INDIAN SUSTAINABLE TRANSPORTATION: THE CONCERNS ABOUT CERTAIN EMISSIONS & FUEL CONSUMPTION

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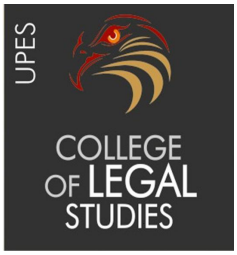
Submitted under the guidance of: Prof. SAM BABU K.C.

This dissertation is submitted in partial fulfillment of the degree of B.A., LL.B. (Hons.)



College of Legal Studies

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CERTIFICATE

This is to certify that the research work entitled **"*INDIAN SUSTAINABLE TRANSPORTATION: THE CONCERNS ABOUT CERTAIN EMISSIONS & FUEL CONSUMPTION*"** is the work done by **Avinash Choudhary** under my guidance and supervision for the partial fulfillment of the requirement of **B.A., LL.B. (Hons.)** degree at **College of Legal Studies, University of Petroleum and Energy Studies, Dehradun.**

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DECLARATION

I declare that the dissertation entitled **"*INDIAN SUSTAINABLE TRANSPORTATION: THE CONCERNS ABOUT CERTAIN EMISSIONS & FUEL CONSUMPTION*"** is the outcome of my own work conducted under the supervision of **PROF. SAM BABU K.C.**, at **College of Legal Studies, University of Petroleum and Energy Studies, Dehradun.**

I declare that the dissertation comprises only of my original work and due acknowledgement has been made in the text to all other material used.

Signature & Name of Student

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ABBREVIATIONS

BRT: Bus Rapid Transit

GDP: Gross Domestic Product

GEF: Global Environment Fund

ITS: Intelligent Transport System

IUT: Institute of Urban Transport (India)

JnNURM: Jawaharlal Nehru Urban Renewal Mission

KMC: Knowledge Management Centre

MoUD: Ministry of Urban Development, Government of India

MRT: Mass Rapid Transit

NGO: Non-Governmental Organization

NMT: Non-Motorized Transport

NUTP: National Urban Transport Policy

PT: Public Transport

SLBM: Service Level Benchmark

SUTP: Sustainable Urban Transport Project

TDM: Transport Demand Management

TERI: The Energy and Resource Institute

TOD: Transit Oriented Development

UT: Urban Transport

UTF: Urban Transport Fund

UNFCCC:

SPM: Suspended Particulate Matter

WCED: World Conference on Environment and Development

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I FEEL HIGHLY ELATED TO WORK ON THIS DISSERTATION TITLED, "**INDIAN SUSTAINABLE TRANSPORTATION: THE CONCERNS ABOUT CERTAIN EMISSIONS & FUEL CONSUMPTION** WHICH HAS NOT ONLY FULFILLED THE ACADEMIC REQUIREMENTS OF COMPLETION OF A DISSERTATION BUT ALSO HAS GIVEN ME AN INSIGHT ABOUT THE ISSUES AND CHALLENGES FOR THE POLICY MAKERS AND DECISION MAKERS SO AS TO BRING THE URBAN TRANSPORT POLICIES IN ORDER PERFECTLY SUITED TO THE REQUIREMENTS OF THE PUBLIC. THIS ANALYSIS BECOMES MUCH MORE IMPORTANT SINCE EVEN AFTER A LOT OF EFFORTS THE ROAD TRANSPORTATION IN URBAN AREAS IS IMPROPERLY MANAGED IN INDIA ESPECIALLY IN THE MEGA CITIES AND WE STILL ARE FAR AHEAD FROM THE REALIZATION OF THE CONCEPT OF SUSTAINABLE TRANSPORT.

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CHAPTER: I

INTRODUCTION

The major concerns about environmental quality, economic vitality, and social equity and at the most "the threat of climate change" has compelled for the emergence of the concept of Sustainable Development. It is the concern of human society and its need for security which has driven this concept. The term Sustainable development has many definition but the dominant definition, however, has always undoubtedly been that of Brundtland Report[1] which defines the Sustainable Development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Whereas, the word 'sustainable' connotes the future perspective with having the environmentally orientation while the 'development' is mainly being defined in the context of economic growth: as for instance the countries experiences the increased growth & their productive capacity expands and then they 'develop'[2].

Transportation on the other hand can't be excluded from the parameter of development as it provide boost to the Nation's GDP. It can be by means of air, land or sea but in the present thesis it would only be confined to the Urban Transportation and the linkage it possesses with the sustainability. The very concept of Sustainable Transportation has only been derived from the Sustainable Development and thereby can be termed as a branch of the latter. At present the urbanization has been accompanied and coincided with the increased consumption and ecological degradation across the globe. Determining the best way of dealing with the climate change has become the subtle goal.

Transportation plays a constructive role in obtaining a community's ability to provide services such as education and cultural programs and to control crime. It is an asset through which the communities can build and develop. It allows the communities with an option to the suburban sprawl which degrades inner cities and the environment and creates public health problems. Yet there is an inequity in the expenditure of public funds on urban/rural poor and communities of colour in comparison with those spent

[1] Report of the world commission on Environment and Development, Ch. 1(3), Dec. 11, 1987, A/RES/42/187.

[2] Michael Redclift, ROUTLEDGE: TAYLOR & FRANCIS GROUP, Sustainable Development: Exploring the Contradictions 14-15 (3rd ed. 2002).

on wealthy/suburban communities. Government has a responsibility to correct its historical lack of investment in inner city communities and repair the harm already done[3].

