marine ecosystem due to the effect of gravity. This oil gets consumed by the fishes and other marine animals and thus affecting them internally.

INCIDENTS	YEAR	AMOUNT OF OIL SPILLS
The Amoco Cadiz Oil spills	1978	69 Gallons
The Castillo De Bellver Oil Spills	1983	110,000 tons
The incident at the Noweuz Oil Fields	1983	63000 Gallons
The Kolva River Spills	1994	84 million Gallons
The Mingbulak Oil spills	1992	88 million Gallons
The Atlantic Express Oil Spills	1979	90 million Gallons
The Ixtoc 1 Oil Spills	1979	140 million Gallons
BP's Deepwater Horizon Oil Spills	2010	206 million Gallons
The Persian Gulf War Oil Spills	1991	380-520 million Gallons (estimated)



Ingestion of oil or dispersants can cause problems like-gastro intestinal irritation, irritation, ulcer, bleeding, diarrhea, and other digestive problems for the aquatic animals. These problems can further affect marine animals and can lead to serious problems like- impaired ability to digest food and ultimately affecting their health and fitness and even choke them causing death. Aquatic herbivores like turtles can consume oil by intaking plants coated with oil droplets. Other animals which are dependent on aquatic animal for their food may intake oil by the consuming animals whose body is soaked in oil. This includes carnivores' animals like- shorebirds.



Absorption-Oil or oil dispersants get absorbed in the body through skins and feathers, badly affecting vital body organs like - Kidney, Liver. It can even cause serious problems like anemia, suppresses the immune system, and also affects the reproductive system. In severe cases, it can also cause death. Oils also affect the growth of animals - like the embryo of fishes and turtles grow slower than normal leading to more mortality rates and developmental impairments. "Hydrocarbons have a volatile nature and, therefore, inhalation of them results in respiratory tract irritation and narcosis of mammals and birds."(WEC285/UW330: Effects of Oil Spills on Marine and Coastal Wildlife, n.d.)Physical contact of oil also affects birds as these animals depend on feather i.e. their outer coat for buoyancy and warmth but on contact with oil, it adheres to this layer causing problems like hypothermia " heavy oils get onto the feathers of birds, the birds may die of hypothermia", (How Oil Harms Animals and Plants in Marine Environments | Response. Restoration. Noaa.Gov, n.d.) smothering, and drowning.

Inhalation- Oil contains volatile compounds, inhalation of these compounds by wildlife can cause serious problems like- respiratory inflammation, irritation, emphysema, and pneumonia. "Manatees, dolphins, whales, and sea

turtles all come to the surface to breathe periodically, and all are susceptible to this risk." (Evans et al., 2001)

Oil Spills also affect animals in affecting their behavior -

- Oil spills cause the animal to relocate in search of food and a clean environment- the relocation of animals may directly cause mortality for animals. As they are shifting from their natural habitat in search of food. And this also results in competition for available food in a new place, this affects their survival rates.
- Oil spills disrupt natural lifecycle- oil affects body functions and body organs of the animals who are exposed to oils. Lives of juveniles are more vulnerable to the harmful effects of oils and thus affects their life processes
- Oil spills result in an increase in foraging time. -animals who are exposed to oils face serious digestive and gastrointestinal problems, especially when they have ingested oil in their body. These processes slow down their digestion process and reduce overall health. Also, the oil absorbed by the skin and feathers affects their body temperature and results in a poor immune system.

Factors influencing the degree of impact of oil spills on animals

- Amount of exposure
- Pathway through which oil is exposed
- Animal age
- Process of cleaning and chemical used for Cleaning Oil Spills

IS THERE ANY SOLUTION OR JUST A CALL FOR ANOTHER CAUSE OF DEATH FOR MARINE ANIMAL?

Oil Spills are one of the major reasons for the death of marine animals. As animals consume toxic compounds in oil which affects their gastrointestinal tract and thus affect their health. Another cause of death due to the oil spill is the movement of animals for food and an oil-free environment. This causes an increase in competition for food and survival and thus causes deaths.

The events causing oil spills have increased since

the last decade. This is causing serious concern in terms of pollution, as this problem is getting serious every year, solutions have been tried to resolve or just minimize this effect. but the problem for concern is that the methods are yet effective in cleaning the dirt on the layer of water but the by-products released are also affecting the marine ecosystem.

The following are the major methods used today to clean this issue:-

Using Oil booms- this is the most simple and commonly used method to clean human error and spills from water. This process is mainly done with the help of equipment called- Containment booms, which act as a fence with preventing weathering oil. This process is only useful when oil is in one spot and oil spills have taken a few hours ago and external environmental conditions must not contain rough waves and high wind velocity. This boom floats on the surface of the water and has three parts which include-

1. FREEBOARD - this part rises above the water surface containing oil and prevents it from splashing away
2. SKIRT- this part is placed below the surface of the water which contains oil. This prevents oil squeezing under the boom and escaping
3. A kind of cable or chain that connects these parts and provides stability

Using Skimmers -after oil booms have confined oil at one place, skimmers are implanted in boats to remove the containment from the surface of the water. These skimmers suck the oil from the surface of the water.

Using Sorbents - sorbents are the soak up liquids that soak oil spilled on the surface of the water wither by the process of absorption or by the

process of adsorption. the materials commonly used as sorbents are - straw, hay, vermiculite, etc. "sorbents need to be both oleophilic (oil-attracting) and hydrophobic (water-repellent). Although they may be used as the sole clean-up method in small spills, sorbents are most often used to remove final traces of oil, or in areas that cannot be reached by skimmers."(Sorbents | US Environmental Protection Agency, n.d.)

Apart from these methods, there are some methods which are causing a serious threat to the lives of marine animals. These methods are yet effective for cleaning oil spills that have spread over a large area and are difficult to block in one place. So to remove oil spills methods used are as follows

Burning In-Situ-" in situ burning to be widely effective, it needed to be considered as one of the primary oil spill response methods."(How Do Oil Spills out at Sea Typically Get Cleaned Up? | Response.Restoration.Noaa.Gov, n.d.) in this process oil floating on the surface of the water is ignited and burn it off. This is most effective as it removes 98% of the oil spill on the surface of the water but it is harmful to marine animals as harmful gases are released during this process which may be inhaled by animals and thus affecting their health. "In-situ burning is the term given to the process of burning floating oil at sea, at or close to the site of a spill."(In Situ Burning of Oil Spills, n.d.)

