Triple Bottom Line-The Modern Approach to Sustainable Development

Dr. Chandra Sekhar Dash
Associate Professor
Department of Commerce
Aryabhatta College, University of Delhi
Corresponding Author's Email id: *csdashh@gmail.com*

Abstract

Nations grow through a process of development that harnesses the socio-economic resources of country through a sequence of discoveries & innovations, tested and trialled into usable goods and services, produced by means an industry and business, satisfying the needs of the society at large, through the vehicle of entrepreneurship. Originally measured in GDP or GNP, the index of national growth was factored to HDI (Human Development Index) to ensure that the wellbeing of the society is not subdued by extreme human greed for profit. Now, it's time, the GDP needs to be factored with environmental or ecological wellbeing to ensure that the ecology or environment are not degraded that would annihilate the whole planetary system on whose existence, the existence of the whole human society thrives. Realisation that the global economy is exhausting the world's natural resources and generating waste streams at an unprecedented scale. calls for the redesign of commercial activity that would stop the annihilating process, instilling equity & justice, and protecting environmental quality of present and future generations. These three aspects form the basis the triple bottom line concept of sustainability. Sustainability in business is not about altruism and doing what is right for its own sake but, businesses with successful strategies that are profitable as well, because they integrate considerable amount of green and clean design and resource. Sustainability innovation is about defining economic development as the creation of private and social wealth to ultimately eliminate harmful impacts on ecological systems, human health,

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and communities. A review of research in this field is found to be rich with corporate reporting and relates to mostly CSR. The socio-economic equality, social justice and environmental safety, as a major part of sustainability are rarely studied. Hence, in this paper an attempt is made to delve deep into the field by adopting a methodology that covers, firstly, the analysis of existing knowledge as available from secondary sources such as journals and periodicals, books published/unpublished, UN and World Bank reports, TEDx Talks, epoch-making discoveries and innovations and secondly by Participant observation and case study. The finding of the study indicated that poverty, lack of social equity and justice are as much a cause of degradation of environmental safety with growth of industrialisation. It also cited the case of the initiatives taken by a young scientist in the dept. of botany, university of Delhi, which perfectly matches or a model of the concept of triple bottom line.

***Keywords**: - poverty, equity, sustainable development, triple bottom line*

INTRODUCTION

The world today is facing a great challenge from environment, such as depletion of Ozone layer and emission of greenhouse gasses that causes climate change; air, water and land pollution, caused by emission of CO2, particulate matters, solid and chemical waste due to growing industrialisation, unsustainable ways of production and consumption. Add to this, the burning of coal, oil and fossil fuel; running of transportation vehicles, desertification, deforestation and landslides caused by our unwarranted use of land; cutting of woods for fuel, furniture's and luxurious living. Our society is also infested with many other societal challenges, including rising income inequality and other forms of social injustice.

All these problems are due to the fact that either our business has failed to make their solutions a priority or did not make any prediction about the future state of affairs that would take place after 100 or thousand years ahead. As Albert Einstein said, "We can solve the worlds problem by using the same kind of thinking we used when we created them", but the laps will take too long to reconcile and the status of things will not remain the same, as it was when we started. Yet, it is not too late to correct the harm.

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Nations grow through a process of development that harnesses the socio-economic resources of country through a sequence of discoveries & innovations, tested and trialled into usable goods and services, produced by means an industry and business, satisfying the needs of the society at large, through the vehicle of entrepreneurship. Originally measured in GDP or GNP, the index of national growth was factored to HDI (Human Development Index) to ensure that the wellbeing of the society is not subdued by extreme human greed for profit. Now, it's time, the GDP needs to be factored with environmental or ecological wellbeing to ensure that the ecology or environment are not degraded that would annihilate the whole planetary system on whose existence, the existence of the whole human society thrives.

Realisation that the global economy is exhausting the world's natural resources and generating waste streams at an unprecedented scale, calls for the redesign of commercial activity that would stop the annihilating process and restructure a new economic model and implement business practices that would preserve the world's natural resources for today's communities and the economic, environmental, and social health and vitality of future generations. Sustainability in business is not about altruism and doing what is right for its own sake but, businesses with successful strategies that are profitable as well, because they integrate considerable amount of green and clean design and resource conservation throughout product life cycles and supply chains in ways that make economic sense. Sustainability innovation is about defining economic development as the creation of private and social wealth to ultimately eliminate harmful impacts on ecological systems, human health, and communities.

REVIEW OF LITERATURE

The first work on entrepreneurship and innovation probably comes from Anne Gerlach, in 1997, presented a systematic approach to sustainable entrepreneurship [i]. In 2000, Walden Paddlers, a market leader in popularly priced recreational kayaks, partners to produce light, strong, inexpensive kayaks with superior performance characteristics made from 100-percent-recycled plastic, the only such kayaks on the market [ii]. J. Kikul et.al. in 2018, examined the practice of identifying, starting, and growing successful mission-driven for-profit and non-profit ventures, that is, organizations that strived to advance social change through innovative solutions [iii]. N Goyal

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et al., in conceptualized entrepreneurship using a six-stream variant of the multiple streams framework (MSF)—which addresses key limitations—to examine entrepreneurial activities in the case of the *Jyoti gram Yojana*, a widely recognized policy innovation for managing the energy–water nexus in Gujarat, India [iv] .

METHODOLOGY

Research Design

The research design will be **Explorative and Descriptive.**

Source of data

The sources of data will basically be secondary in nature, collected from the existing knowledge available in book, journals and periodicals, available manuscripts published or unpublished, reports and resolutions of UN conferences, World Bank, UNEP & UNDP, TEDx Talks, TV programmes on sustainability, epoch-making discoveries and innovations that are undergoing in the world at the moment.

Sampling Techniques

Since the research is not of primary nature, sampling is irrelevant, yet the methodology covers, along with, the analysis of existing knowledge as available from secondary sources such as journals and periodicals, books published/unpublished, UN and World Bank reports, TEDx Talks, epoch-making discoveries and innovations and secondly takes into consideration some form of Participant observation and case study and interview.

THEORETICAL FRAMEWORK

Sustainability defined: A bird's eye view of the Semantics & Complexity of sustainability

General Definition: As a model of economic development, Sustainability can be defined as "meeting the needs of the present without compromising the ability of future generations to meet their needs". According to this view, natural resources are part of "global commons" and are considered as the property of the whole humanity irrespective of nationality and generations. No nation has an exclusive right to exploit or utilise it for its own nation or own generation. The upcoming future generations are the owners of this property in the same way as we are today. Hence, the present generation does not have an exclusive right to exhaust the whole of earth's resources for it own benefit and comfort.

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Sustainability Defined by Engineers: -A sustainable product or process is one that constraints resource consumption and waste generation to an acceptable level, making a positive contribution to the satisfaction of human needs, and provides enduring economic value to the business enterprise [v].

Sustainability Defined by Educators: "Resource utilization should not deplete existing capital, that is, resources should not be used at a rate faster than the rate of replenishment, and waste generation should not exceed the carrying capacity of the surrounding ecosystem". [vii] A scientific, consensus-based articulation arrived by "The Natural Step", an educational foundation with global reach based in Stockholm, Sweden, says that "for sustainability to be achieved by society and for humans to prosper *and* coexist compatibly with natural systems, natural and man-made materials would not be extracted, distributed, and built up in the world at a rate exceeding the capacity of nature to absorb and regenerate those materials; habitat and ecological systems would be preserved; and actions that create poverty by undermining people's capacity to meet fundamental human needs (for subsistence, protection, identity, or freedom) would not be pursued. According to this philosophy, the concept of sustainability is composed of three pillars: economic, environmental, and social—also known, informally, as profits, planet, and people. [vii]

Sustainability Defined in Business Operations: "Sustainability perspective may seem extreme in calling for waste-free businesses in which the non-product outputs become inputs for other products or services. [viii] But sustainability's zero-waste goal offers a critical, underlying insight: health, environmental, and community social issues offer opportunities for businesses.

SUSTAINABILITY INNOVATION

The approach to **Sustainability Innovation** extends the premises of entrepreneurial innovation, a long-standing driver of social and economic change, to consider natural system viability and community health [ix]. Drawing on systems thinking, ecological and environmental health sciences, and the equitable availability of clean commerce, economic development opportunities, sustainability innovation offers a fast-growing market space within which entrepreneurial leaders are offering solutions and paths forward to address some of society's most critical challenges.

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It is important to **recognize Sustainability Innovation** as a cross-disciplinary approach [x]. Sustainability in business is about designing strategies for value creation through innovation using an interdisciplinary lens. Specialization and grounding in established disciplines provide requisite know-how, but sustainability innovation requires the ability to bridge disciplines and to rise above the narrow bounds and myopia of specialized training in conventional economic models to envision new possibilities. Sustainability innovation occurs when entrepreneurs and ventures stretch toward a better future to offer distinctly new products, technologies, and ways of conducting business. The empirical evidence suggests that while entrepreneurs who succeed typically bring their uniquely specialized know-how to the table, they also have a system view that welcomes and mixes diverse perspectives to create change.