Although the transportation plays a very vital role in the human lifestyle but with the speed through which it is rapidly growing and being adopted, clearly signifies the severe impact upon its sustainability. The most important precondition for achieving Millennium Development Goals for the poor and vulnerable groups in the developing countries is the enhanced mobility. Whether it to be the trade, commerce, industry, education, tourism and services; those cities which are encompassing the integrated transport system are most likely to evolve and prosper in all the former fields. At present 30% of the Indian's population resides in the urban areas and the current trend which has already been inspired by the better quality of life, are posing multiple stresses on our environment.

The definition of sustainable transportation as has been put forward by the European Union Council of Ministers of Transport is appropriately indispensable for understanding the very concept. Hence, this definition, as quoted in 'Sustainable Transportation and TDM'[4] is reproduced here.

A sustainable transportation system is one that[5]:

i. Allows the basic access and development needs of individuals, companies and society to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations.
ii. Is affordable, operates fairly and efficiently, offers a choice of transport mode, and supports a competitive economy, as well as balanced regional development.
iii. Limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and uses non-renewable resources at or below the rates of development of renewable

[3] Jacky Grimshaw, *Public Facilities Siting & Transportation Access*, Race, Poverty & the Environment, Vol. 6, No. 1, Special Issue: Transportation & Social Justice, 11-14 (1995).
[4] Victoria Transport Policy Institute, Sustainable Transportation and TDM; available at http://www.vtpi.org/tdm/tdm67.htm (26 December 2010).
[5] Partha Chakroborty, *Sustainable Transportation for Indian Cities: role of intelligent transportation systems*, CURRENT SCIENCE, VOL. 100, NO. 9, 1387 (2011).

substitutes, while minimizing the impact on the use of land and the generation of noise.'

The Concerns about sustainability can easily be considered as a reaction to the tendency in decision making, to focus on easy-to-measure goals and impacts, while ignoring those that are more difficult to measure. Sustainable decision making can thereby be described as a planning, that considers such goals and impacts regardless of how difficult they are to measure. Interest in sustainability originally reflected concerns about long-term risks of current resource consumption, reflecting the goals of 'intergenerational equity' (i.e., being fair to future generations) and ecological integrity. On the other hand if future equity and environmental quality are concerns, it makes a somewhat little sense to ignore equity and environmental impacts that occur during this generation in distant places. Thus, sustainability ultimately reflects the goals of equity, ecological integrity and human welfare, regardless of time or location[6].

The present reality is that the urban transportation systems in most developing countries are far from ideal. The most visible and frequently mentioned transport problem of a city is its traffic congestion, and it is well known that high levels of congestion creates the major impact on a local and national GDP. The number of private vehicles has been increasing continuously and dominating the roads in India as well as in various Developing and Developed Countries. The day to day deficiency in accessing and affording the public transport service and safe infrastructure for non-motorized transport such as cycling and walking, would amount to a greater impact on the transportation Sustainability[7].

As a result, the transportation sector is heavily responsible for public health issues in cities such as air pollution (acidification, smog), noise, greenhouse gas emissions, and road accidents. Despite the fact that the transport facilitates the economy to grow, if not well-managed, it can also hinder the growth and the efficient delivery of essential social services. The lack of inclusive planning for transport systems, without due consideration to social, economic, environmental and cultural elements of the city, can

[6] Todd Litman & David Burwell, *Issues in Sustainable Transportation,* Vol. 6, No. 4 Int. J. Global Environmental Issues, 333 (2006).
[7] Carlos Felipe Pardo, *Sustainable Urban Transport*, Shanghai Manual- A Guide for Sustainable Urban Development in the 21st Century, 1-2 (2011).

very well ended in physical breaks in the fabric of communities and reinforce the social exclusion. The impact on quality of life and the environment cannot be underestimated[8].

The Environmental Concern

As the fact has already been explained above, about the linkage between the environmental degradation and the urban transportation throughout across the globe. Higher incomes, mobility, expanding cities and the proliferation of employment centres have increased the demand for motorised transport, resulting in a disproportionately high concentration of vehicles in urban centres.

The Indian cities at present are facing the challenge of power, resources and trained personnel to provide their rapidly growing population with clean drinking water, sanitation, sustainable transport system and other facilities. Along with over-crowding, Indian cities are filled with automobiles like scooters and private cars, buses and inappropriate industrialization. As due to the poor transportation and the inadequate measures to control the various types of pollutions, the Indian cities are mushrooming illegal settlements and slums with emission of harmful gases (Ex. Carbon Monoxide, SPM etc.) and the rampant diseases linked to an unhealthy environment. The proportion is significantly higher in cities like Mumbai, Chennai, Kolkata and Delhi.

A Nationally Coordinated Project on Urban Transport Environment Interaction was undertaken at IIT, Roorkee for studying traffic noise and air pollution at identified locations in the major cities of India (Delhi, Jaipur, Allahabad, Chandigarh and Lucknow) and to analyse the trend of various air pollutants and noise pollution. Air pollution parameters measured were Nitrogen dioxide (NO2), Sulphur dioxide (SO2), and SPM[9].

Consequent to the boom in automobiles in the urban areas the pollution level in the air has gone up. A study by Central Pollution Control Board reveals that the air pollution shares of transport have gone up from 20 percent to 70 percent in the last four decades.