The thick smoke released in this process is extremely harmful to the environment and marine ecosystem, as it releases toxic gases

Using Dispersants - the dispersant is used when oil booms cannot contain oil in one place. The chemicals like Corexit 9500 are sprayed upon oil spills which aid the natural break down of oil





compounds. This is mainly done when oil is spilled over a large area. These dispersants harm marine organisms especially like corals and seagrass, “using dispersants has its drawbacks, shifting potential impacts to the marine life living in the water column and on the seafloor” (Ali et al., 2020)

Bioremediation – this process includes specific microorganisms for removing toxins or harmful substances. This process includes a class of organisms like bacteria, fungi, algae which have the ability to degrade petroleum and breaking them into a non-toxic form. “This involves using the enzymatic capabilities of the indigenous hydrocarbon-degrading microbial populations and modifying environmental factors, particularly concentrations of molecular oxygen, fixed forms of nitrogen, and phosphate to achieve enhanced rates of hydrocarbon biodegradation.” (Atlas, 1991) Sometimes for this process fertilizers and reagents are added to provide nutrients for microorganisms and allow them to grow and multiply quickly. The only drawback of this process is the presence of fertilizers that may cause the growth of unwanted algae which may consume oxygen and cut-off sunlight and thus negatively affect marine life. “oil-bioremediation is globally recognized as a cost-effective and environmentally safe approach.” (Ali et al., 2020)

CONCLUSIONS

Oil spills can be defined as the spread of liquid petroleum hydrocarbon on the surface of water due to which they are one of the major causes of ocean pollution. Oil spills are the result of either human mistakes or accidents, but the real cost of these mistakes is paid by the marine animal, they are the ones whose health is sacrificed due to toxic contents in oil and ultimately causing deaths. There are measures available to clean this mistake but these measures are giving birth to another problem continuing to affect the marine ecosystem as a result the problem remains but in a different form and even after cleaning oil from the surface of the water marine animals still not in the safe and healthy ecosystem as they are still affected with the side products (like – chemicals and harmful gases released during the burning of oil) formed in the process of cleaning the layer.

REFERENCES

- 9 of the Biggest Oil Spills in History | Britannica. (n.d.). Retrieved September 30, 2020, from <https://www.britannica.com/list/9-of-the-biggest-oil-spills-in-history>
- Ali, N., Dashti, N., Khanafer, M., Al-Awadhi, H., & Radwan, S. (2020). Bioremediation of soils saturated with spilled crude oil. *Scientific Reports*, 10(1), 1–9. <https://doi.org/10.1038/s41598-019-57224-x>
- Atlas, R. M. (1991). Microbial hydrocarbon degradation – bioremediation of oil spills. *Journal of Chemical Technology & Biotechnology*, 52(2), 149–156. <https://doi.org/10.1002/jctb.280520202>

- Bartha, R., & Atlas, R. M. (1977). The Microbiology of Aquatic Oil Spills. *Advances in Applied Microbiology*, 22(C), 225-266. [https://doi.org/10.1016/S0065-2164\(08\)70164-3](https://doi.org/10.1016/S0065-2164(08)70164-3)
- Evans, D. D., Mulholland, G. W., Baum, H. R., Walton, W. D., & McGrattan, K. B. (2001). In situ burning of oil spills. *Journal of Research of the National Institute of Standards and Technology*, 106(1), 231-278. <https://doi.org/10.6028/jres.106.009>
- Globalization Definition. (n.d.). Retrieved September 30, 2020, from <https://www.investopedia.com/terms/g/globalization.asp>
- How Do Oil Spills out at Sea Typically Get Cleaned Up? | response.restoration.noaa.gov. (n.d.). Retrieved September 27, 2020, from <https://response.restoration.noaa.gov/about/media/how-do-oil-spills-out-sea-typically-get-cleaned.html>
- How Oil Harms Animals and Plants in Marine Environments | response.restoration.noaa.gov. (n.d.). Retrieved September 25, 2020, from <https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/how-oil-harms-animals-and-plants-marine-environments.html>
- In Situ Burning of Oil Spills. (n.d.). Retrieved September 27, 2020, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4865285/>
- Michel, J., & Fingas, M. (2016). Oil spills: Causes, consequences, prevention, and countermeasures. In *Fossil Fuels: Current Status and Future Directions* (pp. 159-201). World Scientific Publishing Co. Pte. Ltd. https://doi.org/10.1142/9789814699983_0007
- Roser, M. (2013). Oil Spills. *Our World in Data*. <https://ourworldindata.org/oil-spills>
- Saadoun, I. M. K. (2015). Impact of Oil Spills on Marine Life. In *Emerging Pollutants in the Environment - Current and Further Implications*. InTech. <https://doi.org/10.5772/60455>
- Shipping problems: Oil spills | WWF. (n.d.). Retrieved September 30, 2020, from https://www.panda.org/our_work/our_focus/oceans_practice/problems_shipping/spills/
- Sorbents | US Environmental Protection Agency. (n.d.). Retrieved October 1, 2020, from <https://archive.epa.gov/emergencies/content/learning/web/html/sorbents.html>
- Types of Petroleum Oils | US Environmental Protection Agency. (n.d.). Retrieved September 30, 2020, from <https://archive.epa.gov/emergencies/content/learning/web/html/oiltypes.html>
- Weathering - ITOPF. (n.d.). Retrieved September 25, 2020, from <https://www.itopf.org/knowledge-resources/documents-guides/fate-of-oil-spills/weathering/>
- WEC285/UW330: Effects of Oil Spills on Marine and Coastal Wildlife. (n.d.). Retrieved September 25, 2020, from <https://edis.ifas.ufl.edu/uw330>

A Study on Consumer Behaviour Towards Electric Cars With Special Emphasis on Indian Consumers

Gyana*

Gaurangi**

The present business scenario had undergone a paradigm shift, the objective of organization is not limited to sales maximization. The organization is following a holistic approach and they are not only concerned about their profits but also focuses on various environmental factors which not only save the country resources but also ensure sustainability for future. The manufactures are futuristic and don't only think about the current demand but are also involved to develop a model which can meet the future vision. The car manufacturers are switching towards developing an Electric Cars for maximum customer satisfaction and also enhancing their brand image by following Green Marketing practices. The shift towards E-vehicles is not easy it has lots of challenges which need to be examined i.e. customer reluctant to change, costly, unavailability of charging stations, over reliance on electricity where large part of the country doesn't get continuous electric supply in a day and lack of technology. These are the main factors why customers are reluctant to shift towards Electric Cars. The research highlights the customer perception towards Electric Cars and how the demand will shape up in near future. It also highlights various Green Marketing Strategies followed by the organization to ensure sustainability. To achieve this objective Primary data was used and sample of 250 prospective customers were taken. The result of the study was analyzed using various statistical tools to understand the behavior of the customers and what are the challenges that the organization might face during this transition. The study will act as the important tool for the organization to take various decisions related to Marketing Mix.