Business has travelled a long distance from the adversarial pollution control days of the 1970s in the United States, when systemic ecological problems were first acknowledged. Companies were asked to bear the costs of environmental degradation yet often lacked the ability or know-how to realize any rewards for those investments. Decades ago, the goals were narrow: compliance and cost avoidance. Today the intersecting environmental, health, and social challenges are understood as more complex. Community prosperity requires a far broader view of economic development. It requires a sustainability mind-set. While the challenges are undeniably serious, as our examples will show, the entrepreneurial mind sees wide open opportunities.

A growing number of companies now recognize that improving performance and innovation across the full sustainability agenda—financial, ecological, environmental, and social health and prosperity—can grow revenues, improve profitability, and enhance their brands. Sustainability strategies and innovations also position businesses favourably in markets, as their slower-learning competitors fail to develop internal and supply-chain competencies to compete.

We have under gone a train of successive innovations through which we have created new needs, new desires and a whole lot of products and services that has dramatically changed our way of living, our life style, our behaviour. Over a period of three decade, we have come across five successive waves of innovations. In

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1780's innovation in the field of iron, water power, mechanisation, textile and commerce, in 1840's, steam power, rail road, steel and cotton, in 19thcentury, electricity, chemical, internal combustion machines, in 1950's, petrochemical, electronics, aviation and space, 1990's, digital network, biotechnology, soft ware & information technology and now it is time for sustainability, radical resource productivity, systems design, biomimicry, green chemistry, Industrial ecology, renewable energy, green nano technology[xi]. See below **figure 1.**

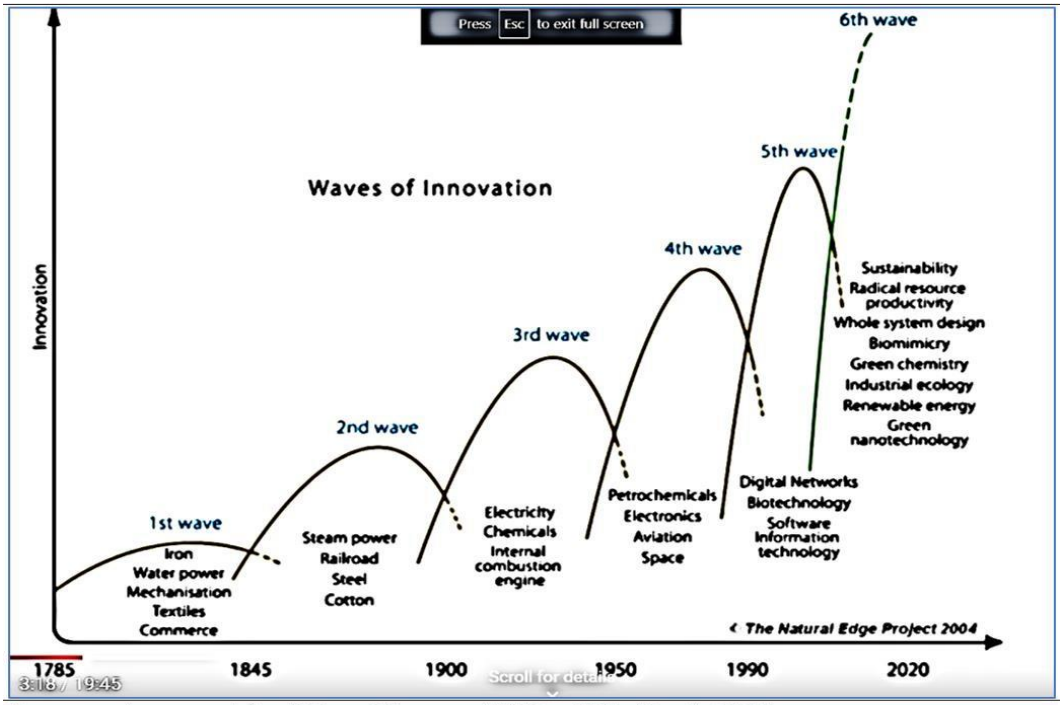
Proactive Approach

Sustainability focuses on meeting the needs of the present without compromising the ability of future generations to meet their needs. The concept of sustainability is composed of three pillars: economic, environmental, and social—also known informally as profits, planet, and people. [xii]

Different meanings given to sustainability. "Resource utilization should not deplete existing capital, that is, resources should not be used at a rate faster than the rate of replenishment, and waste generation should not exceed the carrying capacity of the surrounding ecosystem." [xiii]

Reactive approach

"The search for sustainability can lead to innovation that yields cost savings, new designs, and competitive advantage.



Source – Are we wining? Peter Newman/ TEDx Talks/Perth-2015

Figure 1: Innovations & waves of industrial revolution

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Like the quality gurus who called for zero defects, the early adopters of the sustainability perspective may seem extreme in calling for waste-free businesses in which the non-product outputs become inputs for other products or services. But sustainability's zero-waste goal offers a critical, underlying insight: health, environmental, and community social issues offer opportunities for businesses.' [xiv]

As environmental and social problems increase, with the extent and severity of air, water, and soil contamination and pollution, the concerns for natural resource consumption and food production, drinking water availability, and public health are likely to drive new approaches to pollution prevention and new regulations encompassing previously unregulated activities. As concerns increase, so will the market power of sustainable business. The opportunities are there for the entrepreneurially minded to find solutions through their innovations in containing the challenges sustainability offers. [xv]

THE TRIPLE BOTTOM LINE

The triple bottom line [xvi] considers the different types of impact which can be produced, to varying extents, by business enterprises. They are:

- economic or financial impact
- environmental impact
- social impact.

The three dimensions identify the diverse but highly interconnected components of sustainability. Businesses are challenged to produce all three types of value if they want to be sustainable economically, environmentally and socially. For example, failure to protect natural resources creates barriers for social inclusion by destroying the conditions for accessing the life needs of people.

Failure to pay fair wages in order to accrue profits equally fosters marginalisation and social inequality. The figure below shows the intersections between areas of sustainability. This suggests that economic, environmental and social elements of business activities are not separable aspects when assessing the effects or societal impacts of entrepreneurship and innovation.

The triple bottom line became popular following a series of corporate, unethical practices which destroyed social and environmental value in order to maximise profits.

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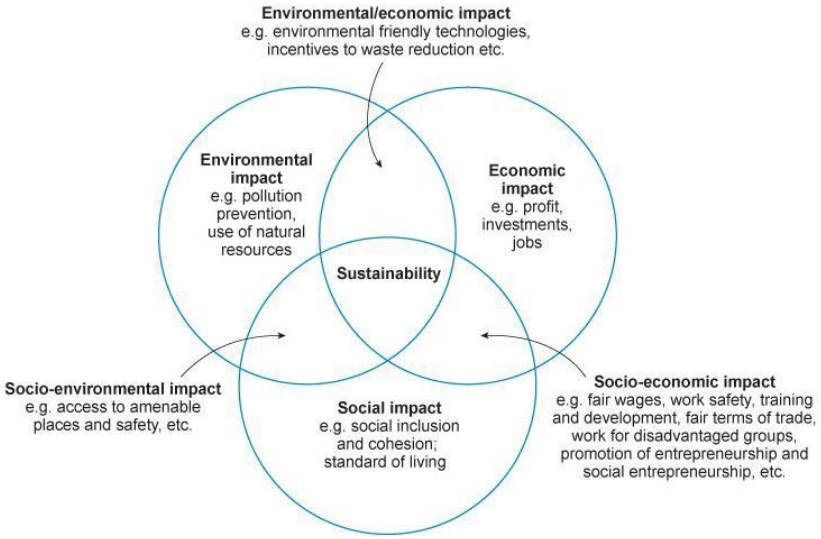


Figure 1: The three components of sustainability and their interconnections

The idea of the triple bottom line is that businesses should pursue economic sustainability together with environmental and social sustainability. In particular the term triple bottom line refers to three interlinked bottom lines that a sustainable enterprise pursues:

- Environmental bottom line: is measured through the so-called 'planet account', which identifies the environmental sustainability of the business.
- Economic bottom line: is typically measured by profit.
- Social bottom line: is accounted for by human wellbeing, or to what extent a business cares about people and societal needs.

Triple bottom line (TBL) [xvii] is also known as "people, planet, profit" or "the three pillars."

i) Profit (economic)

The first decade of the twenty-first century, a growing number of business executives believed that sustainability should play a role in their work. PricewaterhouseCoopers found that in 2003, 70 percent of CEOs surveyed believed that environmental sustainability was important to overall profit. By 2005, that number had climbed to 87 percent. [xviii] In a later PricewaterhouseCoopers survey of technology executives, 71 percent said they did not believe their company was particularly harmful to the environment, yet 61 percent said it was nonetheless important that they reduce their company's environmental impact. The majority of executives also believed strong demand existed for "green" and cleaner products and that demand would only increase [xix]. In a later

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PricewaterhouseCoopers survey of technology executives, 71 percent said they did not believe their company was particularly harmful to the environment, yet 61 percent said it was nonetheless important that they reduce their company's environmental impact. The majority of executives also believed strong demand existed for "green" and cleaner products and that demand would only increase. PricewaterhouseCoopers, "Going Green: Sustainable Growth Strategies". [xx] Wal-Mart Stores, Inc. (WMT), McDonald's Corporation (MCD) and many of the true corporate giants has named sustainability as a key priority moving forward. [xxi] Now other corporations are under pressure to show how *they* plan to commit, and deliver their goods and services in a sustainable manner. This clearly shows that, as of today, green, clean and environmental project towards sustainability development is not a profitless business.