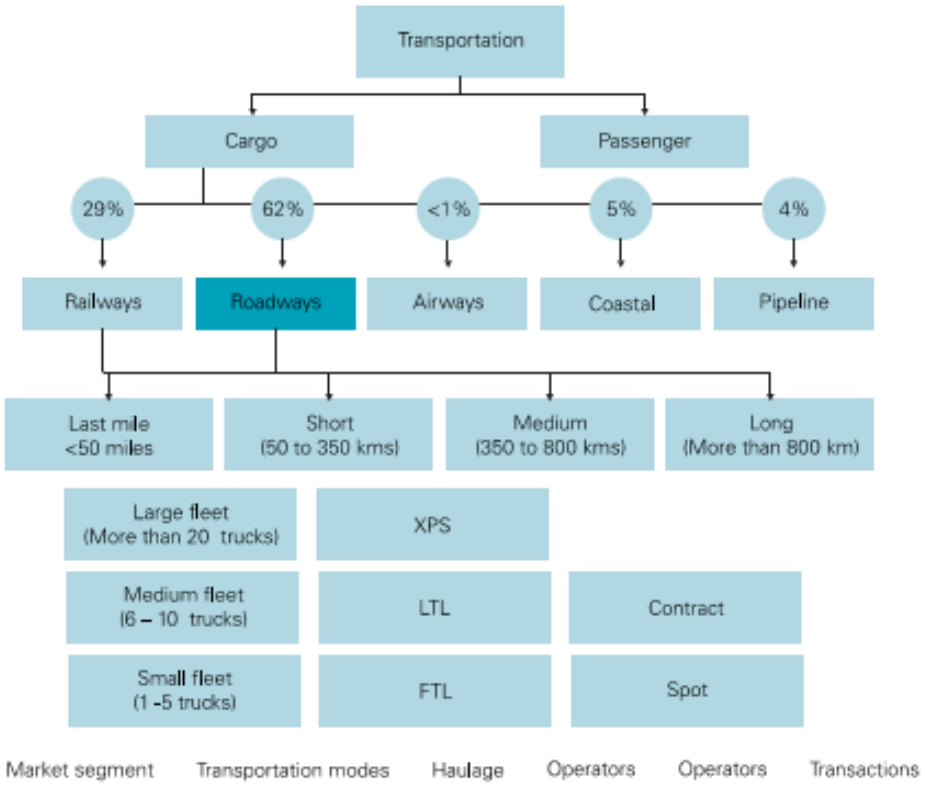
[8] 5 Supra at pg. 2.
[9] Dr Purnima Parida & Dr M Parida, *Environmental Concerns of Urban Transport and NMT as a Sustainable Transport Initiative in India*, CODATU XIII, 2-3 (2008).

The frequent traffic jams, increase in idling time of vehicles at intersections aggravate the pollution levels further.

The contribution of motor vehicles on total pollution in Nations Capital has increased from 23% in 1970-71 to 63% in 2000-01. Cars and two wheelers contribute to 11.5% and 77.7% of the total transport related air pollution. The largest share of transport activity is by road. Road transport is responsible for over 80% of fossil fuel energy consumption and responsible for around 64% of the total air pollution load.

Vehicular contamination is in charge of various respiratory and different infections. All over India, particularly in metro urban areas, individuals are experiencing diverse sorts of ailments as a consequence of vehicular contamination. Continued exposure to high levels of noise results in annoyance, fatigue and temporary shift of hearing; which may prompt lasting loss of hearing. There is expanding proof that commotion introduction causes physic-natural aggravations like changes in assimilation, digestion system, blood dissemination and so forth.

The most important mode of transportation in India is road on which the logistic chain is mainly dependent upon, and this dominance arises from decades of poor supporting infrastructure development on the rail, coastal, pipeline and air transportation side. Despite having one of the world's largest rail networks, India's share of cargo transported by rail has declined steadily. A look at Fig. 1.1 will indicate the shipment of Cargo through the road network.



Source: - Crisis's Roads and Highways Annual Review (2009), KPMG Analysis[10]

Fig 1.1 Evolution of the Road Sector: Roads- The Key Model of Transportation

China is one of the fastest growing countries in the world, and it is also one of the countries with the greatest development improvements in a short time. This kind of development has important implications in terms of social, environmental, and economic repercussions at a world level.

Taking the transport into the consideration, there are two major policy decisions that have to be acknowledged: Firstly, the decision as to the priorities of the automobile industry and Secondly the decision to improve the urban public transport network. On the basis of these two decision, which appears to be contradictory, the transportation development should be ignited coherently to arrive at an optimum mix of improved public and private transport situation for the Indian cities, while not hampering its industrial development.

[10] KPMG, *Adding Wheels*, 20-21 (2010).

Hence, unless the requirements of non-motorised modes of transport are fulfilled, it will be almost incredible to acquire any sustainable transport environment for India's urban areas in general and in megacities in particular. Opportunities regarding the mode of transport by individuals are based on economic factor, convenience and safety. Among all these concerns, the one involving safety is the most challenging for an individual. An indispensable aspect in deliberating the advantage of mobility versus perception of accidental risk, which is the road user's sense of time saved by driving faster exceeds that in reality.

The safety advantages are realised only by a relatively smaller segment of people who save many years of their lives without falling prey to pre-mature accidental deaths. A real issue in articulating a sustainable transport strategy aimed at increasing mobility of motorised vehicles & that the pedestrians and non-motorised road users who do not benefit from increased mobility are widely open to increased accident risk. This requires a constant bearing on planning for public transport, and the safety on the roads[11].

Also, measures to decrease air and commotion contamination might on occasion go up against with those obliged for lessening in street mishaps, For Example, on an normal, increments in vehicular velocities may lessen emanations of toxins however they can quicken the rate of street mishaps.

Therefore three angles are essential to the production of a feasible urban transportation framework. As said before, these are:

(i) The habitat of which the transportation system is a part;
(ii) The resources that such a system will need to harvest, and
(iii) The measure of effectiveness that ought to be utilized to assess such a system.

