

SUSTAINABLE DEVELOPMENT AND THE WAY FORWARD: AN OVERVIEW OF INDIA

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ABSTRACT

Sustainable Development is the organizing principle for meeting human development goal, while simultaneously sustaining the ability of natural system to provide the natural system to provide the natural resources and ecosystem services based on which the economy and society depends. The sustainable development continues to be the key ideas around which environment and development are structured. But in the last few couple of years also witnessed development reversal and accelerated environmental degradation in particular places. Thus, this paper intends to study the impact of development on environment, and factor that impedes sustainability of development.

Keywords: Development, Environment, Degradation, Sustainability.

Introduction

Sustainable development is the organizing principle for meeting human development goals while simultaneously sustaining the ability of natural system to provide the natural resource and ecosystem service based upon which the economy and the society depends .The desired results is a state of society where living position and resources are used instantly to meet the human need without undermine the integrity and stability of natural system .Sustainable development can be defined as development that meets the needs of present generation without compromising the need and desire of future generation while the modern concept of Sustainable development is derived mostly from 1987 Brundtland Report. It is also rooted in earlier ideas about sustainable forest management twentieth century environmental concerns. As the concept develops, it has turned its emphasis more toward the economic development, social development, and environmental projection for future generation. It has been advised that the term Sustainability should be viewed as humanities target goal of human ecosystem equilibrium, therefore Sustainable development refers to holistic approach and temporal processes that lead us to end point of sustainability.

Modern economics are endeavoring to reconcile ambitious economic development and obligation of preserving natural resources and ecosystem. As the two are usually seen as conflicting nature. Instead of holding climatic changes commitments and other sustainable measures as a remedy to economic development, turning leverage for the market opportunities will do greater good. The economic development brought by such organized principles and practices in an economy is called as Managed Sustainable development. The concept of Sustainable development has been still a subject of criticism, for what is to sustained in Sustainable development. It has been argued that there is no such thing as a sustainable use of non-renewable resources, since any positive rate of exponential will finally lead to the exploitation of the earth's limited stock. This perspective renders the industrial revolution as a entire unsustainable. It has been argued that the sustainable has opportunistically been extended from conservation management to economic development, The Brundtland report promote nothing but a business as usual strategy for world development with an ambiguous and in substantial concept attached as a public relation slogan.

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The Sustainable development continues to be the key ideas around which environment and development are structured. In addition, sustainable development is now stated as a principle policy goal of many more institutions in development than at any previous time. But the last decade had also witnessed development reversal and accelerated environmental degradation in particular places.

Objectives

- To find the impact of development on environment.
- To find the challenges which impedes the sustainability of development.
- To suggest policy measures for Sustainable development.

Review of Literature

Archana k (2013), She in her study emphasis that the era of globalization has put huge burden on environment without deeming the future prospectus of the living beings although industrialization plays a vital role in the economic development of a nation, but all activities of industrialization invariably produce discharge, wastes and residual materials that are capable of polluting the entire ecosystem. The increasing population and urge for the higher economic growth demands more resources and put pressure on environment and not many industries have arrived at sustainable measure. The globalization has lead to the integration of countries in the rest of the world which later realize the concept of sustainable development. The WTO which is considered as a open institution of trade also aims to protect the environment. The Rio declaration also insight on the issue of sustainable development and brought together some concepts like polluters pay principle inter-generational equality etc. to preserve environment.

Getha and Yoi (2017), in their paper, The nexus between technology innovation and CO² emission in Malaysia: Evidence from Granger causality test emphasizes mainly to examine the casual relationship between technology innovation and CO² emission with economic growth, electricity consumption and energy prices in Malaysia. The data over period of 1971 to 2013 is analyzed by employing VECM and TYDL granger constantly tests. The results indicate that the technology innovation is negatively related to CO²emission in short run while no long run relationship found. The VECM granger constantly test show that technology innovation granger cause CO² emission in short run, Meanwhile there is no casual effect found in long run from TYDL granger causality. Therefore, policy makers should promote the innovation research without any postponement for the sake of economic development and environment sustainability.