Keywords: Electric Cars, Automobile Manufacturers, Innovation, Green Marketing, customer, Sustainability, Battery Electric Vehicle, Hybrid Electric Vehicle, Market Potential, Technologies

INTRODUCTION

The present business scenario had undergone a paradigm shift, the objective of organization is not limited to sales maximization. The organization is following a holistic approach and they are not only concerned about their profits but also focuses on various environmental factors which not only save the country resources but also ensure sustainability for future. The automobile sector of our country is very vast there are large number of manufacturers who in spite of being a multinational organization manufactures their cars in India and also compete with the Indian brands to gain the market share. The manufactures are futuristic and don't only think about the current demand but are also involved to develop a model which can meet the future vision.

The manufactures are futuristic and don't only think about the current demand but are also involved to develop a model which can meet the future vision. They are following various Green Marketing strategies making an Electric Car is also one such Green Marketing strategies used by the companies.

Being sustainable has always been in the marketing strategy followed by the Automobile Manufactures in India. They always emphasis on environment conversation advertisement which promotes Green Marketing. There are many claims like environmental friendly, fuel efficient and CNG compatible model these promote the company's green marketing practices. As the customers are now environmental cautious these strategies also help to increase brand image and hence leads to gaining new customers and retaining the old ones.

Electric Cars are the demand of today's society as the air quality index is depleting and there is the sustainable decrease in crude oil in the world. To tackle this situation the countries around the world is looking for some alternate source of fuel. The demand for the car is increasing day by day as cars are no more considered luxury it's a necessity now. Hence switching to Electric mode of cars would be a great option to reduce pollution levels and also save crude oils.

Manufacturing and Selling E-Cars is a challenge for the companies as it involves the use of technology and development of favourable ecosystem in the country. The current challenge in

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implementing the change involves setting up of electric charging station, increase the efficiency of the engines for fast charging, to enhance the electricity facility in the highway villages, cost also is the major limitation. It is seen that as the technology for Electric Vehicle is new it involves additional cost to the organization. Hence the electric cars are priced at the higher rates as compared to the cars in the same segment. So, as the cars are not too user friendly and cost effective it is not in the buying choice for the customers of India.

Hence it is very necessary to understand the dynamics of electric 4 Wheelers Car adaptability and scalability on the basis of Indian Scenario.

LITERATURE REVIEW

(Fetene and Manie,2016) The reason like driving range and no fuel consumption investigates the power utilization of BEVs and its affectability to the different driving conditions in the hands of clients. The outcomes show that the vitality utilization pace of BEVs is profoundly delicate to climate conditions and to driving styles. The outcomes may assist people with making educated choices about BEV decision, producers to manufacture trust with clients by give progressively precise data, and governments to structure arrangements dependent on solid data.

(Beggs and Cardell,1981) they studied nine parameters taking the sample of 193 respondents who were interviewed in group of approx. 10 individual each. Ranked preference was used to test various social-economic variables and assuming identical taste parameters in the population. The nine parameter were tested which are price, fuel cost, gas powered, range, top speed, high acceleration, four seats, air conditioning and special three year warranty. The finding of study shows that customers were not receptive to electric cars because they have limited range and long refuelling period.

(Calfee, 1985) his investigation utilizes probabilistic decision models to anticipate potential interest for electric vehicles. Overview information are utilized to evaluate separate utility capacities for every one of 51 subjects. This gives an example circulation of customer inclinations for vehicle qualities including cost, working expense and range. The outcomes demonstrate extraordinary decent variety in singular exchange offs among traits, with range and top speed by

and large being exceptionally esteemed. The example of utility capacities is then used to anticipate potential pieces of the overall industry for different sorts of electric vehicles as second vehicles. Request is very constrained, aside from when (an) electric vehicles are extensively further developed than anything liable to be accessible sooner rather than later, and customers dread huge gas deficiencies. The last impact gets from a watched "inclination" for electric automobiles, which is conceivably deciphered as a support against interruptions in the fuel advertise.

(Cheron and Zins, 1995) the study was undertaken to evaluate general significance related to variables that are generally considered persuasive in debilitating acquisition of an E- vehicle. What's more, exchange offs among the accompanying elements: go, most extreme speed, reviving duration, and battery price and time required for charging are considered. The separation of inclinations is inspected as for financial and segment factors. The level of standard participants leaning toward a particular electric vehicle idea is likewise contrasted and its normal likelihood of being bought.

(Morton, Anable and Nelson,2016) The dispersion of electric vehicles (EVs) is viewed as a significant part of government arrangement which expects to create a change to a low-carbon portability framework in the United Kingdom and the more extensive European setting. This paper explores customer interest for EVs by inspecting the impact of purchaser creativity nearby mentalities concerning the useful capacities of EVs over EV inclinations. A calculated structure is developed and applied which incorporates estimations of ingenuity at both an assenting level, through an appraisal of innovation possession, and at an intrinsic level, by estimating an accomplice of mental and sociological factors. Moreover, the structure fuses estimations of perspectives towards the useful performance of EVs to decide their impact on inclinations. Information has been gathered through the utilization of a self-consummation family unit review circulated over the urban areas of Dundee and Newcastle upon Tyne in the United Kingdom. Consequences of the examination show that receptive creativity and mentalities concerning the useful execution of EVs essentially influence inclinations for module cross breed electric vehicles (PHEVs) and battery electric vehicles (BEVs).