Thereby, on being implementation of few above-mentioned suggestions, the present thesis tries to come at a valid and the substantial conclusion for featuring the sustainable transportation methodology on Indian Roads. The brief description of the certain chapters that is to be follow in the present thesis are as follows:-

[11] Ashok Kumar, *Sustainable Transport Environment in Indian Megacities: Problems and Remedies,* Department of Geography, University of Mumbai, 2-3 (2005).

The Chapter II of the thesis discusses about the very concept of Sustainable Development and tries to demonstrate its relationship with the Sustainable Transportation. Moreover it deals with the adoption of sustainable transportation in the Western nations for protecting the environment and peeks into the position of Sustainable transportation in India.

Chapter III on the other hand mostly focuses on the Environmental Issues in the present transportation system all over the developed as well as in developing nations like India. Further it provides for the various type of pollutions & emission of harmful gases emerging due to the ongoing transportation practices. The laws in India which are governing such emission of dangerous gases and pollution; and whether they are in compliance with the International standards set out by various conventions, treaties and agreements.

Chapter IV discusses the facets of JNNURM policy and NUTP in relation with environment safety and sustainable transportation. Moreover it suggest improvements in its existing features and scope.

Chapter V further concentrates itself to the one aspect of the sustainability on which the present thesis is entirely based upon and that is in relation with the transportation. On the other hand in this present chapter the efforts has been made to justify the relation between the sustainable development and sustainable transportation. Moreover the present chapter after analysing the various issues & challenges in the present mode of transportation in urban cities provides some basic strategies which can very well be adopted if it's being inserted into the NUTP or JNNUR mission in India.

Chapter VI tries to arrive at the reasonable conclusion as in relation with all the above-mentioned chapters.

CHAPTER: II

SUSTAINABLE TRANSPORTATION: PROTECTING THE ENVIRONMENT FOR POSTERITY

Although the origin of the very concept of Sustainable Development may be traced back to decades and even centuries, but it became prominent and persistent feature in the late 1980s with the publication of the Brundtland Commission's landmark report, our common future[12].

In 1984, the United Nations established a sovereign group of 22 people drawn from member states of both the developing and developed worlds, and provide them with responsibility of identifying the long-term environmental policies for the international community. In 1987, the World Conference on Environment and Development published their report entitled, 'Our Common Future' (WCED, 1987), often known as the 'Brundtland Report', after its chair, the then Prime Minister of Norway, Gro Harlem Brundtland[13]. The report used the term 'sustainable development' widely and defined it as 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. This particular report has put the sustainable development firmly into the political arena of international development thinking. Also, it has been translated into more than 24 languages (Finger, 1994) and its explanation of the term remains to be that which is most widely used.

In the fall of the last Millennium, the single term 'sustainability' has became an overall guiding principle for human development. The success of it, stems from the underlying reflections on existent problems of mankind apparent at that time: the major concern over exploitation of natural resources and economic development at the expense of environmental quality[14].

[12] World Commission on Environment and Development, Our common future (Oxford: Oxford University Press, 1987). Full text available at http://www.un-documents.net/wced-ocf.htm, accessed 3rd April, 2015.
[13] *Ibid 12.*
[14] Marco Keiner, Hitory, Definition(s) and Models of "Sustainable Development", 1-3, 2005.

In 1992, the UNCED or the 'Earth Summit', took place in Rio de Janeiro, Brazil[15]. At that time, it was the largest ever international conference held till now, with over 170 governments represented (Adams, 2001) and on further 2,500 NGOs and 8,000 attributed journalists attending (O'Riordan, 2000). The principle aim was to identify the ideologies of an agenda for action towards sustainable development in the future. A souvenir of that Summit can be seen in Fig. 2 in which the dominant meaning of the concept has been summarized in few words.

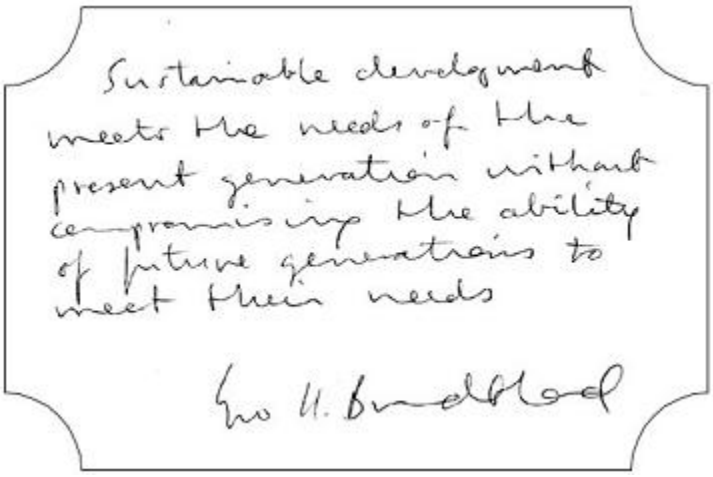


Fig. 2.1 The Definition of Sustainable Development (autograph of Gro Harlem Brundtland)

The task has been seen to require agreement at the topmost level, so that, for the first time, heads of state gathered to consider the environment. Up till now, the term 'sustainable development' had also 'gained a currency well beyond the confines of global environmental organisations' (Adams, 1990: 2). Undoubtedly in the developed world, the substantial media attention provided to the serious environmental troubles, surrounding forest fires in Indonesia, flooding in the Americas, China and Bangladesh, and typhoons in South-East Asia, for example, brought questions of preservation and ideas of sustainability into the public vocabulary. In the fields of development and the environment, an evident consensus was emerging that sustainable development was an important rallying point for research and action and a desirable policy objective which should be striven for[16].