Sen P in his paper, Unilateral emission cuts and carbon leakages in a dynamic north south trade model setup a model with capital accumulation arising from agents smoothing consumption and comparative advantage determining trade and emissions. He analyzed the reactions of the market economy to a unilateral reduction in carbon emissions. The analysis in the literature concentrated mainly on carbon leakage – a movement along a given supply curve for fossils fuels. The problem is shift down of supply curve leading to the possibility of emergence of the green paradox. Fossils fuels produces have an incentives to reduce the prices as long as it is above the marginal cost and to bring the forward time profile of extraction, This would benefit those countries which do not have binding emission (e.g. India and China).Trade would take some of this dirty production back to the now clean economics to be consumed there .Therefore it is imperative that developing countries with substantial industrial base be brought within the ambit of climatic changes agreements with strict bindings constraints.

Pradhan p et al. In their paper, a systematic study of sustainable development goals (SDG) interaction found that sustainable development goals (SDG) have set the 2030 agenda to transform out world by tackling different challenges human kind is facing to ensure well being, economic prosperity and environmental protection. In contract to the traditional development agendas focusing on the restricted set of dimensions, the (SDG) provide a comprehensive and multidimensional sight on the development. Therefore, interaction among the SDG's may cause diverging results. To analyze the SDG's interaction, they systemize the identification of synergies and tradeoff using official SDG'S data for 227 countries. A significant positive correlation between a pair of SDG'S indications was classified as synergy while a significant negative correlation was classified as trade-off. They rank the synergies and trade-off between SDG'S pair on global country scale in order to identify the most frequent SDG'S interaction. For a given SDG'S, positive correlation between indicators pairs were found to outweigh the negative one in most countries.

Valentine's S in his paper, Sustainable development, Renewable resources and Technological progress, found that conflicts between optimality and Sustainability are typical in the literature on

sustainable development. He in his study used capital resource model of optimal growth, Pezzey and Withagen (1998) have recently proved that if natural resources are exhaustible the time of consumption is single peaked declining from some point in time ahead. This paper extends the mode to encompass technical progress, resource Replenishity and population growth. The main result in that, for any constant return to scale technology, optimal path can be sustainable merely if the social discount rate does not exceed the sum of rate of resources regeneration and augmentation net of population growth. Capital depreciation is natural with respect to this necessary condition for sustainability. The development of resource serving technology is vital for sustaining consumption per capital in long run.

Major Findings

So far the impact of development on environment is concerned; it is of large scale and it effects the different sectors of the ecosystem and environment.

In this paper we emphasizes on the some specific problems created through different anthropogenic activities on environment:

- Ground water receded.
- Frequent floods.
- Abrupt weather cycles.
- Crop pattern changes.
- Submerging of coastal areas.
- Threats to flora and fauna.
- Soil erosion.
- Melting of glaciers.
- Increasing global warming.

Life in this world is diverse and unique but what we live and breathe on the same world together, our collective action therefore impact our shared environment which has shown to contribute towards negative outcome, such as frequent climatic changes patterns and lower quality of environmental health. This in turn has related Socio-economic cost on human society. According to UKAID survey in 2017, India has lost an average of USD 170 billion annually over the period of last decade due to weather and environmental related causes.

In large parts of country, due to drastic environmental shifts the variability in rainfall in certain regions of India has contributed to more and drought-prone conditions. At present approximately one-third of the county is either drought prone or under desert areas. This has increased the vulnerability of communities dependent on agriculture and demands on the local water resources leading to resource mismanagement and geological distress. Subsequently water is contaminated from over exploitation and the situation is compound when the communication lack necessary knowledge, infrastructure and service to maintain environmental health standards related to water safety planning.