Companies are focusing on reducing their carbon footprints, packaging waste, water usage and their overall effect on the environment. They have also found that having a beneficial impact on the planet can also have a positive financial impact on their business. Lessening the amount of material used in packaging usually reduces the overall spending on those materials. For example, Walmart keyed in on packaging through their zero-waste initiative, pushing for less packaging through their supply chain and for more of that packaging to be sourced from recycled or reused materials. [xxii] Other businesses that have an undeniable and obvious environmental impact, such as mining or food production, approach the environmental pillar through benchmarking and reducing. One of the challenges with the environmental pillar is that a business's impact is often not fully costed, meaning that there are externalities that aren't being captured. The all-in costs of wastewater, carbon dioxide, land reclamation and waste in general are not easy to calculate because companies are not always the ones on the hook for the waste they produce. This is where benchmarking comes in to try and quantify those externalities, so that progress in reducing them can be tracked and reported in a meaningful way.

ii) Planet (environmental)

The Sustainability crunches

1. World Economic Foot print[2]

Ecological Footprint measures humanity's demand on the earth's productive capacity. This productive capacity, known as biocapacity [xxiii], is the area of

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biologically productive land and sea required to provide the resources humans use and to absorb our waste. It includes all the cropland, grazing land, forest, and fishing grounds required to produce the food, fibre, and timber people consume. Ecological Footprint also includes the land required to absorb emissions from the energy people use, and to provide space for our infrastructure including roads and built areas.

Put simply: *environmental sustainability can only occur when the amount of productive land that people* ***demand*** *(ecological footprint) is equal to, or less than, the* ***supply*** *of productive land available (biocapacity).*

According to the National Accounts for the year 2014, the total Earth's biocapacity is estimated at 1.7 global hectares (gha) per person but humanity's Ecological Footprint has reached 2.6gha per person. Correspondingly, the number of planets demanded by all humans is now 1.53 planets and growing.

People consume resources and ecological services from all over the world, so their footprint is the sum of these areas, wherever they may be on the planet. That is why ecological footprint and biocapacity are both measured in global hectares.

Carbon footprint

Probably the best-known component of the Ecological Footprint is the Carbon Footprint. Carbon Footprint is the land required to absorb the CO_2 that is released from the burning of fossil fuels and other sources.

Separating the Ecological Footprint into its individual components demonstrates how each one contributes to humanity's overall demand on the planet. Globally, the Carbon Footprint was the fastest growing component, increasing more than nine-fold from 1961 to 2003.

Overshoot

Humanity's footprint first grew larger than global biocapacity in the 1960s; this overshoot has been increasing every year since, with demand exceeding supply by over 50 per cent in 2014. This means that it took approximately a year and six months for the Earth to produce the ecological resources we used in that year.

How is it possible for an economy to continue operating in overshoot? Over time, the Earth builds up ecological assets, often called natural capital, like forests,

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fisheries and soil. These accumulated stocks can, for a limited period, be used faster than they regenerate. CO^2 can also be emitted into the atmosphere faster than it is removed, accumulating over time.

For more than four decades we have been in overshoot, drawing down these assets and increasing the amount of CO_2 in the air. We cannot remain in overshoot much longer without depleting the planet's biological resources and interfering with its long-term ability to renew them.

Figure 2 and 3 below shows our greed for land/surface on earth's crust, that we are already living beyond our means (2005). In 2016 we have reached a biocapacity level of level of 1.7 earths.

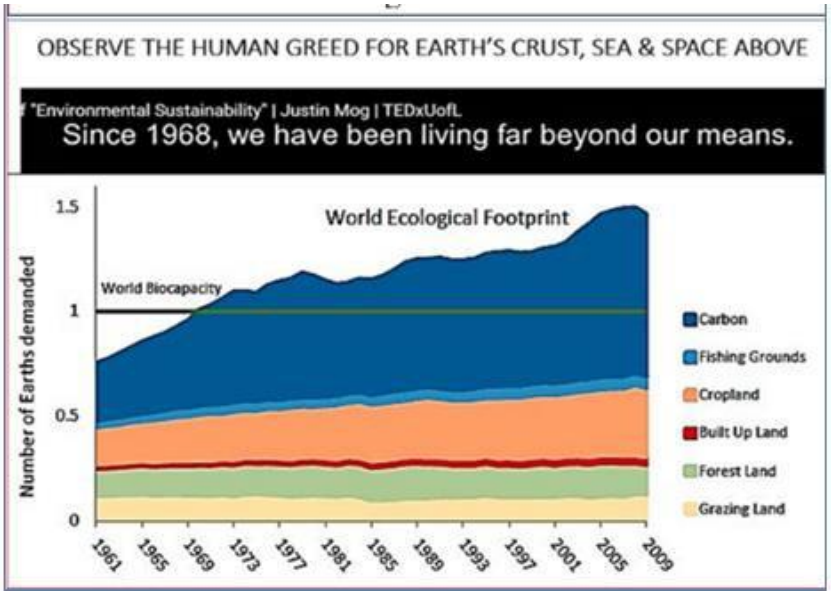


Figure 2

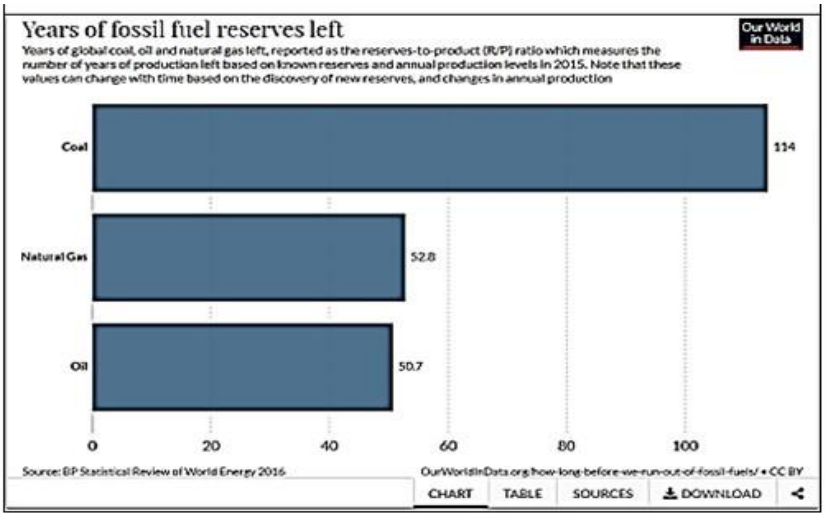


Figure 3

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World reserve of natural fossil fuels

If we look to figure-3 below we can find that at present level of technological development, the total reserve of coal will continue for a maximum of 114 years of based on annual production rate, while oil will continue for 50 years and natural oil to continue for 52 years only [xxiv] .

iii) People (social)

Employers as well as employees have begun striving toward sustainability. Labour unions and environmentalists, once at odds, jointly created the Apollo Alliance to promote the transition to a clean energy environment under the slogan "Clean Energy, Good Jobs." Van Jones, formerly with the Obama administration, led "**Green for All**", an organization that proposed the new green economy tackle poverty and pollution at the same time through business collaboration in cities to provide clean energy jobs.

Poverty, inequity and justice are not the genre of environment yet they form essential part of it as provided in "triple bottom line,"[xxv] because poverty, inequality and injustice created by the affluent people of the society by garnering all benefits of natural resources by using power and throwing the wate after consumption to be borne by the poor.

We will discuss each of these factors separately here

A. *Inequality and Environmental Quality*

i. Inequality and loss of biodiversity

Recent evidence shows that greater income inequality is associated with greater loss of bio-diversity. Studies highlighting this relationship include Mikkelsen, Gonzalez, and Peterson (2007) and Holland, Peterson, and Gonzalez (2009).[xxvi] The former conducts regressions on the basis of both cross-country data and data across the states of the United States of America (USA). For the cross-country regressions, the authors take as a dependent variable the 'number of threatened plant and vertebrate species.' They measure inequality by 'Gini ratio of household income' distribution and control for variations in 'human population size' and 'GDP per capita.'

To account for the 'stock effect,' they control for the 'total number of plant and vertebrate species.' Based on the results, the authors conclude that "a 1% increase in the Gini ratio is associated with an almost 2% rise in the number of threatened species. See below **figure 4**.