[15] Jennifer A. Elliott, an Introduction to Sustainable Development, Routledge Perspectives on Development, Taylor and Francis Group, 8-9 (3rd ed. 2006).
[16] Richard A. Matthew and Anne Hammill, *Sustainable Development and Climate Change*, Int. Affairs (Royal Institute of Int. Affairs), Vol. 85, No. 6, 1117-1128 (Nov. 2009).

On the other hand, this specific perplex situation has been caused because sustainable development, sustainable growth and sustainable use have been used inter changeably, as if their meanings were the same[17]. But indeed it is not true. "Sustainability" is that characteristic of a process or a state which can be maintained indefinitely (for all practical purposes). Sustainable growth meanwhile is a contradiction in terms: nothing physical can grow indefinitely. Sustainable use is only applicable to renewable resources: it means using them at rates within their capacity for renewal. Sustainable development is being used in the Strategy to mean this & i.e.: "improving the capacity to convert a constant level of physical resource use to the increased satisfaction of human needs." "This is consistent with the WCED's definition: but recognises explicitly that qualitative development can be maintained while this quantitative growth in the scale of the economy is constrained by the capacity of the ecosystem to regenerate raw material inputs and absorb waste outputs."

2.1. Emergence and Evolution of the Concept of Sustainability

When we wish to study the foundations of issues related to the interface between development and sustainability, it would be a decent beginning stage to quickly outline the development of the thought of advancement, not only because it was the precursor to notions of development, but also because it would in due course as its own opposition elicit calls for sustainability. In the literature progress, the idea 'that civilization has moved, is moving, and will move in a desirable direction', has been investigated in terms of scientific (and technological), material and moral advancement (Von Wright 1997: 7).

Despite the fact that the terms 'sustainability' and 'sustainable' has appeared for the first time in the Oxford English Dictionary during the second half of the 20th century the alike terms in French (durabilite´ and durable), German (Nachhaltigkeit, literally meaning 'lastingness', andnachhaltig) and Dutch (duurzaamheid and duurzaam) have always been used for centuries (Van Zon 2002: 20, 21, 22)[18].

The interest for crude materials and its effect on the earth have been a consistent issue all through mankind's history. Environmental problems such as deforestation and the

[17] Naresh C. Singh, *SUSTAINABLE DEVELOPMENT- IT'S MEANING FOR THE CARIBBEAN,* Sir Arthur Institute of Social and Economic Studies, Vol. 41, No. , 151-152 (1992); Accessed on 5th April, 2015.
[18] Jacobus A. Du Pisani, *Sustainable development – historical roots of the concept*, Environmental Sciences, 3:2, 83-96 (2006).

salinization and loss of fertility of soil, which we presently refer them as sustainability problems and that in the ancient Egyptian, Mesopotamian, Greek and Roman civilizations has already been discussed. Plato in the 5th century BC, Strabo and Columella in the 1st century BC and Pliny the Elder in the 1st century AD discussed different types of environmental degradation which results from the human activities such as farming, logging and mining. These authors were not only aware of environmental degradation, but also suggested what we would call sustainable practices to maintain the 'everlasting youth' of the earth. Varro (1st century AD) stated that 'we can, by care, lessen the evil effects'.[19]

Before the 18th Century the major concern was the shortage in the wood because it has only been used until now as a fuel and construction material & thereby making it as an indispensable raw material at that period. But later in the 18th century the concern was shifted to population growth and its consequences for the consumption of resources. Later in the 19th century the centre moved to coal as most critical wellspring of vitality and alerts were raised that coal stores may be depleted.

More than a century prior to the term 'Sustainable Development' came into general utilize, a number of productions showed up which managed what we would today call practical improvement. In *Principles of political economy*, first published in 1848, John Stuart Mill included a short chapter on the 'stationary state', which implied a stationary condition of capital and population, but not of human improvement. 'I sincerely hope, for the sake of posterity', he wrote, and that the world's population 'will be content to be stationary, long before necessity compels them to. George Perkins Marsh's Man and nature, published first in 1864, has been described as the fountainhead of the conservation movement. Marsh stated: 'Man has long forgotten that the earth was given to him for usufruct alone, not for consumption, still less for profligate waste'.

He depicted how diverse parts of the regular habitat had been exasperates by human intercession and contended that the Earth may get to be unfit for human home, which may even result in the eradication of mankind. Be that as it may he likewise examined conceivable solutions for natural issues. Marsh would not have liked to secure nature

[19] *Ibid 17.*

for its own particular purpose, however for the purpose of mankind, which is like the methodology of the contemporary defenders of reasonable advancement.

2.1.1 A Short case study: "Let us arise and Plant" - John Evelyn's 'Sylva'[20]

The primal activity for turning towards practical techniques for ranger service originated from the Commissioners of the British Royal Navy. In 1662 they have feared that a shortage of timber, especially of tall oak trees, would threaten their plans to equip their convoy with bigger and better ships, thus strengthening the wooden 'bulwarks of the kingdom' and – indeed – the spearhead against the 'Hollanders' and other rivals in the bloody skirmish for global reach and global control.

Those reasons for alarm were not unwarranted. Since 1500, Britain had been persistently losing quite a bit of her forests. The developing populace expanded the requirement for kindling and house-building material. New glass production lines and ironworks devoured colossal measures of charcoal, their just fuel. Amid the Civil War (1642 - 1651) a number of the conventional primitive laws and traditions securing the forested areas had crumpled or were relinquished. As the wide open was more deforested, a possibly appalling asset emergency came in sight.