UNICEF is a key technical partner to the government of India on water and sanitation programming and is dedicated to supporting the nation's progress towards sustainable development goals. 6-Universal access to safety managed water and sanitation by 2030. It is working with everyone form of the government to local communities to roll out initiatives and frame works that would tackle various challenges in the spectrum of the stress on our water sources.

The impact on the environment due to different economic activities in Rajasthan is a beautiful example; the state of Rajasthan makes a classic case on the socio-cultural and environmental implication of sourcing drinking water in a semi-arid and water scare region. As state population is highly dependent on ground water for the agricultural and for the drinking requirements in large parts due to absence of perennial rivers, inadequate surface resources and due to arid climatic conditions. In additional, traditional sources such as step wells were closed for stopping the spread of guineas worms and thereby limiting access of water. In remote areas this translated to digging through ground for ground water sources for creating numerous tube wells and hand pumps especially in the most remote areas of state.

Thus over-exploitation of ground water which has increased due to recent climatic changes, along with recurrent droughts have contributed to the leaching of rocks with fluoride compounds, thereby releasing the volatile elements into the water resources, making it unfit for drinking purpose. Thus with

the passage of time, it posed a dual challenge for the management of water resources: That is maintaining availability and quality of water resources. As in December 2019, a total of 7752 fluoride affected habitations across the country, out of which 3748 (50%) are from Rajasthan.

Drinking water with fluoride level above WHO optimum level of 1.5ppm for prolonged period can lead to fluorosis, especially in children, Dental, skeletal non-skeletal fluorosis each with rising severity in succession are irreversible diseases that severely affect joint movements cause incredible pain and often leads to afflicted living in vegetative state. Achieving SDG6 targets would require addressing environmental health falls out such as this to be prioritized by government and solved urgently. Despite different mitigation initiatives with huge financial implications peoples in affected areas are still at risk, because the efforts were usually limited to defluoridation of water without any consideration for related aspects, on the contrary mitigation approaches need to start with better understanding of health impact of excessive fluoride intake.

Global warming with increasing anthropogenic greenhouse gases (GHG) emission (400ppm from 280ppm CO₂ emission of pre industrial era) has been changing the climate, eroding the ecosystem productivity and polluting water, thus affecting the livelihood of people. The anthropogenic activities such as burning of fossil fuels, power generation, agriculture, industrialization, polluting water bodies and urban activities are responsible for GHG foot print of 73% consist of CO₂. GHG footprints need to be balanced with sequestration of carbon to sustain ecosystem. Forest is the major carbon sinks about (45%) that aid in mitigating global warming.

The land under cover (LULC) dynamics leading to deforestation and land degradation is the prime driver of global warming due to loss of carbon sequestration potential as well as emissions. For instance, the Western Ghats are one among 36 global biodiversity hotspot and forests in the region sequestering atmospheric carbon, which aid in moderating the global climate.

The land use (LU) dynamics was assessed using temporal remote census data of land sat 8 operational land manage (OLI-30m resolution) 2018 data integrated with field estimations and decade land use (1985,1995 2005-100m resolution) available from international geosphere – bio sphere programme (IGBP). The collateral data include the vegetation maps developed by the French institute of Pondicherry, topographic maps (the survey of India) and virtual earth data (Google of India) and virtual earth data (Google earth, Bhuvan). The carbon sequestration potential of forest ecosystem was assessed on :

- Published literature based on the standard biomass experiment and
- Field based measurement collected across the forests of Western Ghats of Karnataka using transect based Quadrat sampling technique.

The spatiotemporal LU analyses, the loss of forest cover due to anthropogenic activities. The region had 16.21% evergreen forests cover in 1985 which is reduced to 11.3% in 2018. It has 17.92%, 37.53% and 4.8% under plantation agriculture, mining and built up respectively. The increase in monoculture plantations such as acacia, eucalyptus, leek and rubber development projects and agriculture expansion are the major drivers of LU changes.