(Patt, 2019) On the off chance that nations are to satisfy their promises to the Paris Agreement, at that point EVs will in all likelihood need to diffuse quickly, commanding the market inside 20 years. The aftereffects of a randomized controlled overview that we regulated propose that entrance to private charging foundation may turn into a factor impacting individuals' readiness to buy EVs in the coming years, conceivably an important factor. Individuals who own their parking spot, and for whom private charging access is unproblematic, were twice as prone to demonstrate a high eagerness to buy an EV as the individuals who leave their vehicle in the city, and half almost certain than the individuals who leave their vehicle in a mutual part or carport. For those stopping in the city, proposing that chargers would be introduced for nothing out of pocket brought about these individuals being similarly likely as parking spot proprietors to show a high ability to buy an EV. For those individuals stopping in a mutual part or carport, this recommendation had a progressively moderate impact.

(Franke,2011) Scope of electric vehicles (EVs) has for some time been viewed as a significant

hindrance in acknowledgment of electric versatility. The idea was inspected of how range is experienced in an EV and whether factors from other adjustment settings, outstandingly stress, have logical force for between singular contrasts in what we term agreeable range.

Research Objectives:

The following objectives had been set by the researcher for the study:

- I. To determine awareness level of customers towards Electric Cars.
- II. To identify the reasons that contribute towards less sales of Electric Cars in India
- III. To understand the role of green marketing polices in consumer purchase decision
- IV. To determine the future demand for Electric Cars
- V. To know the relationship between various factors and Electric Car purchase intention.

RESEARCH METHODOLOGY

The following steps of Research Methodology was followed in the research:



DATA ANALYSIS

Analysis based on Objective 1: To determine the current awareness of customers towards Electric Cars.

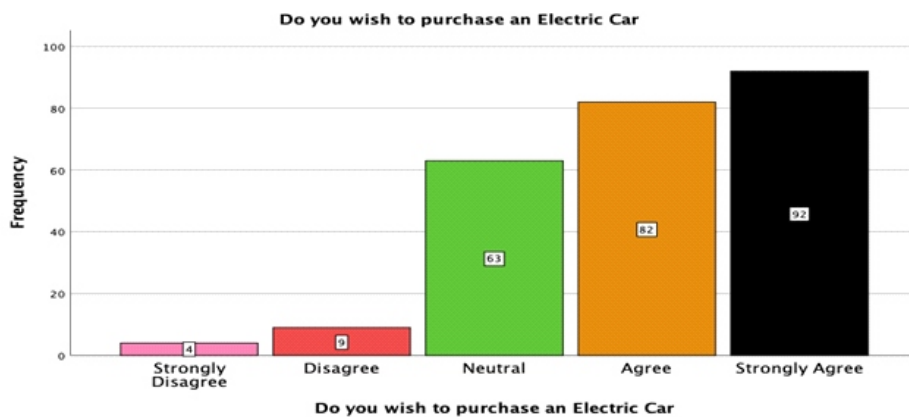
Parameters	Mean	Standard Deviation
Are you aware about the present charging facilities of your area	2.75	1.201
Are you aware about Government Rules regarding Electric cars	3.16	1.300
Do you feel maintenance cost of Electric Cars are higher	3.16	1.473
Do you feel Electric car have better Quality	2.99	1.156

Analysis based on Objective 2: To understand the reasons that leads towards less purchase of Electric Cars in India

Parameters	Mean	Standard Deviation
Are you aware about the present charging facilities of your area	2.75	1.201
Do you think the charging facility available is Convenient	2.05	.858
Do you think charging facility available is restricted to Major Cities	3.72	1.148
Do you feel Electric Cars are not suitable for long drive	3.76	.985
Do you feel that the Driving Technology involved is not effective	3.93	.990
Do you feel Electric Cars are priced higher than other cars	3.49	1.186

Analysis based on Objective 3: To understand the significance of green marketing in consumer buying behaviour

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
Do you consider eco-friendly features before making a purchase	250	1	5	3.11	1.294
Do you feel using Electric Cars would decrease pollution levels	250	1	5	3.54	1.057
Do you feel that Electric Cars would decrease the reliance on Fossil Fuels	250	1	5	3.26	1.244
Do Electric Cars ensure sustainability	250	1	5	3.41	1.275



Analysis based on Objective 5: To know the relationship between various factors and Electric Car purchase intention

Factor	R	R Square	Adjusted R Square	Standard Error of Estimate	R Square Change	F Change
Availability of Charging Facility	0.283	0.08	0.061	0.925	0.08	4.237
Government Schemes	0.431	0.186	0.176	0.867	0.186	18.731
Driving Related	0.406	0.165	0.154	0.878	0.165	16.156
Finance Factors	0.466	0.217	0.207	0.85	0.217	22.71
Green Marketing Strategies	0.27	0.073	0.058	0.927	0.073	4.816
Personal Opinion	0.272	0.074	0.059	0.926	0.074	4.88

The four components were included in the research to determine the objective of awareness among customers:

- It was found that the customers were not aware about the charging facility available in their locality.
- The respondents were somehow moderately aware about the Government Rules and incentives, but they feel that the maintenance charge associated with the Electric Cars would be higher, but it is not true. They also feel that Electric Cars don't have good quality.
- Overall it can be termed that the respondents are not aware about the functionality of electric cars.

The Mean and Standard Deviation analysis highlights the reason that lead to less purchase of electric cars in India.

The reasons are:

- Presence of Charging Facility
- Convenience of Charging Facility.
- Charging Facility confined to Metro Locations
- Not Suitable for long drives.
- The technology involved is not effective.

Electric Cars are highly priced.

The finding of the research shows that the consumer is becoming environment friendly and the regression analysis shows that green marketing strategies have the positive impact on the purchase decision of the customers. The large number of respondents tells that the electric cars would solve various pollution related problem and reduce the reliance on the fossil fuels.

The respondents were asked their intention to buy electric cars in coming future. The analysis regarding intention shows that around 50% Agreed or Strongly Agreed to purchase Electric Cars in near future. With this analysis it can be interpreted that the demand for the electric cars is supposed to increase in coming time.