The admirals has brought this emblematic topic before the Royal Society, which has newly been founded research institution consisting with the rank of most brilliant minds in the country. In several addresses the Royal Society has discussed this topic. Later, within two years after the oral discourse in the halls of the Royal Society, Evelyn had completed his book. On February 16, 1664 he presented it to the King, the Royal Society and to the public his 'Sylva or a Discourse of Forest Trees and the Propagation of Timber in His Majesties Dominions'. The book became a 17th century best-seller and has been instigated, according to Evelyn's remarks in later editions, the planting of millions of trees all over England. It tackled the timber problem in a way that certainly went beyond the schemes of the Royal Navy.

[20] Ulrich Grober, *A Conceptual history of 'Sustainable Development* (Nachhaltigkeit), Social Science Research Centre Berlin for Social Research, 8-9 (February 2007).

> Although, many has declined to provide their assent on the implementation of the great idea provided by Evelyn's. Later on, in his arguments he persistently call that "Let us arise then and plant" and that has been backed by numerous examples of successful forestry all over Europe. He points to the "Noble Forest of Nuremberg" as an example for an "almost continual forest". He mentions Montello-Wood in Northern Italy, which over the centuries had provided sufficient timber for the famous Arsenale of Venice and applauds the legislation of Luxembourg where "no farmer is permitted to fell a timber-tree without making it appear he hath planted another". As he describes the practice of land-owners in France and Germany, who "divide the woods and forests into eighty partitions, every year felling one of the divisions, so that no wood is felled in less than fourscore years", the book touches on the basic methods of early sustained-yield forestry.[21]

The particular suggestion, which has been portrayed in the above case study may not have been very much successful in Britain at that point of time, but peeking into the situation that exist now especially when the matter is in itself in relation with the transportation, such idea can very well be the part of the solutions for promoting the Sustainable Transportation.

2.2 The Dimensions of Sustainability

In several definitions of Sustainable Development which incorporates the very idea that there are three interdependent pillars of sustainable development and i.e. Environmental, Economical, and Social. In other words, these three independent pillar reflect all the dimension of the Sustainable Development and consequently these also defines the objective of the concept. In the year 1987 Barbier has presented these three interlocking circles which can be seen in Fig. 2.2.

[21] Supra 19 at pg.

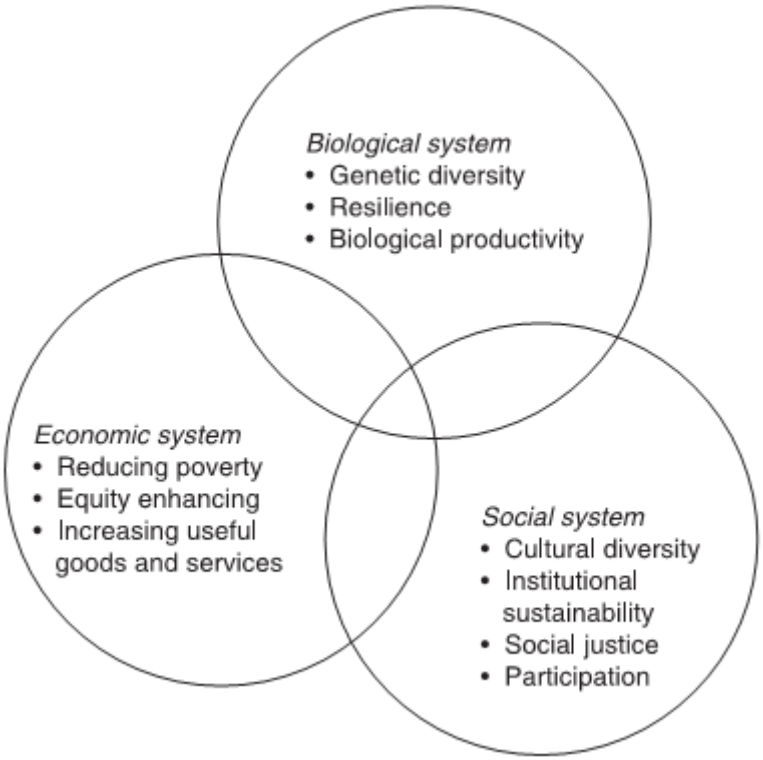


Fig. 2.2 The Objectives as well as Dimensions of Sustainable Development

Source: compiled from Barbier (1987).

While several of the early contribution for defining Sustainable development has come from the disciplines of economics and ecology, but the third sphere has accommodated the more complex labour. For Starkey and Walford (2001), as for instance, supportable advancement is a moral idea that tries to characterize a 'reasonable and just' advancement. They propose that since nature is the premise of all the monetary action, what's more, of life itself, ‘it is surely only right that the quality and integrity of the environment be maintained for future generations’. The Impression of ‘environmental justice’ are currently a noticeable part of contemporary examinations of the importance and practice of sustainable development and take the ethical concerns further: in addition to environment protection, the worry is for how environment is being ruined (for example, pollution) and products, (for example, access to green space) are circulated crosswise over society. Environment justice additionally incorporates a concern toward the value of environment administration interventions and the nature of public indulgence in choice making. Comprehension is mounting of the political way of manageable advancement by and by; how the arrangements proposed (and the

decisions furthermore, exchange offs made) can convey distinctive expenses for diverse gatherings of individuals.

Development has always been discussed in relation with the 'developing Countries', but it is a notion which relates to all parts of the world at every level, from the individual to global transformations. It is something by which we all aspire and, specifically in the more developed world, 'self-development' has become something which is actively advocated and an endeavour on which large amounts of money are spent. Ideas about the best means by which to achieve our aspirations and needs are potentially as old as human civilisation[22]. The study of development, however, has a relatively short history, really dating back only as far as the 1950s. Since then, the interdisciplinary field of development studies has seen many change in thinking regarding the meaning and purpose of development and in development practice in the field.