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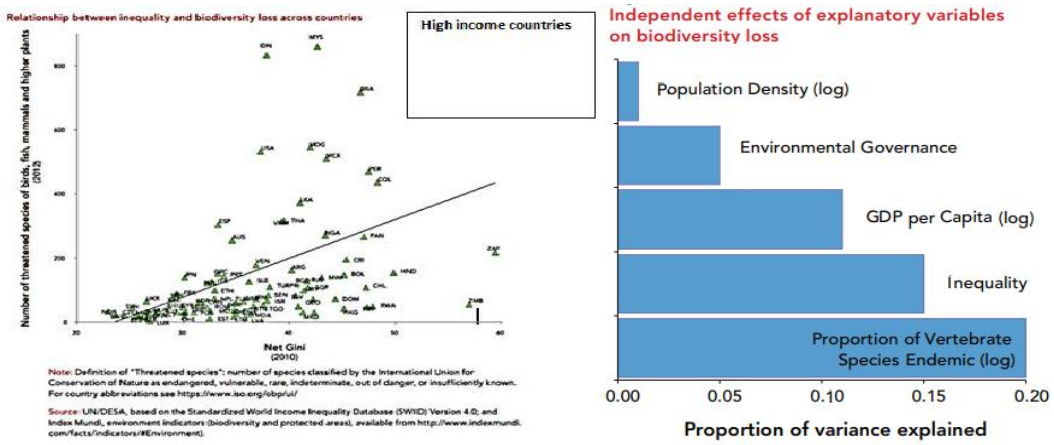


Figure 4

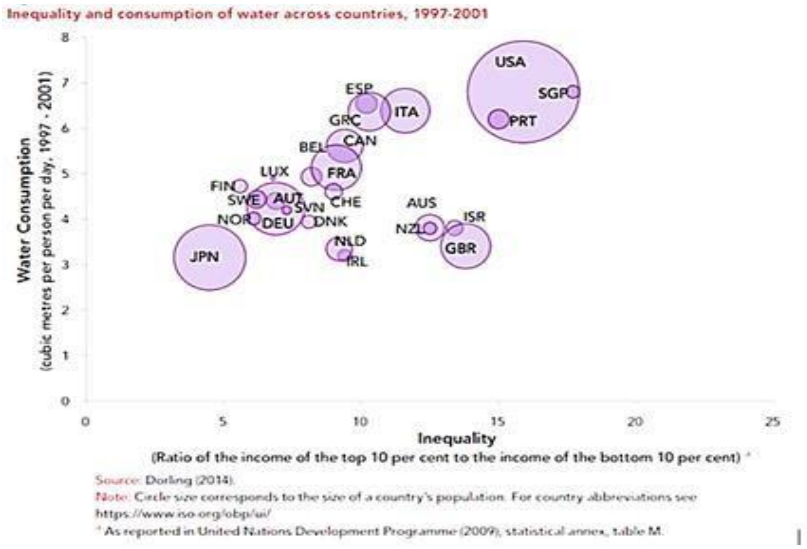


Figure 5

ii. Inequality and Consumption

Example of a negative correlation between income inequality and environmental outcome is observed via the consumption behaviour. For example, Dorling and other researchers examine the relationship of income inequality with personal consumption and generation of waste among affluent countries. Their findings show that rich countries with higher inequality consume more resources and generate more waste per person. [xxvii]

Be that as it may, the evidence does point to a negative correlation between inequality and environmental quality.

a) Inequality and water consumption

For example, the per capita consumption of water increases from 3.2 cubic meter in Japan, where the income of the top ten per cent of the population is 4.5 times greater than that of the bottom ten per cent, to 6.8 cubic meter in the USA where the latter ratio is 16 (See above **Figure 5**)

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b) Inequality and fish & meat consumption

Similarly, while Japan's per capita annual consumption of fish and meat is limited to 43.9 kilogram, the analogous consumption in New Zealand, where the above income inequality ratio is 12.5, is 130.1 kilogram (**Figure 6**).

iii Waste Generation/Environmental Quality

A similar situation can be seen with regard to waste generation. For example, in Sweden, where the above inequality ratio is 6, the per capita annual waste generated is 513 kg. However, the amount of per capita annual waste generated increases to 728 kg in Switzerland, where the inequality ratio is 9, and it increases further to 1072 kg in Singapore where the inequality ratio is 18 (**Figure 7**). In these figures, income inequality is measured by the ratio of the income of the top ten per cent of the population to the income of the bottom ten per cent.

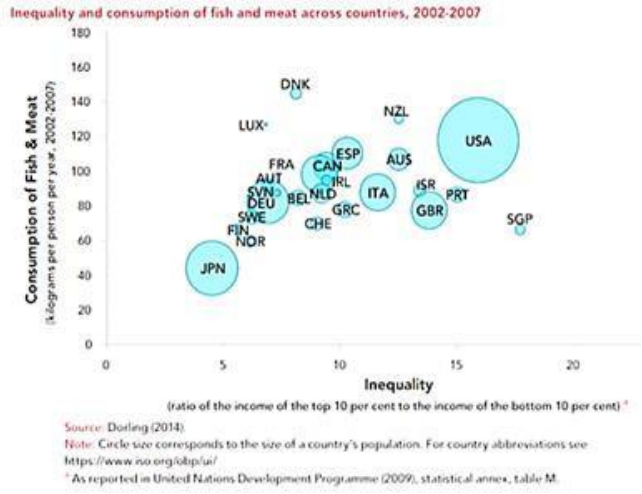


Figure 6

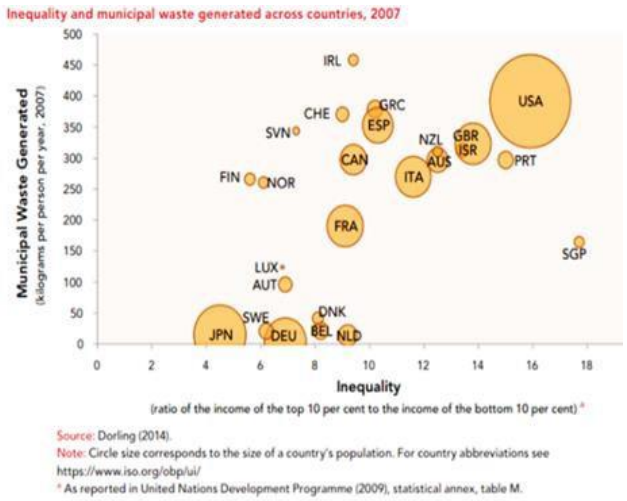


Figure 7

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iii) Four Channels of Influence of Inequality on Environmental Outcomes

The next questions are, first, whether the observed correlation represents causation, and second, if it does, what explains the causation. In other words, what the mechanisms and channels are through which inequality may exert a negative influence on environmental outcomes. Understanding these channels and mechanisms is necessary in order to formulate appropriate policies. Researchers generally think that there is causation behind the observed correlation between inequality and environmental quality. As noted above, Holland, Peterson, and Gonzalez (2009) conclude that they identified causation in their results. They also feel that it is necessary to try to reveal the mechanisms through which the causality may work. They distinguish between 'individual' and 'collective' effects (p. 1312). The former refers to the changes in individual behaviour and incentives brought about by increased inequality. The latter refers to changes in collective behaviour that are generally mediated through environment management institutions. Carrying these ideas forward, the following four channels through which inequality may exert its negative influence on environmental outcomes (**Figure 8**) :

a. Household channel
b. Community channel
c. National channel
d. International channel

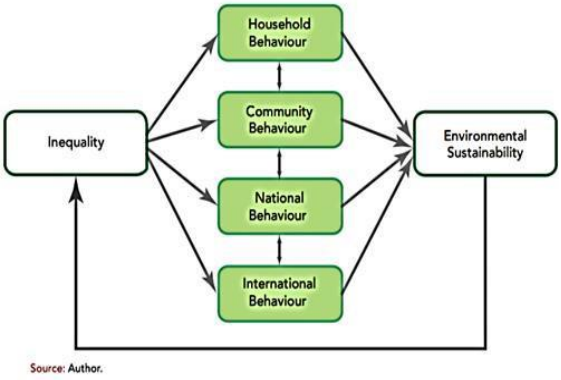


Figure 8: Different channels of influence of inequality on environment

a) Household Channel of Influence of Inequality on Environmental Outcomes

An important way in which inequality can affect environmental sustainability is through its influence on household behaviour. The evidence of the household channel has to be sought in intra-country variation in environmental outcomes, because the inter-country variation relies on national level outcomes that embody the impact of other channels, in particular, the national channel. For example, there is evidence suggesting that more unequal countries have higher per capita ecological footprint than countries that are less unequal, even though they have similar levels of income.