The region has lost 12% of interior (contiguous) forest cover during 1985 to 2018 with an increase of non forest cover 11%. The interior forest cover (25% in 2018) are confined to major protected areas, edge forest are becoming more prominent due to sustained anthropogenic pressure. Goa has experienced loss of large tracts of interior forest cover due to the indiscriminate mining activities. The projected LU of 2031 highlights likely loss of evergreen forest with increase in agriculture cover (39%) and built up area 5%. The large scale changes of agriculture and built up cover are noticed in the eastern Kerala, Tamilnadu and Maharashtra states of WG. The evergreen forests cover will only be 10% of the WG by 2031, which would threaten the sustenance of water food security and livelihoods of people in the peninsular India.

Carbon footprint is contributed by emissions from the energy sector (68%) agriculture (19.6%) industrial process (6%) LU change (3.8%) and forestry (1.9%) in India with CO₂ emissions of about 3.1 MGG (2017) and the per capita emission of CO₂ is 2.56 metric tonnes. The carbon emission 2.56 from the major metropolitan cities of India is about 1.3MGG contributed by major cities such as Delhi (38633.20Gg) Greater Mumbai (22783.8Gg) Chennai (22090.55Gg) Bangalore (1976.6Gg) Kolkata (14812.1Gg) Hyderabad (13734.59Gg) and Ahmadabad (6580.4Gg) from energy, transportation, industrial sector, agriculture, livestock management and waste sector per year.

Carbons Emissions across State of Western Ghats

State/UT	Emission (Gg) per year			Total (Gg)	Carbon storage in WG (Gg)per year
	CH4 (CO2 equivalent)	CO(CO2) equivalent	CO2		
Goa	233	337	3881	4451	872
Gujarat	15546	14498	79138	69182	1947
Karnataka	15662	15239	54337	85237	10401
Kerala	3167	6108	26047	35321	7617
Maharashtra	23129	26497	105260	154886	11020
Tamil Nadu	15761	19190	71107	106058	5375
Dadra & Nagar Haveli	46	63	1458	1567	601
Total (Gg)				496703	37833

The other main affect of anthropogenic activities is problem of electronic waste. Although electronic industry is the world’s largest and fastest growing manufacturing industries has provided some leverage to the socio- economic and technological growth of the developing society of India. However consequence of its consumer oriented growth combined with rapid product obsolescence and technical advances are a new environmental challenge-growing menace of “Electronic waste or e-waste” ,that consists of obsolete electronic devices. Solid waste management which is already a critical task in India is becoming more complicated by the invasion of e-waste, particularly computer waste .The surge in the information technology during the few decades have drastically muted Indians especially urban living style. But its mismanagement has lead to new problems of contamination and pollution. For instance, personal computer (Pc) contain many components which are highlytoxic, such as chlorinated and brominated substances, toxic gases, toxic metals, biologically active materials, acids plastics and plastic additives posing environmental and health challenges.

According to the survey conducted by the Global e-waste monitor 2017 published by the United Nation University estimated that India generates about 20 lakh tonnes of e -waste annually, nearly 82% of which is personal devices. Another study identified that computer equipment account for almost 70% of e-waste followed by telecommunication equipment like phones (12%) electronic equipments 8% and medical equipments 7% and remaining from household sectors

S.No.	Material	Weight %	Recycling %	Location
1	Lead	6.2988	5	Acidic battery CRT
2	Cadmium	0.0094	0	Battery, CRT,housing
3	Chromium	0.0063	0	Decorative hardness, corrosion proctive agents
4	Plastic	22.99	20	Computer moulding, cabling
5	Mercury	0.0022	0	Battery, switches, housing

Source: <https://www.ncbi.nlm.nih.gov/>

Above elements lead to many defects in human beings like:

- Kidney failure, central and peripheral nerve systems damage to the reproductive system.
- Long term cumulative poison, Bone disease.
- Chronic damage to brain, liver damage, damage to central and peripheral nervous as well as foetus
- DNA damage, Lung cancer.
- Generates dioxin and furans

In general the electronic goods are classified under the three major categories:

- White hoods :Household appliances
- Brown goods; TVs, cam coders Cameras
- Grey goods : computers, printer, Fax machines, scanner etc.