2.3 The Major Problem – Rising of Population in Urban areas

The general trend all over the developing, as it can be seen in Fig. 2.3, there are noteworthy differences between regions and countries in the pattern of change.

Region	Millions (2003)	% of world total, 2003	Predicted annual rate of change (%), 2000–30
Africa	329	10.8	3.10
Asia	1,483	48.7	2.22
Europe	530	17.4	0.10
Latin America and Caribbean	417	13.7	1.42
North America	261	8.6	1.16
Oceania	24	0.8	1.07
Total	3,044	100	

Source: Compiled from United Nations (2003).

Fig. 2.3 Actual and predicted distribution of the world's urban population, by region

Thereby, it can very well be seen as the Asia has the largest numbers of people residing in urban areas and where the greatest expansion in terms of additional urban resident will occur in the future. Countries as like India have very large urban (as well as total) populations, for example. Indian cities such as Calcutta and Mumbai are amongst the largest centres in Asia and indeed the world.

[22] Jennifer A. Elliott, *an Introduction to Sustainable Development*, Routledge Perspectives on Development, Taylor and Francis Group, 8-9 (3rd ed. 2006).

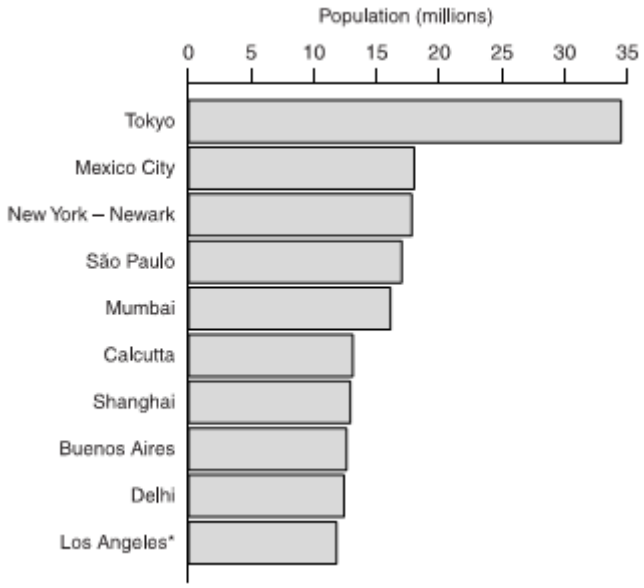


Fig. 2.4 The world's largest urban agglomerations in 2000

Issues of air contamination have long been connected with urban areas, albeit there is at present much assorted qualities worldwide in the relative significance of specific toxins. Contamination levels can likewise fluctuate generously via season. In the creating scene, sulphur dioxide contamination and the centralization of suspended particulates are the real reasons for urban air contamination, bringing about the fundamental from modern generation and the blazing of coal, oil and biomass fills. In many urban communities of the more created areas, more tightly natural regulations, measures to advance more productive fuel use and the more noteworthy utilization of the slightest contaminating powers, (for example, characteristic gas for local and mechanical utilization) have diminished contamination from these 'customary sources'. Nonetheless, extensive ecological issues moreover stem from exercises other than modern creation. Congested streets and ineffectively looked after vehicles, for instance, are a developing wellspring of "photochemical".

2.4 Towards Sustainable Urban Development

Reversing the deterioration of the urban environment without slowing economic development will require an environmental policy strategy that takes into account a wide range of actors, difficult political and economic trade-offs, and a complex set of natural, social, and economic relationships.

(Bartoneet al., 1994: 8)[23]

Meeting the needs of the present . . .

- Economic needs: include access to an adequate livelihood or productive assets; also economic security when unemployed, ill, disabled or otherwise unable to secure a livelihood.
- Social, cultural and environmental health needs: include a shelter which is healthy, safe, affordable and secure, within a neighbourhood with provision for piped water, sanitation, drainage, transport, health care, education and child development. Also a home, workplace and living environment protected from environmental hazards, including chemical pollution. Also important are needs related to people's choice and control – including homes and neighbourhoods which they value and where their social and cultural priorities are met. Shelters and services must meet the specific needs of children and of adults responsible for most child-rearing (usually women). Achieving this implies a more equitable distribution of income between nations, and in most, within nations.
- Political needs: includes freedom to participate in national and local politics and in decisions regarding management and development of one's home and neighbourhood – within a broader framework which ensures respect for civil and political rights and the implementation of environmental legislation.

. . . without compromising the ability of future generations to meet their own needs

- Minimising use or waste of non-renewable resources: including minimising the consumption of fossil fuels in housing, commerce, industry and transport plus substituting renewable sources where feasible. Also, minimising waste of scarce mineral resources (reduce use, re-use, recycle, reclaim). There are also cultural, historical and natural assets within cities that are irreplaceable and thus non-renewable – for instance, historic districts and parks and natural landscapes which provide space for play, recreation and access to nature.
- Sustainable use of renewable resources: cities drawing on freshwater resources at levels which can be sustained; keeping to a sustainable ecological footprint in terms of land area on which producers and consumers in any city draw for agricultural crops, wood products and biomass fuels.
- Wastes from cities keeping within absorptive capacity of local and global sinks: including renewable sinks (e.g. capacity of river to break down biodegradable wastes) and non-renewable sinks (for persistent chemicals; includes greenhouse gases, stratospheric ozone-depleting chemicals and many pesticides).