The Regression Analysis was performed to understand the relationship between Dependent Variable i.e. Purchase intention and independent variable by finding the R square value

The Analysis of Regression was performed to understand the relationship between Dependent Variable i.e. Purchase intention and independent variable by finding the R square value it was found that the most important factors that influence the customer buying intentions. The highest value of R was obtained of financial factors and Government schemes hence it can be said that these two factors plays a significant role in developing purchase intentions.

FINDINGS OF THE RESEARCH

The main findings of the Research were as follows:

- It was found that the respondents want to purchase Electric Cars in future. Almost 50% of the respondents agreed to purchase E- Cars.
- It was found that the respondents desire to purchase E-Cars but are not aware about all the specifications and features of Electric Cars.
- It was also highlighted that green marketing strategies play a key role in purchase intention because the customers feel that it would ensure sustainability and decrease reliance on fossil fuels.
- It was also observed that finance factors like No Fuel Cost also promote buying intention among respondents.
- It was observed that around 70% of respondents feel that they would opt for Electric cars if there is swapping battery facility.

IMPLICATION

The research will help the organization that how the green marketing strategy enhances the customer perception and which in turn leads to conversion of prospects to customers. The research will help the organization to take the decisions which would help them to decide the factors which constitute towards customer satisfaction and retention of customers. It is very necessary to conduct the research on this subject because this issue is an emerging topic in today's market.

The journey towards transition is very long. These research findings will help the future researcher to conduct the research on the related subject in a large scale. It will help not only the organizations

dealing with Cars manufacturers but also the other Electric Vehicles manufactures. They will also help them to make the necessary strategic decisions related to product design, promotional strategies and distributional decisions.

LIMITATIONS OF THE STUDY

The following limitations had been identified while conducting the Research:

- 1) Area of the Research: The research was conducted to analyse the behaviour of the customers towards Electric Cars. The geographic area selected for the research was Delhi NCR which is the metropolitan city and hence the adoption and belief about Electric Cars are much favourable.
- 2) Sampling: The sampling size selected for the research was 250, hence, to analyse the behaviour of the entire population, the sample size was not large enough.
- 3) Limited factors: The scope of the research is limited to seven identified factors many other factors could have been considered to enhance the scope.
- 4) Time: As the time frame for the research was limited, it acted as the major limitation for the research. The research would have been conducted in much larger scale and with more efficiency, the researcher would have gone through many more review literature and the results could have been more precise. But the time acted as the constraint for the research

RECOMMENDATIONS FOR FUTURE RESEARCH

As there are few limitations of the research there are few unidentified gaps of the present research and hence the researcher has given following recommendations for the future study on the related topic.

- o The research was conducted for the limited sample size and the geographic area selected for data collection was confined to Delhi NCR and hence the same research can be conducted in a large geographic area with a large sample size. Tier 1 and Tier 2 cities can be chosen for the research.
- o The research is confined to study of few reasons that influence customer buying

decision and hence more factors can be identified and the influence must be measured to know the impact of those factors on purchase decision of the customers.

- o The main factor that influence customer purchase decision is the availability of charging facility and hence a comprehensive study can be conducted to analyse the charging ecosystem and future possibilities.
- o It is expected that the electric cars would capture the App based Cab service providers and hence the opinions about driving range can be conducted on Cab Drivers. Their opinions can be used to design the important features of the car.

CONCLUSION

At last it can be concluded that the customers wants to purchase Electric Car in future and hence the segment can expect enhancement of sale in the near future. The research also says that the customers of the present generation are keen about environment conservation and sustainability and hence they would switch towards Greener mode of the transport. The research has also raised the concern for the automobile companies about awareness of consumer about Electric Vehicles. The customers are not fully aware about the charging ecosystem and many common features of electric cars and hence before thinking of sales maximisation the organisation must focus on generating awareness about various features of Electric Cars. As the Government is taking necessary steps to ensure the smooth transition towards Electric Based Transportation System, the lucrative incentives provided by the Government is very useful, but the consumers are not informed about the same. There are customers who are aware about the schemes but their lack interest to explore or reminder about the same. The constant reminder about the benefits will act as the brainstorming and which will constantly lead to demand for Electric Cars in near future. The Green Marketing strategies are very useful to change the perception of the customers these environment conservation and sustainability reasons are playing the important role in the buying behaviour of the customers.

REFERENCES

- Balderjahn, I. (1988). Personality variables and environmental attitudes as predictors of ecologically responsible consumption patterns. *Journal of Business Research*, 17(1), 51-56.
- Barbarossa, C., Beckmann, S. C., De Pelsmacker, P., Moons, I., &Gwozdz, W. (2015). A self-identity based model of electric car adoption intention: A cross-cultural comparative study. *Journal of Environmental Psychology*, 42, 149-160.
- Blok, C. (2007). *Introduction to Energy Analysis*. Amsterdam, the Netherlands: Techne Press.
- Bockarjova, M. and Steg, L. (2014). Can Motivation Prediction Theory predict proenvironmentalbehavior? Explaining the adoption of electric vehicles in the Netherlands. *Global Environmental Change*, 28, 276 - 288.
- Bryman, A. 2011, *Business Research Methods*: Alan Bryman, Emma Bell, Oxford University Press, 2011. Print
- Bühler, F., Franke, T., Schleinitz, K., et al. (2013). Driving an EV with no opportunity to charge at home - is this acceptable?, in de Waard, D., Brookhuis, K., Wiczorek, R. et al. (Eds.) (2014): 'Proceedings of the Human Factors and Ergonomics Society Europe Chapter 2013 Annual Conference', 369-379.
- Bühler, F., Cocron, P., Neumann, I., Franke, T., &Krems, J. F. (2014). Is EV experience related to EV acceptance? Results from a German field study. *Transportation Research Part F: Traffic Psychology and Behaviour*, 25, 34-49.
- CAIT Climate Data Explorer. (2017). *Cait.wri.org*. Retrieved 15 March 2017, from <http://cait.wri.org/>
- CIREN, Portela et. Al, OSCP - AN OPEN PROTOCOL FOR SMART CHARGING OF ELECTRIC VEHICLES, http://cired.net/publications/cired2015/papers/CIREN2015_0106_final.pdf [Accessed 3 July 2017]
- Chen, C., Xu, S., Frey, S. (2016). Who wants solar water heaters and alternative fuel vehicles? Assessing social-psychological predictors of adoption intention and policy support in China. *Energy Research & Social Science*, 15, 1-11.
- Church, J. A., White, N.J. (2006). A 20th century acceleration in global sea level rise. *Geophysical Research Letters*, 33, L01602
- Dagsvik, J. K., Wennemo, T., Wetterwald, D. G., &Aaberge, R. (2002). Potential demand for alternative fuel vehicles. *Transportation Research Part B: Methodological*, 36(4), 361-384.
- Daziano, R. A., &Chiew, E. (2012). Electric vehicles rising from the dead: Data needs for forecasting consumer response toward sustainable energy sources in personal transportation. *Energy Policy*, 51, 876-894.
- Diamond, D. (2009). The impact of government incentives for hybrid-electric vehicles: Evidence from US states. *Energy Policy*, 37(3), 972-983.
- E c o f y s (2 0 1 6) . EindrapportToekomstverkenningelektrischvervoer. [online] Available at: <http://www.ecofys.com/files/files/ecofys-2016-eindrapport-toekomstverkenning-elektrisch-vervoer.pdf> [Accessed 13 Jul. 2017].
- Egbue, O., Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. *Energy Policy*, 48, 717-729.
- Elaad.nl. (2017). Veelgestelde vragen Smart Charging, Smart Charging 1 | ElaadNL. [online] Available at: <https://www.elaad.nl/innovatie/veelgestelde-vragen-smart-charging/> [Accessed 15 May 2017].