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However, this may be the combined result of inequality's influence working through both national and sub-national channels. To decipher the household channel, it is

necessary to consider variations in ecological footprint across people within the same country. Fortunately, data on intra-country variation are gradually becoming available. For example, a recent study of Canadian households finds that ecological footprint varies with the level of income. It finds that the richest 10 per cent of Canadian households have an ecological footprint of 12.4 hectares per capita, which is 66 per cent higher than the national average of 7.5 hectares (Figure 14). The ecological footprint of the richest 10 per cent is about 2.5 times greater than that of the poorest 10 per cent. The study breaks down the total ecological footprint into its components arising from different sources, namely (i) food, (ii) housing, (iii) mobility, (iv) goods, and (v) services. Looking at these sources, the study finds that most of the difference in ecological footprint is due to differences in mobility (travel), with respect to which the footprint of the richest 10 per cent is 9 times higher than that of the poorest 10 per cent. This ratio is 3.75 for 'goods,' 2.7 for 'services,' and 2.25 for 'housing.' It is only with respect to food that the difference in ecological footprint across different income groups is not that pronounced. The differences in ecological footprint across income categories are likely to be more pronounced in developing countries, where consumption of the rich often differs from that of the poor not only in magnitude but also in kind. The rich of developing countries generally emulate the consumption pattern observed in developed countries. As a result, their consumption basket generally includes more damaging to the environment components—such as various non-biodegradable materials—than is the case for the consumption of the poor.

b) Community Channel of Influence of Inequality on Environmental Outcomes

An important way in which the reduction of inequality can help environmental protection is through its influence on community behaviour. In particular, the reduction of inequality may be conducive to the collective efforts necessary for the protection of environmental resources that are owned or controlled by communities.

i) Inequality and Common Property Resource (CPR) Management

Proceeding from the criteria of 'rivalry' and 'excludability,' goods and services have been classified in the economics literature into four categories, namely (i)

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private goods, (ii) club goods, (iii) common property resources, and (iv) public goods (Table 1). Inequality can affect the volume, distribution, and use of all of them. However, the precise way in which inequality affects, and the way in which these effects may be modified in order to protect the environment, differs depending on the category of goods. It is easy to see that many environmental resources fall under either the Common Property Resources (CPR) category or the Public Goods category. While inequality's role in the protection of environmental resources that are in the public goods category has gained more attention in recent years, its role in the protection of environmental resources that are of the CPR category has been emphasized for a long time now. An important consideration with regard to the CPR is the possibility of over-exploitation. Hardin (1968) dramatized this problem by coining the expression 'tragedy of the commons. The idea is that, with access to a common property resource, each individual has an incentive to extract and/or use as much as possible of this resource, disregarding the fact that emulation of this behaviour by others will lead to exhaustion of the resource. Many initially saw the solution of this problem in privatization of the CPR. Accordingly, policies geared to privatization were actively pursued, especially in the more economically unequal countries, in the 1970s through the 1990s. However, researchers have shown that many communities found efficient ways of managing the CPR, preventing their overuse, without privatisation. Several factors that are found to be helpful in successfully managing the CPR are (i) definable boundaries of the CPR, (ii) the high degree of dependence of the community members on the CPR (so that its exhaustion would pose a significant threat to the welfare of the co-sharers, and there are no readily available substitute of the resource), (iii) the presence of a community that is small in number but stable and is characterized by dense social network and social norms, and (iv) the existence of community-based rules and procedures with built-in incentives for following the rules and punishments for violation. . It is not difficult to see that the homogeneity of a community and the density of social network in it depend to a large extent on the degree of equality among the community members. However, there is also the contrary view that, in certain situations, inequality may actually be helpful for the protection of the CPR (Olson 1965). This hypothesis is a corollary of the general proposition that collective action is difficult when the size

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of the collective is large, so that the possible benefit for each individual from the collective action is small in magnitude, and the scope for free riding is large. By contrast, collective action is more likely to materialize in a small sized collective, because the benefit from the collective action to be derived by each member of such a collective is likely to be large and the scope for free-riding is likely to be small. Thus, if it is the case that only a few members of the community can reap bulk of the benefit from the protection of the CPR then they may offer the protection even if the rest of the community (who reap only a small part of the benefit) does not share the cost of protection. The 'large' members of the community will do so because the benefit reaped by them will exceed the cost of protection borne by them.

This proposition regarding beneficial effect of higher inequality on the protection of the CPR however has been challenged on grounds of both theory and empirical validity. The bulk of the research published to date has shown that equality is generally more conducive to collective efforts necessary for the protection of environmental resources under common ownership or control.

Table 1: Goods, services and resources by category

	Excludable	Non-excludable
Rivalrous	Private goods	Common-property resources
	(e.g., food, clothing, cars, electronics)	(e.g., commonly held fish stock, timber, fields for grazing)
Non-rivalrous	Club goods	Public goods
	(e.g., patented goods, satellite television)	(e.g., open radio transmission, national defence)

Source: Author

ii) Inequality, Community Effort and Climate Change

The role of collective effort in the protection of the environment has become now more important in view of climate change. Successful mitigation and adaptation efforts require cooperation at the global, national, sub-national, and community levels. The cooperative effort is particularly vital for communities that live at the frontier of the climate change impact. For example, many islands and low-lying countries are getting partly submerged, and the people living in these areas have to either migrate or put-up resistance to the processes and/or adapt to the new situation. While migration can be an individual response, resistance and adaptation require collective effort. Similarly, in many areas, climate change is drying up water bodies which are crucial for the survival of local communities.

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Again, collective efforts are necessary in those places to resist and adapt. Furthermore, experience shows that orderly migration requires collective action of both the migrants and the host population of the locations to which migrants are moving. However, as noted earlier, cooperation and collective efforts becomes difficult when the members of the community are very unequal. Higher inequality hinders crystallization of a common purpose and creates obstacle to trusting relationship among the community members. Thus, by facilitating collective efforts, the reduction of inequality can help communities in confronting and coping with climate change.

c) National Channel of Influence of Inequality on Environmental Outcomes

Just as inequality can be a hindrance to collective efforts necessary for the protection of local environmental resources, so can it be a hindrance to collective efforts required for the protection of national and global environmental resources. It is well known from the ecological footprint literature that rich countries have much larger per capita ecological footprint than poorer countries have. The main reason behind this relationship is that people in rich countries on average consume more than the people in low-income countries. What is less known is that even among similarly affluent countries, the ecological footprint in more equitable countries tend to be much smaller than in more inequitable countries. As noticed earlier, Japan is one of the more equitable of affluent nations while the USA is one of the more inequitable. The income of the top 10 per cent of the population is 4.5 times greater than the income of the bottom ten percent in Japan, while in the USA this inequality ratio is 15.9. The average per capita ecological footprint in Japan is roughly half of that of the USA.12 A similar relationship can be observed with respect to inequality and per capita Green House Gas (GHG) emissions. Countries with less inequality tend to have less per capita GHG emission compared with countries that have similar per capita income but where inequality is high. For example, Canada, where the income of the top 10 per cent of the population is 9.4 times greater than the income of the bottom ten percent, had an annual per capita CO2 emission (during 2010-2014) of 14.1 tons, whereas Sweden, where the above income inequality ratio is 6.2, had an annual per capita CO2 emission during the same period of 5.5 tons.13 These findings should not be surprising, because we already observed that among the affluent

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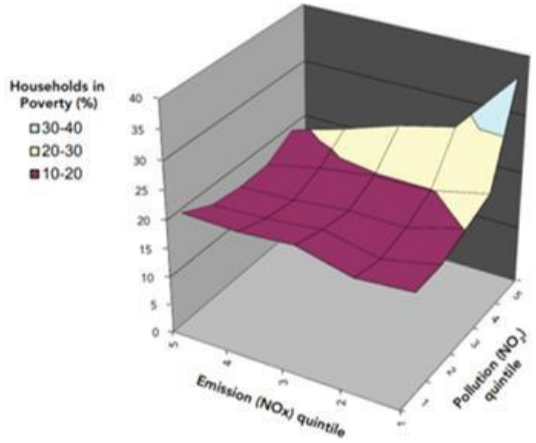
countries those with higher inequality also had higher per capita levels of consumption (of water, fish, and meat) and of volume of waste generated.

Poverty- and Environmental Quality

The next issue is poverty. **First**, on the consumption side, the rich generally consumes more than the poor. Hence, they should have more consumer surplus in the aggregate than the poor. **Second**, the rich are generally the ones who make investments. As a result, they are also the main beneficiary of the producer surplus. Thus, the interests of the rich are likely to be more aligned with policies that increase their consumer and producer surplus, even though these policies are damaging to the environment. This alignment becomes stronger if the rich can (as they often do) insulate themselves from the consequences of environmental degradation, for example, by 'dumping' pollution on the poor, living in exclusive neighbourhoods that are far from pollution sites, and by adopting modes of life that are less affected by pollution (such as traveling in air-conditioned cars and thus be unaffected by air pollution), etc. It is clear that under the above situation, the aggregate level of resource consumption and pollution will be higher than it would be in a more equal society, where such dumping would be difficult and the benefits and effects and costs of pollution would be more equally distributed. the fact that the rich can insulate themselves from pollution may help them reconcile their preference for living in a better environment with their support for environmentally damaging policies. Research by and large supports the above conjectures. For example, Boyce (2007) shows that many of the hazardous waste dumps and other environmental damaging sites in the US are indeed located in the neighbourhoods inhabited by the poor, people of colour, and immigrants. Dorling in 2010 provides similar evidence from the United Kingdom. He conducts a study of more than 10,000 wards and finds that those having higher proportion of households in poverty were also suffering from higher degree of NOx pollution (**Figure 9**). Dorling therefore concludes that "Environmental justice requires social justice and social justice cannot be achieved without greater equality of income and wealth… Maintaining high income inequality will speed up global warming (Dorling 2010b, p. 13)." The fact that higher degree of inequality creates the possibility of 'dumping' pollution on the poor has led to the call for 'environmental justice.'