Waste from the white and brown goods is less toxic as compared to grey goods. The table above enumerated that the effects of grey goods on health.

Policy Measures for Sustainable Development

Policy Measures

The Prime Minister of India at the United Nations General Assembly has aptly remarked that if you look at it from the historic and per capita emissions perspective India's Contribution to Global warming is very low. However, India is one of the leading nations when it comes to taking steps to address this issue. On the other hand, we are working towards achieving the target of 450 Giga watts of renewable energy and on the other hand we have also taken the initiatives to create the International Solar alliance. As one of the effects of global warming is the increasing number and severity of natural disasters, at the same time they are appearing in new areas and in new forms. In view of this India has initiated the formation of Coalition for Disaster Resilient Infrastructure (CDRI). This coalition will help build infrastructure which can withstand natural disaster.

The Government of India is emphasizing on creating sustainable infrastructure, system and processes, but needs more policy directions and measures ahead. As an enabling environment would need to be created through conducive policy support and refocus leveraging technology for mission implementation, robust and real time, data-driven monitoring by third party verification capacity building and private sector participating action to sustain the outcomes achieved and the momentum generated.

To mitigate the problem of global warming and its numerous effects, the Government of India should switch from traditional and conventional sources of energy to renewable source of energy. No doubt, India has been working in this direction and reduces emissions intensity of GDP by 21% and is on track to achieve the goal of 35% emissions reduction as promised in Paris. India has achieved 83 Giga watts of renewable energy far behind 175 Giga watts of renewable energy under Paris agreement, which subsequently increased the target to 450 Giga watts at the recent UN climate action summit. There should be more progress on solar, biomass, and wind energy. Levying of carbon tax on coal production led from Bharat 4 to Bharat 6 for vehicle emissions norms.

LED bulbs to be used in homes of all rural and poor households, 360 million LED bulbs already fitted. Replacement of conventional street lights by LED lights, there should be strong push for the use of e-vehicles by introducing multiple policy intervention and incentives. The government of India has already provided 80 million LPG gas connections by replacing conventional firewood cooking stores. But it is pertinent to mention that the cooking action plan and adaptation plan should work to achieve set targets. The creation of carbon sinks through increasing green cover should be the top priority of the government. It is important that government at all levels work together with local leaders and representatives who rise to become the champions of the cause so that resources can be synergized to gain the maximum output. The other states of India should learn from Maharashtra that how it is investing in women leadership for sustainable development in water stressed areas. For instances, women-led water, Sanitation, Hygiene And Resilient Practices or W-SHARP was implemented in 2018 to test the effectiveness of risk informed planning driven by local contexts and communities such as those of Maharashtra wards especially during lean periods, March to June when water availability is all time low. W-SHARP targets women's and vulnerable families participation as a core aspect of project.

The Government of India should take lessons from the past into the present and implement a comprehensive multispectral approach to take the problem of environmental deterioration. To protect the environment, identification and promotion of reuse of water and recharging of aquifers and sources for creating a balance between discharge and recharge of water are needed. It also helps in maintaining the quality of water in the source. The recent Jal Shakti Abhiyaan is a great initiative by the government which has shown good intent by converging all the line departments on common platforms of the integrated approach to water management.

The Government should emphasize the role of Community Radio station in disaster management and climate change communication. Community radio stations specialize in providing local information to the local people. Therefore, it can play a vital role in mitigation of disaster risk particularly in pre-disaster preparedness and mitigation through awareness to the different community groups. There is a need to develop a vibrant community radio stations movement through participation involvement and ownership of local community for greater information dissemination and further empowerment of people.