A Study on Environment Hazard Due to Covid 19 & Its Impact on Business

Prachi Jha*

Today we are in the middle of a crisis this whole human kind has never seen before; COVID-19. COVID-19 is an infectious disease caused by the most recently discovered corona virus; SARS CoV 2. The World Health Organization (WHO) declared the COVID-19 as a Pandemic on 11 March, 2020. Since then many actions has been taken by the governance in order to ensure the safety of the people of the country. The nation went to lockdown on 25th March, 2020, restricting the movements of the people as well as all the goods and services across cities. The government is sending advisory notice for the people to stay at home. As we can expect, the lockdown has severely impacted the economy of our country and also various sectors and industries of our country. According to the UN Department of Economic and Social Affairs, the GDP is expected at 1.2 percent for the current year which was expected at 6.6 percent in the month of January.

With strict restrictions imposed on the movements of goods, social-distancing getting prevalent across the lives of the people and the fear among the consumers regarding the availability of the essential and non-essential items; has hugely impacted on various sectors of the economy; especially the e-commerce sector. With people considering it safer to stay at home and preferring online mode of delivery of items and with more people shifting to online retail stores for the purchase of their essential items; operational activities coming to halt; it has become difficult for the e-commerce sector to be fully functional during this crisis.

The research was done to understand the impact of COVID-19 on the e-commerce industry with special emphasis to the change in consumer behaviour towards online shopping during pandemic. The research was exploratory in nature and the data was collected from both primary and secondary type. Questionnaire was developed in order to collect primary data and secondary data was collected from websites, newspaper and journals. It was found that many people are now considering online shopping as their main mode of shopping yet their exists many challenges for the e-commerce sector to ensure safe and hygienically delivered items to the consumers. The research can act as a medium to understand how the perception of a consumer can change during a crisis; what are its demand and what it expects from the e-commerce sector as a regular online shopper. The research deals with the factors that influence a consumer to adopt online shopping and also those factors that makes consumer choose retail shopping during pandemic.

Keywords: Consumer, E-commerce, COVID 19, Lockdown, Perceived risk, Perceived trust, Perceived benefits, Perceived Ease, Online Shopping, Adoption

INTRODUCTION

Today we are in the middle of a crisis this whole human kind has never seen before; COVID 19. COVID-19 is an infectious disease caused by the most recently discovered corona virus; SARS CoV 2. The World Health Organization declared the COVID-19 as a Pandemic on 11 March, 2020. Since then many actions has been taken by the governance in order to ensure the safety of the people of the country. The nation went to lockdown on 25th March, 2020, restricting the movements of the people as well as all the goods and services across cities. The government is sending advisory notice for the people to stay at home. As we can expect, the lockdown has

severely impacted the economy of our country and also various sectors and industries of our country. According to the UN Department of Economic and Social Affairs, the GDP is expected at 1.2 percent for the current year which was expected at 6.6 percent in the month of January.

With strict restrictions imposed on the movements of goods, social-distancing getting prevalent across the lives of the people and the fear among the consumers regarding the availability of the essential and non-essential items; has hugely impacted on various sectors of the economy; especially the e-commerce sector. With people considering it safer to stay at home and preferring online mode of delivery of items and with more people shifting to online retail stores for the purchase of their essential items; there has been a huge impact on the e-commerce industry amidst corona virus crisis.

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With over 560 million internet users, India is the second largest online market in the world, ranked only behind China. By 2021, there will be over 600 million internet users in India. The E-Commerce market size was expected to grow to US\$ 200 billion by 2026 from US\$ 38.5 billion as of 2017. But, post the outbreak, the recent trends suggest that the goal of US\$ 200 billion may reach sooner than originally predicted because of the paradigm shift in consumers opting for online deliveries over physical stores amidst fears of possible infection if they step out of their homes.

Hence, there has been a shift in the preference of majority of the consumers in their online product consumption. Also, halt in the supply chain movements across the countries especially from China where most of the product development takes place along with restrictions in the movement of goods and services across cities and states has put the e-commerce sector into tremendous pressure. Plus, this covid19 crisis holds a lot of challenges and opportunities in front of the e-commerce sector and it surely is testing our level of preparedness towards such times.

CONCEPTUAL FRAMEWORK

The E-commerce sector in our country is transforming the lives of people in different forms. Be it entertainment, grocery shopping, fashion & apparel, health and beauty, with just a click on the screens, we can have the item that we need within an hour or a day. E-commerce is playing a very vital role in our lives. But still, in our country, there is a section of our population who still likes to feel and touch the product before buying it; or likes to bargain with the vendor for extra discounts or gifts.

With the spread of this deadly corona virus; and with strict restrictions in the movement of people plus goods and services; it has forced many people to change the way they perceived online shopping and e-commerce sector. Social distancing and the risk of getting infected if stepped outside to purchase items has forced many people to consider online shopping and switch their mode of purchase of items to online groceries. While people are sitting at home and seeking for options of entertainment; there are many people who are opting and subscribing to many online subscriptions.