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Poverty rates of wards by quintiles of emission and pollution by nitrogen oxide (NOx) and nitrogen dioxide (NO_2)



Source: Dorling (2010b)

Figure 9: Poverty rate vs. emission and NO_2 pollution

Inequality and Environmental Kuznets Curve (POLICY AND ENVIRONMENTAL ACTIVISM)

National Policy for irradiation of inequality, poverty and injustice is needed to correct the environmental evils

National policies are therefore very important for environmental outcomes. They can exert influence at several levels. By reducing inequality, they can influence household behaviour. They can also reduce inequality within communities (for example, through redistributive land reform) and thus facilitate collective efforts of the members of a community. National policies are vital to initiate environment-friendly macro processes. Recent research has shown that sustainable development requires sustainable consumption patterns. One of the important ways in which the reduction of inequality may help to protect the environment is through the adoption of national policies directed toward the promotion of sustainable consumption at all levels of society, both rich and the poor. In addition to the above, national policies also determine what happens globally, because it is the national governments which jointly determine the international policies and bear the responsibility for implementing these policies in their respective countries. Environmental outcomes at the global level are affected by inequality at the global level. This brings us to the 'international channel' of influence of inequality on the environment. Before discussing this channel, it is however necessary to take note of a competing explanation of the variation across countries with regard to environmental quality. This explanation takes the form of the 'Environmental Kuznets' Curve.'

a. Relationship between inequality of (income) distribution and the (average) level of income (as a measure of the stage of development) of a country

A concept that plays an important role in

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the discussion of cross-country pattern of environmental dynamics is the Environmental Kuznets Curve (EKC). As the name suggests, this concept is inspired by the Kuznets Hypothesis (KH) regarding the relationship between inequality of (income) distribution and the (average) level of income (as a measure of the stage of development) of a country. According to the KH, as a country grows inequality will first increase with rise in (per capita) income level and then decrease, yielding an inverted U-shaped relationship between inequality and the level of economic development (figure-16). The KH however remains controversial, on both theoretical and empirical grounds. In his book, Piketty (2014) reiterated some of the theoretical arguments against the KH. At the empirical level, it is well known that many East Asian economies have grown without any significant increase in inequality, defying the KH.

b. Relationship between quality of the environment and the per capita income level of a country:

Nevertheless, the EKC follows the KH to propose a U-shaped relationship between quality of the environment and the per capita income level of a country. According to the EKC, at the initial level, when a country is still largely pre-industrial, it enjoys better, pristine environment, characteristic of pre-industrial societies. However, as it industrializes and its per capita income increases, its environmental quality deteriorates due to the adverse impact of industrialization. After it completes the industrialization process, it faces more domestic demand for quality environment and also becomes more financially and technologically capable to meet this demand. As a result of the combined effect of the two, the environmental quality of the country starts to improve. This argument also becomes controversial, because it does not apply to all pollutants equally.

c. Inequality and Environmental Quality

More importantly, even if the KH and the EKC were valid, they do not suggest a U-shaped relationship between inequality and environmental quality (IE relationship, for short). **Figure 10** can help to see this. Part (a) of this Figure shows that the relationship between inequality (I) and per capita income level (Y), as per the Kuznets Hypothesis, is of inverted-U shape. On the other hand, Part (b) shows that the relationship between environmental quality (E) and per capita income level (I), as per the EKC, is of U-shape.

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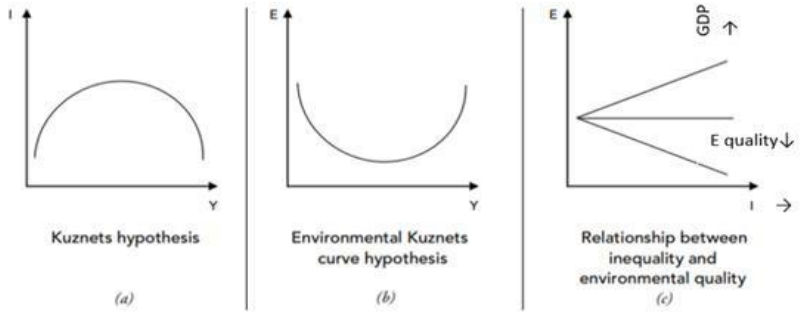


Figure 10: Relationship possibilities between income and environment

Given the opposite nature of these two curves, the pattern of relationship between environmental quality (E) and inequality (I) is likely to be indeterminate, as shown in Part (c) of the figure.

d. International Channel of Influence of Inequality on Environmental Outcomes

In examining the 'international channel,' it is first necessary to note that one of the ways in which the world is changing is that public goods (resources) are often becoming common property resources (CPR). In other words, even if these resources remain non-excludable, they are no longer non-rivalrous. A prominent example of this change is the atmosphere, which used to be a classic example of a public good, because it was both non-excludable and non-rivalrous. However, now that safe limits on carbon concentration have been exceeded, the atmosphere is no longer non-rivalrous, because carbon emission by one country leaves less space for carbon emission by others, without aggravating climate change. Similar is the situation with the oceans, another classic example of what used to be a public good (resource). One reason why ocean is becoming CPR (instead of a global public good) is the increased atmospheric carbon concentration, which is also causing increased acidification of the oceans. While ecological footprint is a comprehensive measure of the environmental impact of human activities, the accuracy of this measure has been questioned (Toye 2013). However, cross-country disparity in the impact on the environment is apparent from other measures too. The most prominent in this regard is Greenhouse Gas (GHG) emissions, which is well-accepted and is a relatively accurate measure. Though GHG emissions may be a partial indicator (relative to say ecological footprint) of the environmental impact, its consequence—namely climate change—has the potential to destabilize the entire eco-system of the earth and put the very human civilization at a grave risk. From that point of view,

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GHG emissions are a no less important measure of environmental impact than measure ecological footprint.

Percapita ecological foot print and development

Developed countries have much larger per capita ecological footprint than developing, low-income countries have (**Figure 11**). The main reason behind this is the difference in consumption levels and patterns. The people in rich countries on average consume more than the people in poorer countries. Furthermore, as noted earlier, the content of consumption in rich countries is often more damaging to the environment than it is in low-income countries.

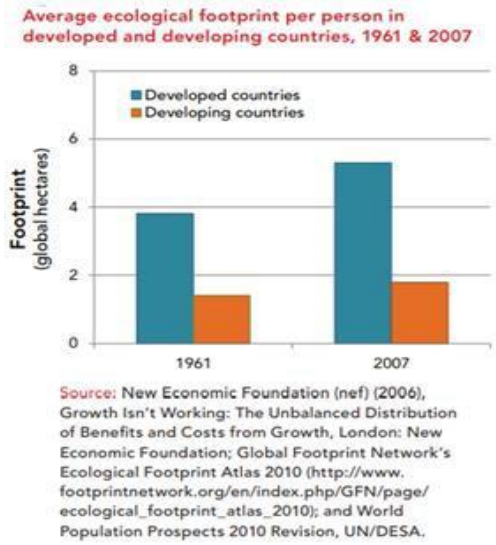


Figure 11

An example is the greater presence of non-biodegradable plastic materials in the consumption basket in rich countries. Also, in recent decades per capita ecological footprint in developed countries has increased by several times more than it has in developing countries (**Figure 11**).

It may be noted here that, in recent years, developed countries have shifted much of their natural resource non-energy intensive, pollution creating industries to developing countries. (See **figure-12**). While ecological footprint is a comprehensive measure of the environmental impact of human activities, the accuracy of this measure has been questioned (Toye 2013). However, cross-country disparity in the impact on the environment is apparent from other measures too. The most prominent in this regard is Greenhouse Gas (GHG) emissions, which is well-accepted and is a relatively accurate measure. Though GHG emissions may be a partial indicator (relative to say ecological footprint) of the environmental impact, its consequence—namely climate change—has the potential to destabilize the entire eco-system of the earth and put the very human civilization at a grave risk. From that point of view, GHG emissions are a no less important measure of environmental impact than ecological footprint. **Figure-13** below shows the co2, Emission is highest in high income countries than low-income countries.

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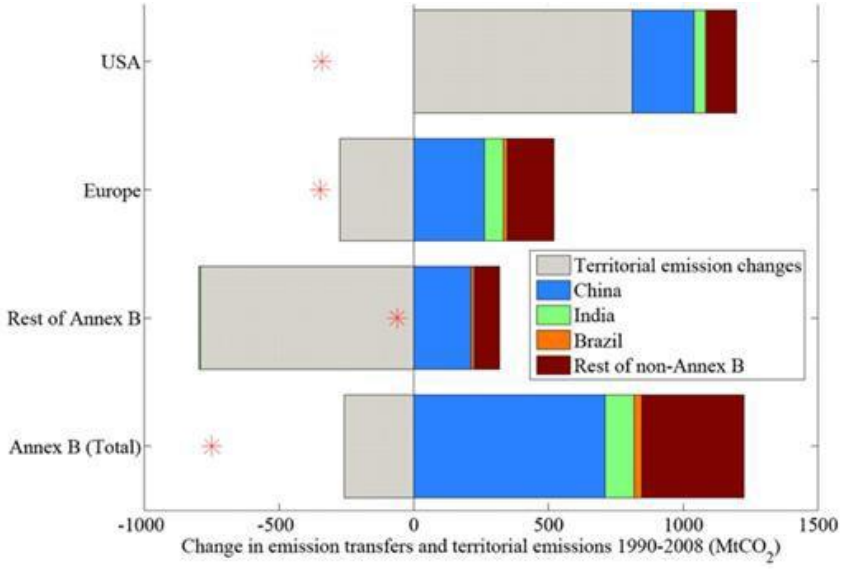