At present 276 functional community radio stations are operating in India and there is a need of more such radio stations for dissemination of information to the entire people in the event of any natural calamities.

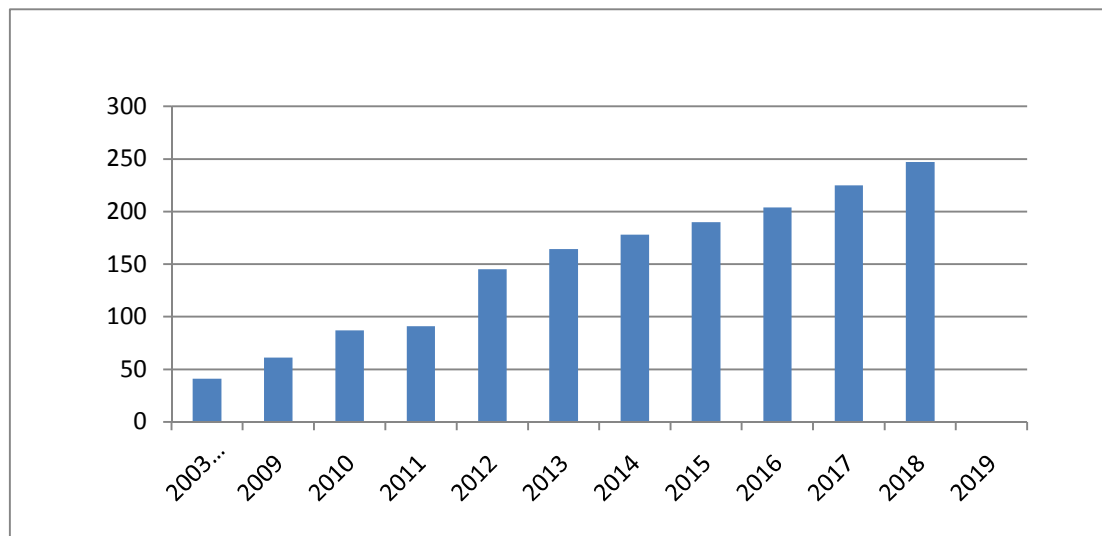


Figure 1: Operational community radio stations (year wise)

For sustainable living, mitigation of carbon foot print, management of electronic waste, maintain the fine balance between development and environment management of plastic waste and sustainability of agriculture is the need of hour. Carbon sequestration should be done on large scale to mitigate the carbon footprints. For instance, ecological fragile Western Ghats has been playing the pivotal role of mitigating carbon footprints with the potential to sequester carbon emission of all Southern India cities and 1.6% of all total CO₂ emissions from India.

So far the management of electronic waste is considered, it should be contained by minimizing its generation. The product designers must ensure the longitivity of the products through their reuse, repair and upgradability features. Stress should be laid on use of less toxic, easily recoverable and recyclable materials which can be refurbished, disassembled and remanufactured. Recycling and reuse of materials are the next options to reduce generations of e-waste. Recovery of metals, plastic glass and other material reduces the magnitude of e-waste. The policy makers need to address all related issues ranging from production and trade to find disposal including technology transfers for the recycling of electronic waste. The government of India has amended the e-waste management rule 2016 by E-WASTE (management) amendment rule 2018 under which e-waste targets have been revised.

Climate has already significant effect on productivity and quality of life. A balance has to be struck between Industrial progress and environmental degradation caused primarily by industrial production. Development and environmental protection can dealt with proper planning and management. The gap between thermal power and solar has been narrowing and gap should be further wiped out.

For the management of plastic, the old plastic should be melt to repurpose it into useful new items thereby reducing the plastic in the oceans and the landfills. Initiatives should be taken to use plastic waste out of landfills in building roads. Plastic road is a circular product based on recycled plastics. It has significantly smaller carbon footprints than traditional road construction material used because of its longer life span and reduced transportation of material involved. Unmanaged plastic waste negatively impacts the natural environment.

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