The purpose of this study is to analyze the impact of the COVID 19 on the e-commerce sector with special emphasis on the change in the perception of the consumers towards online shopping. The research will also try to find out the factors that favor the consumers to adopt online shopping and also the factors that makes them conscious of the adoption of the online shopping during pandemic.

Despite many lucrative offers and discounts offered by the e-commerce there is a segment of the population which still prefers retail shopping. The research will help the organizations to understand the consumer mindset; which would help them to properly strategize and market their brands according to the consumer needs.

The present study was confined to people who are currently at their home while strict lockdown restrictions have been enforced on them. A pandemic like never before has hit the world and it definitely would lead to a change in the way consumers consume products and their attitude and perception towards a lot many industries. One such industry is the E-commerce industry. While people are anxiously sitting at their homes; the convenience and relaxation e-commerce giants like Amazon, Grofers are providing them is at par from their expectations. E-commerce entertainment giants like Netflix, Prime, Hotstar are helping people get through their days in this lockdown period. The E-commerce industry would largely see a positive change towards the end of this pandemic; but there are some sectors like food & beverages sector which aren't able to get back on track even after promising the customers with safely delivered items at their doorstep. Hygiene issues and with increasing cases of number everyday; people are refraining themselves to only selected items; yet, a major portion of the people want to get their hands on regular items which are not considered to be essential by the law and orders. To attain the objective of this study, 150 respondents, were selected randomly, and were given a questionnaire to be filled, to understand their viewpoint, which helped us estimate and study the pattern and factors associated with change in their attitude towards the e-commerce sector and online shopping. This study will help the industry to improve its functioning during times of crisis and to understand in depth the attitude of a customer when such pandemic hits the economy.

RESEARCH METHODOLOGY

The research is conducted to study the impact of COVID 19 on the e-commerce industry with respect to change in the consumer behavior towards online shopping. During this crisis, as everybody is sitting at home and social-distancing becoming the new normal; there are people who are now considering switching to online mode of buying and ditching conventional method to ensure safety of them and their families.

After going through review literature, it was found that there is still a large segment of the population that still prefers traditional method of shopping because of the perceived benefits such as extra discounts, ease of getting item, availability of items, etc. There are different segments of the e-commerce which are performing differently across our country. The food and beverages segment, the entertainment segment of the e-commerce is quite popular and prevalent among the youth but is not that popular among the baby boomers. They still prefer to watch on the DTH services. The various factors that prevent the customer from adopting to online sector is lack of awareness, lack of education, lack of trust, less knowledge about the internet and various other factors.

But due to the outbreak of corona virus and restriction in the movement of people and goods and services; more and more people are drawn towards the e-commerce sector and more people are willing to adopt to online shopping during this corona crisis. This crisis has brought many challenges and opportunities for the e-commerce to serve to people and attract new customers. This study focuses on to find out the factors that influence a customer to switch to online shopping and factors which prevent them to shop online and describe various challenges and opportunities for the e-commerce sector.

The present research is exploratory in nature so as to explore the factors that influence and prevent the customers to shop online and explore the various opportunities and challenges that have come across the e-commerce sector.

To attain the objective of the research a quantitative technique in the form of questionnaire which is used to study the relationship between a dependent variable that is consumer behavior towards online shopping during pandemic and

independent variables such as perceived risk, perceived trust, perceived benefits, perceived ease, personal opinion. The research uses both Primary and Secondary mode of Data collection.

The questionnaire method was used to collect primary data and was designed with structured questions and was based on liker five pointscales. The response of the respondent will be analyzed using statistical tools like mean, frequency, standard deviation, correlation and factor analysis. The analysis was done using SPSS software.

Objectives-

- 1) To determine the consumer perception towards online shopping.
- 2) To understand the factors that contributes towards adoption of online shopping during COVID 19.
- 3) To understand the factors leading towards less adoption of online shopping during COVID 19.
- 4) To determine the impact of COVID 19 on the e-commerce industry.

Research Design

- Exploratory Research Design

The research design is exploratory in nature so as to understand the impact of the COVID 19 pandemic on the e-commerce industry with major emphasis on the change in the consumer behaviour towards online shopping and various factors that have hugely impacted the e-commerce sector amidst corona crisis and to study the challenges and opportunities for this sector during and after this crisis.

- Quantitative Research: Quantitative technique is used in this research to analyze the consumer behaviour towards the e-commerce industry during this pandemic. It involves gathering of Numerical data which can be used to derive the conclusion using various statistical tools.

Sampling

Probability Sampling was used for sample designing in which every respondent was selected by Simple Random Sampling method.

Sample Size- 200 Respondents

Sample Unit- Residential/Households

Sample Area- Delhi/NCR

Duration of The Study: 32 Days

Data Collection

Primary Data-

The questionnaire method of data collection was used in this project to collect the primary data which was largely focused to know the change in the consumer behaviour towards online shopping. The questionnaire framed for the study contained different types of questions to understand the consumer perception and attitude towards online shopping.

Secondary Data-

Secondary data includes information from websites, journals, newspapers and various other research papers and thesis related to this topic

Tools Used for Analysis of Data

As the research is quantitative in nature, SPSS was used to derive the results. Some tools used to analyze the data are:

- Bar Graphs.
- Frequency Distribution.
- Percentage Analysis.
- Regression Analysis
- Factor Analysis

FINDINGS

The research was conducted to understand the impact of COVID 19 pandemic on the e-commerce industry with factors influencing the change in the consumer behavior towards online shopping. There were four objectives which were set up by the researcher during the onset of the research.

Objective 1: To determine the consumer perception towards online shopping

The first objective set up by the researcher was to understand the perception of the customer regarding online shopping. The respondents have made various perceptions on online shopping pertaining to various needs during pandemic. Many questions were asked from the respondents. The results of descriptive statistics have shown that the respondents are inclined more towards online shopping during pandemic as compared to traditional method of shopping. But, there is a slight variation in the fact that people are

considering to shop from organized vendors when it comes to daily essential items such as milk, vegetables etc, because it takes a huge amount of time to get things delivered if they shop from online websites.