Figure 12: Transmitting the CO_2 burden to keep up with Kyoto protocol

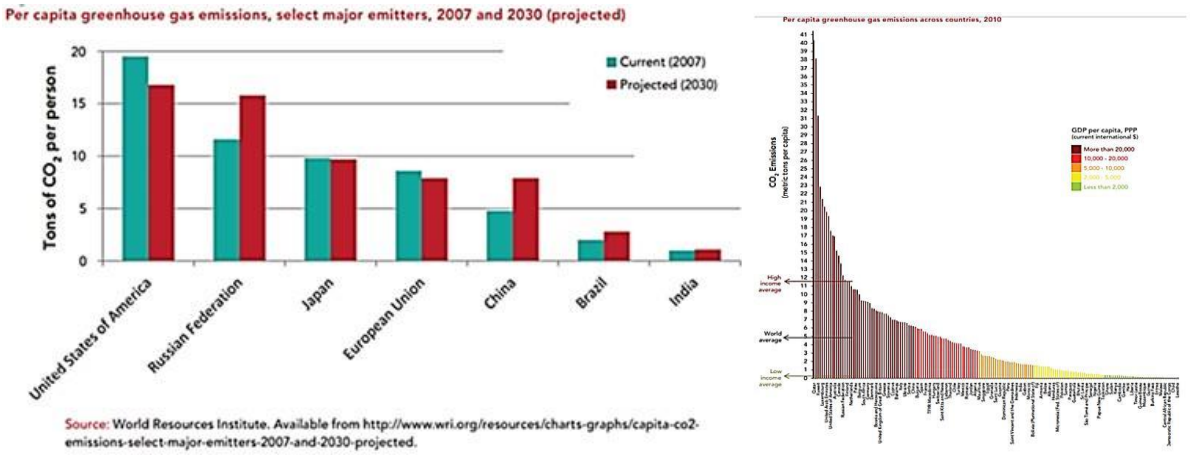


Figure 13: GHG in low- & high-income countries compared

i) Gender Inequality and Environmental Outcomes

Income and wealth are not the only dimensions of inequality that affect environmental outcomes. In particular, gender inequality plays an important role in the protection of the environment. Clearly, gender inequality often works in combination with other dimensions of inequality. For example, gender inequality generally reinforces the income and wealth inequality. However, there are aspects of gender inequality that go beyond income and wealth inequality and often prove important for environmental sustainability. The role of gender inequality has been discussed particularly in the context of collective efforts necessary for managing common property resources. Agarwal (2007), for example, provides detailed

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information about how gender inequality affects collective efforts aimed at the protection of forests under common and public property in India. The example of Chipko movement is an instance of role of women protecting environment and natural resources (**figure-14**).



Chipko movement, also called **Chipko andolan**, nonviolent social and ecological movement by rural villagers, particularly women, in India in the 1970s, aimed at protecting trees and forests slated for government-backed logging. The movement originated in the Himalayan region of Uttar Pradesh (later Uttarakhand) in 1973 and quickly spread throughout the Indian Himalayas. The Hindi word *Chipko* means "to hug" or "to cling to" and reflects the demonstrators' primary tactic of embracing the trees to impede the loggers.

Figure 14

In addition to extensive qualitative analysis, she conducts quantitative analysis. For example, she examines the multiple correlation between 'forest quality' and a host of explanatory variables, including the variable 'WEC (Women in the Executive Committee),' which denotes the percentage of the local community forest group (CFG) executive committee members who are women. Agarwal finds that given the values of other variables, the higher this percentage the better is the quality of forests. Agarwal thinks that the observed positive effect of women's participation in the protection of forests can be enhanced further by ensuring their greater and more effective participation in CFG activities and decision making. Agarwal (2010) amplifies this argument further. The beneficial impact of the reduction of gender inequality is not limited to the protection of environmental resources under common property. It rather has more general validity. As noted already, gender inequality is often a manifestation of unequal power situation rooted in unequal distribution of income and wealth and in social norms and tradition. Thus, there may be synergy among efforts towards the reduction of income inequality and gender inequality. This synergy may be used for promoting the goal of environmental sustainability through different channels, including community and national channels.

ENVIRONMENTAL JUSTICE

The global economy is currently exceeding ecological limits, and is producing a variety of destructive impacts, including climate change, desertification, deforestation, degradation of arable land, freshwater shortages, depletion of fish stocks, unprecedented species extinction, and widespread chemical contamination of air, land, and water.[xxix] The United Nations Millennium Ecosystem Assessment concluded that human economic activity

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during the last half century has produced more rapid and severe ecosystem degradation than in any comparable era of human history. The loss of ecosystem services intensifies poverty, exacerbates inequality, and poses significant obstacles to the achievement of the Millennium Development Goals. Ecosystem degradation will also diminish the benefits that future generations derive from the planet's natural capital.[xxx] The primary cause of global environmental degradation is the unsustainable consumption of environmental resources by the planet's most economically privileged inhabitants, most of whom reside in the global North or in the industrial centres of the global South [xxxi]. Twenty percent of the world's population consumes approximately 85 percent of the planet's timber, 70 percent of its energy, and 60 percent its food [xxxii]. This population is also responsible for more than 90 percent of the world's annual production of hazardous waste, some of which is exported to Southern countries and contributes to illness and widespread environmental harm [xxxiii]. While the affluent reap the benefits of unsustainable economic activity, the burdens of resource depletion, land degradation, and pollution are borne disproportionately by the global South and by the most vulnerable communities in both the North and the South, including indigenous peoples, racial and ethnic minorities, and the poor. Some scholars have described the ecological segregation of the world's population along economic and racial lines as "eco-apartheid." [xxxiv]

There are four-part of the definition of environmental justice consisting of distributive justice, procedural justice, corrective justice, and social justice. [xxxv] Distributive justice calls for the fair allocation of the benefits and burdens of natural resource exploitation among and within nations. Procedural justice requires open, informed and inclusive decision-making processes. Corrective justice imposes an obligation to provide compensation for historic inequities and to refrain from repeating the conduct that caused the harm. Social justice, the fourth and most nebulous aspect of environmental justice, recognizes that environmental struggles are inextricably intertwined with struggles for social and economic justice. Environmental injustice cannot be separated from economic inequality, race and gender subordination, and the colonial and post-colonial domination of the global South. As a practical matter, environmental disputes frequently involve several aspects of environmental justice, and do not fit

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neatly into one of the four categories. Environmental justice has an important North-South dimension. Through their overconsumption of the planet's natural resources, wealthy countries have contributed disproportionately to a variety of environmental problems, including climate change, deforestation, and the hazardous waste trade. Despite their far smaller contribution to global environmental degradation, poor countries bear most of the harm due to their vulnerable geographic locations, lack of resources for climate change adaptation and disaster response, and lack of administrative infrastructure to regulate waste disposal, logging, mining, and petroleum development. [xxxvi] In addition to this distributive injustice, North-South relations are also plagued by procedural inequities. The North dominates decision-making in the International Monetary Fund (IMF), the World Bank, the World Trade Organization (WTO), and multilateral environmental treaty fora as a consequence of its greater economic and political clout. While the South can present alternatives points of view, the preferences of the powerful generally dictate the substantive outcomes.[xxxvii] Corrective injustice is evident in the plight of small island states whose very existence is threatened by climate change, but who possess no legal mechanism to obtain compensation or cessation of the harmful conduct.[xxxviii] In addition, North-South environmental conflicts reflect broader social injustice because they are inextricably intertwined with colonial and post-colonial economic policies that impoverished the global South and facilitated the North's appropriation of its natural resources.

The concept of environmental justice draws its moral force from the social struggles that gave birth to environmental justice movements in both the North and the South. Beginning in the 1980s, the environmental justice movement emerged in the United States in response to the concentration of polluting industry and hazardous waste disposal facilities in low-income and minority communities.[xxxix] The movement soon expanded to encompass additional environmental issues, including access to parks and open space; farmworker exposure to pesticides; inequities in disaster preparedness and emergency response; workplace health and safety; access to healthy and affordable food; and enhancement of tribal regulatory authority over indigenous lands.[xl] Environmental justice advocates alleged distributive injustice in the form of disproportionate exposure to environmental hazards; procedural

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unfairness in environmental decision-making; corrective injustice due to inadequate environmental enforcement; and social injustice because environmental degradation cannot be separated from other problems plaguing low income communities and communities of colour (such as unemployment and underfunded schools).[xli] Environmental justice struggles are taking place on every continent. Among the most prominent are the conflicts between indigenous peoples and transnational mining, oil, and logging corporations.[xlii]

The resistance of Nigeria's ethnic minorities to environmentally devastating oil drilling in the Niger Delta, and the challenge by transnational agrarian movements to corporate-dominated free trade policies that undermine rural livelihoods, exacerbate poverty and hunger, and degrade the environment.[xliii] Many environmental justice struggles in the global South, including **the Chipko movement in India** and the struggles against reckless **exploitation of the Brazilian Amazon**, have been spearheaded by local and indigenous communities in opposition to development projects that threaten their lands, livelihoods, and natural resources.[xliv] Historian Ramachandra Guha and economist Joan Martinez-Alier have dubbed these grassroots social movements "the environmentalism of the poor."[xlv]

Environmental injustice is rooted in colonial and post-colonial economic policies that subordinated the global South and enabled the global North to secure a disproportionate share of the planet's finite resources. One of the obstacles to the achievement of environmental justice is the fragmentation of international law into three distinct fields: international economic law, international human rights law, and international environmental law. If international law is to advance environmental protection and social and economic development, then environmental justice norms and policies must be integrated into the broader corpus of international law. The achievement of environmental justice also requires cooperation and collective action among nations to regulate the extraterritorial conduct of transnational corporations.