The main factor that influences the consumer to choose online shopping is to avoid crowded areas and items are delivered at the doorstep if they purchase items from online sites. Perceived benefits like better price, convenience, safely delivered items; discounts are some of the highly influencing factors for online shopping.

The results show that customers are concerned about the risk of getting the virus transmitted from the delivery agent and late delivery of items are preventing the people to shop from online.

But a larger proportion of the respondents approximately 45% switched to online shopping during corona virus crisis and the majority of them approximately 92% said they would continue to shop from online even after the outbreak ends.

Objective2: To understand the factors that contribute towards adoption of online shopping during COVID 19

The second objective set up was to understand the factors that contribute towards adoption of online shopping during COVID 19.

Factors such as

- Home delivery of items
- Safely delivered packages at doorstep
- Less hassle and conveniently delivered items
- Better prices
- Avoid crowded areas
- Convenience
- Ease of sitting at home and ordering things online

The above factors are preferred factors for the consumer to choose online shopping.

Objective 3: To understand the factors leading towards less adoption of online shopping during COVID 19

The third objective was set up to understand the factors leading towards less adoption of online shopping during COVID 19.

Factors such as

- Risk of getting infected from delivery agent
- Delay in delivery of items
- Unavailability of items
- Risk of online transaction frauds
- Not sure about the quality
- Post-purchase difficulties

These are the factors that prevent the consumers to adapt to online shopping and lead towards less adoption of online shopping during COVID 19.

Objective 4: To determine the impact of COVID 19 on the e-commerce industry.

- Most used online platform
 - OTT Services
- Least used online platform
 - Online Food Delivery Services
- Most flourishing segment of e-commerce
 - 1) Grocery Sector
 - 2) Online Subscriptions
 - 3) Health & Hygiene
- Most affected segment of e-commerce
 - 1) Electronics
 - 2) Home decor & furnishings
 - 3) Fashion & Apparel
- Overall decline in the expenditure of people who shop online since pandemic.
- Overall decrease in the frequency of online shopping. But, 20% rise in the number of people who shop once every 14 days.
- Challenges and threat for the e-commerce sector as local kirana stores are setting up online delivery system.

DISCUSSION & CONCLUSION

The findings of the study say that consumers are switching to online sector and would want to continue shopping from online sector even after the outbreak ends. The research says that the major driving force behind many people opting for online shopping is to avoid crowded areas and delivery of items at their doorstep. Hence, they find it convenient to shop online.

The findings also suggests that there are certain aspects such as risk of getting infected from the delivery staff and delivery time being very high in online shopping is preventing them from online shopping and they are preferring to shop daily essential items from their local kirana stores or organized vendors.

The adoption of online shopping depends on the benefits the consumer gets such as better prices than local vendors and is one major reason of switching to online shopping.

The research findings suggest that there is a segment of respondents who think there is risk of getting frauds in online transactions and they are not sure about the quality of the items delivered and aren't aware/ unsatisfied by the post-purchase steps in online shopping.

There has been a huge impact of COVID 19 on the e-commerce sector as people have stopped spending as much as they were doing previously per consumer but the good point is that more costumers have been added over a period of time. The frequency of the online shopping has also decreased for the regular consumers as they prefer to shop only monthly as compared to weekly before corona crisis.

The major segment to have benefitted the most from corona crisis is the grocery, food and beverages and the online subscription platforms. The most items purchased during corona crisis is grocery items followed by food and beverages and online subscriptions.

The research findings suggests that the most used platform during COVID 19 is Amazon Prime, Netflix and Hotstar followed by Amazon and Flipkart and the most affected sites are pizza hut and dominos followed by Zomato and Swiggy.

The most preferred online website to shop from is Amazon and its regular users who use Prime say that Amazon not being able to deliver the items in one day will not impact their future purchase decision from this website.

The research findings also suggests the regular online shoppers believe that companies should focus more on getting essential items delivered first to the ones who need it, but, there is also a segment of people who think that the companies

should start delivering non-essential items as well.

The research findings also suggest that the recent case of a delivery agent being positive for corona virus is highly preventing them from ordering food online from eateries like pizza hut and dominos and they prefer to prevent eating things from outside.

MANAGERIAL IMPLICATIONS

The findings of the present study provide valuable insights to academic researchers along with the organisations working on the e-commerce platform to understand the impact of COVID 19 on the e-commerce industry. Also, it helps to understand how the behaviour of the consumer changes with change in environment in our case COVID 19.

It helps the e-commerce organisations understand the factors that make consumers choose e-commerce during pandemic and what are the factors that make them avoid the e-commerce and go for a local kiranastore. It will help organisations work on their weak areas and strengthen their strong points.

REFERENCES

- Domenico Cucinotta, M. V. (2020, 03 19). NCBI. Retrieved 04 2020, 16, from www.ncbi.nlm.nih.gov: <https://pubmed.ncbi.nlm.nih.gov/32191675>
- India Business. (2020, 04 02). Retrieved from www.india.com: <https://www.india.com/business/indias>
- Kumar, V. (2020, 04 08). Indurty Wired. Retrieved 04 20, 2020, from industrywired.com: <https://industrywired.com/what-impact-covid-19-puts-on-indias-retail-and-e-commerce-sectors>
- Pandey, A. (2020, 04 14). The Hindu-Business Line. Retrieved 04 20, 2020, from thehindubusinessline.com: <https://www.thehindubusinessline.com/opinion/covid-19>
- Reddy, A. (2020, 04 14). The Hindu Business Line. Retrieved 04 2020, 16, from www.thehindubusinessline.com: <https://www.thehindubusinessline.com/opinion/covid-19-impact-consumers-move-more-towards-digital/>
- Shopify;Business Encyclopedia. (n.d.). Retrieved from www.shopify.com: <https://www.shopify.in/encyclopedia/what-is-ecommerce>
- Statistica . (2020). Retrieved from www.statista.com: <https://www.statista.com/topics/2157/internet-usage-in-india>
- World Health Organisation. (2020, 04 19). Retrieved from www.who.int: <https://www.who.int/>
- Kian Bakhtiari (2020,05 18). How Will The Pandemic Change Consumer Behavior. Retrieved from <https://www.forbes.com/sites/kianbakhtiari>

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