Economic and environmental cooperation between the global North and the global South must rest on a shared understanding of historic injustices and a shared commitment to right these injustices for the benefit of present and future generations.

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Case study

Chilika Seaweed Cultivation – A Blue Revolution



Source: Naturewildlife.org

Figure 15

Growth of macro algae in Chilika Lake – Photo via www.ostcbu.nic.in

Chilika Lake, a wintering ground for millions of migratory birds, home to thousands of fisher folk, a paradise for tourists and nature lovers, is the largest brackish water lagoon in Asia. Located along the coast of Odisha, this 1,100 sq km lagoon filled with water with salinity between that of freshwater and sea water. Rich in fishery resources housing about 205 species of fish, this highly productive area has been a source of livelihood for 150,000 fisher folks.

Problem – Loss of livelihood

However, over the years, the lagoon bore the brunt of various intensive and rash agricultural activities including the conversion of paddy fields into prawn ponds, which eventually caused heavy pollution in the area. Furthermore, the rapid expansion of the commercial aquaculture led to a significant decline in the fish and bird population of the lake. This drastic change adversely affected the livelihood of the community that depended on Chilika, forcing them to abandon their ponds. With no food to eat, nowhere to go, not enough fish to catch and severe unemployment, the once flourishing lagoon became a dismal and hopeless place for the locals.

When all seemed lost, renowned marine biologist, Dr. Dinabandhu Sahoo made an effort to apply his scientific knowledge and findings for the socio-economic development of the people living in coastal areas. Chilika seemed the perfect place to implement his extensive research on **microalgae** and he spent 20 years studying the area and its problems in an effort to arrive at a sustainable solution.

Solution – Seaweed cultivation

After detailed work in the field of seaweed cultivation, Dr. Dinabandhu Sahoo developed a model called the 'Chilika Model' based on the concept of generating

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wealth from waste. This model is aimed at the socio-economic upliftment of the distressed communities by generating employment around the lagoon.

Dr. Sahoo based his project on the fact that the seaweeds' industry is economically rewarding, which is worth around $8 billion per year. Furthermore, the demand for seaweed is increasing at the rate of 10% every year due to its wider applications in the manufacture of toothpaste, ice-cream, textile printing, teeth filling, cosmetics, tissue culture, plywood and biofuels.

Along with his team, Dr. Sahoo studied 14 different algae species, which were suitable for the Chilika Lake region and narrowed down on four species that were the most economically beneficial. Next, his team carried out the task of determining which species to grow where based on an analysis of salinity, pH and turbidity conditions of the lagoon. The subsequent task was on educating the locals about the technique of seaweed cultivation in a simple manner. It was not an easy task to encourage the villagers to shed their orthodox beliefs and apprehensions and become a part of this new project. The entire activity was handled by NGOs and self-help groups (SHGs) under the able guidance of Dr. Sahoo.

The beauty of Chilika seaweed cultivation lies in its sustainability and simplicity. The technique used in the project requires common local material like bamboo, nylon rope, torn fishing nets and hammers, and therefore can be easily carried out by the people of nearby villages. The crop is ready to be harvested within 45 days of planting and cultivators earn INR5,000 per month on an average. An added advantage is the continuous cycle of cultivation unlike some traditional crops. Along with harvesting, seeds are sown for the next cycle of crops, thus paving the way for continuous daily income for the cultivators.

Initiated in 2009, the Chilika seaweed cultivation project was a great success allowing the dislocated people to move back to Chilika and engage in this new form of livelihood. Today, several self-help groups, especially women are involved in seaweed cultivation. Apart from financially empowering the people around the Chilika lagoon, the seaweed cultivation activity is also environmentally beneficial as it restores the carbon absorption capacity of the water. The only setback for the project is that it is a slow

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setback process.

This pioneering Chilika Model has been used as the base by the Department of Science & Technology, Government of India, to develop the first nation-wide project of seaweed cultivation in different coastal areas of India as an alternative source of livelihood for local people. Its success was also highlighted in detail in the bestseller book, '**I Have a Dream'** by Rashmi Bansal. In order to sensitize the masses about the situation in Chilika Lake, Dr. Sahoo also co-directed a documentary, '**Chilika – The Untold Story'**. A scientist with a mission, he says, "We have seen the green revolution, and the white revolution. My dream is to see a 'Blue Revolution', by harnessing the vast potential of the sea."

As an environmentalist he also applied the same concept of triple bottom line in converting a large dry land into a diversity park when he joined as the director of Institute of Bioresources & Sustainable Development, Imphal, Manipur, by growing seasonal trees, flowering and medicinal plants by using the local unemployed & jobless workers providing them a means of livelihood and increasing the earning of the state from foreign tourists visiting the diversity park. He runs a global campaign on biodiversity for everyone's life through you tube to disseminate the message.

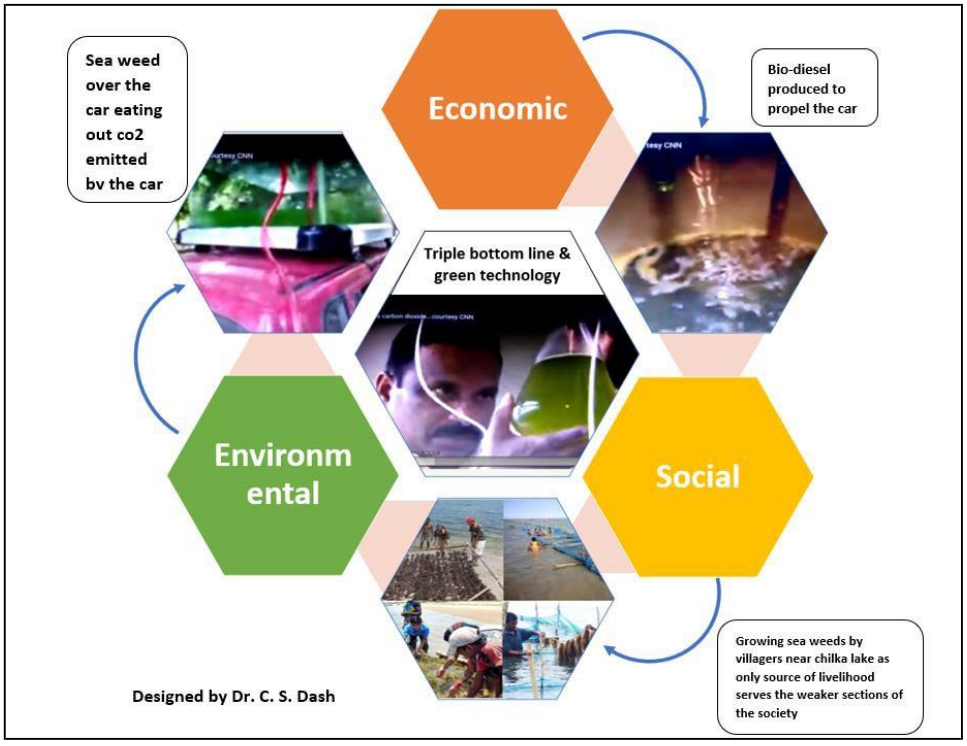


Figure 16

CONCLUSIONS

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Realisation that the global economy is exhausting the world's natural resources and generating waste streams at an unprecedented scale, calls for the redesign of commercial activity that would stop the annihilating process and restructure a new economic model and implement business practices that would preserve the world's natural resources for today's communities and the economic, environmental, and social health and vitality of future generations. These three aspects form the basis the triple bottom line concept of sustainability. Sustainability in business is not about altruism and doing what is right for its own sake but, businesses with successful strategies that are profitable as well, because they integrate considerable amount of green and clean design and resource conservation throughout product life cycles and supply chains in ways that make economic sense. Sustainability innovation is about defining economic development as the creation of private and social wealth to ultimately eliminate harmful impacts on ecological systems, human health, and communities. It is eminent from the study that poverty, social inequity, injustice and discrimination of women, minority communities and weaker sections of the society are as much a cause of degradation of environmental quality as industrialisation is. It also cited the case study of a young scientist in the dept. of botany, university of Delhi, which perfectly matches with the model of triple bottom line simultaneously solving the environmental degradation, enhancing the economic wellbeing of the poor and corporate profitability via green technology converting micro-algae into biofuel. Not only that he has also applied the same concept of triple bottom line in converting a large dry land into a diversity park by growing seasonal trees, flowering and medicinal plants by using the local unemployed & jobless workers providing them a means of livelihood and increasing the earning of the state from foreign tourists visiting the diversity park.

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