In congruity with the advancement indicated towards sustainable rural development, if the needs of urban inhabitants worldwide are to be met without bargaining the capacity of future eras to meet their own needs, change is needed all throughout the local problems, there causes and where the Urban Transportation system in India and in many developing nations occurs to be the major local problem for sustainability.

[23] Jennifer A. Elliott*, an Introduction to Sustainable Development*, Routledge Perspectives on Development, Taylor and Francis Group, 222-224 (3rd ed. 2006).

CHAPTER: III

POLLUTION: THE CONCERN FOR SUSTAINABLE TRANSPORTATION

The impact of various pollutants such as carbon monoxide, SPM etc. on human health is very much dangerous in nature and can easily be the cause of short death. The exposure to air contamination is a major environmental health problem, affecting the developing and the developed countries in the same manner. Transport is evaluated to be in charge of almost a quarter of worldwide vitality related CO_2. There are also worries rising about its effect on the nature of the urban life, including social disparities, and about the impacts of its contamination on wellbeing and structures.

The several industries, power plants etc. are the major cause of stationary air pollution. But in the urban areas in both in developing and developed countries, it is predominantly mobile or vehicular pollution that majorly contributes to overall air quality problem. In National capital, the data shows itself that the total 3,000 metric tonnes of pollutants erupts out every day, almost two-third or 66% is from vehicles. Likewise, the involvement of vehicles in the urban air pollution is 52% in Bombay and nearby 1/3rd in Calcutta. Katz (1994) has projected that in Santiago, Chile, wherever the pollution concentration exceeds the ambient standards, mobile sources or vehicles are the major cause. Similarly, in the case of Budapest, Hungary, transport is the dominant source of emissions apart from sulphur dioxide (SO2), it is contributing 57% of Oxides of Nitrogen (NOx), 80% of lead (Pb), 81% of carbon monoxide (CO) and 75% of hydrocarbon (HC) emissions[24].

It is settled that air quality in different cities has shifted spatially furthermore that contamination in a given city changes transiently, yet also vital is the conveyance of air quality inside an extensive city. The air quality in the city could have been highly skewed distribution and affecting many of the people more adversely than the others.

Air contamination is one of the major ecological issues that has been confronted by Delhi today. Notwithstanding with the successful usage of the utilization of compacted common gas (CNG), Delhi is still a standout amongst the most contaminated urban communities of Asia and positions fourth on the planet. Rapid urbanization and the subsequent increment in the quantity of vehicles have contributed fundamentally to the

[24] Dr. Vinish Kathuria, *Vehicular Pollution Control-Concept Note*, Madras School of Economics, 1-2 (2005)

increment in ignition of petroleum items, and consequently, contamination. Vehicular contamination contributes 67 % of the aggregate air contamination stack in Delhi, while commercial enterprises and coal based warm power plants contribute around 25 %. Prior to the appraisals in 1995 by the Centre for Science and Environment (CSE) show that around 9,859 individuals kick the bucket rashly consistently in Delhi because of the terrible nature of air. Besides, the occurrence of respiratory illnesses in Delhi is 12 times the national normal with 30 every penny of Delhi's population experiencing the respiratory issue[25].

There is a developing accord on the requirement for more feasible examples of transport exercises. This indulges the principal move in speculation examples, in light of the standards of evading or decreasing excursions through incorporated area utilize and transport arranging. Besides form that it is important to move to all the more earth well-disposed modes of transport and enhancing vehicles and fills, which is seen as a need to lessen urban air contamination and nursery gas emanations. Keeping in mind the end goal to lessen volumes of activity and emanations, regulations and models, natural agreeable innovations and ideas for open transport and 'green urban communities' must be executed. UNEP encourages the various governments and to accomplices in actualizing arrangements, innovations and speculations that prompt low-carbon, green transport on the ground.

3.1. The ill it contains

The most exceedingly terrible thing about the vehicular contamination is that it can't be dodged as the outflows are transmitted at the close ground level where we breathe. Contamination from vehicles gets reflected in expanded mortality and dreariness and is uncovered through symptoms like hack, cerebral pain, queasiness, disturbance of eyes, different bronchial problems and deceivability. The contamination from vehicles are due to the discharges of various pollutants like CO, unburned HC, Pb compounds, NOx, soot, SPM and aldehydes etc.. A recent reports study that in Delhi out of 10 one children suffers from the asthma that is worsening due to vehicular pollution[26]. As indicated by the World Health Organization (WHO), 4 to 8% of deaths that happen every year on

[25] Vinish Kathuria and Nisar A. Khan, Vulnerability to Air Pollution: Is There Any Inequity in Exposure, Economic and Political Weekly, Vol. 42, No. 30, 3158-3165 (Ag. 2007).
[26] Source: www.oneworld.org/cse/html/eyou/eyou222.html accessed on April 4th, 2015

the planet occur due to the air pollution and of its constituents, the WHO has distinguished SPM as the most evil in wording of its impact on health.

The SPM is not standardised it has a number of constituents. As a result, it is measured and characterised in various ways, such as:

1. TSP (Total suspended particulates) with particle diameters < 50-100 μm is the fraction sampled with high-volume samplers.
2. PM_{10}: Inhalable particles having a diameter <10 μm penetrates through the nose, by breathing.
3. Thoracic particles: are approximately equal to PM_{10} particles.
4. $PM_{2.5}$: 'Fine fraction' with a diameter <2.5 μm penetrates to the lungs; and
5. Black smoke: a measure of the blackness of a particle sample gives a relative value for the soot content of the sample. Due to their high health damaging potential, recent studies have started paying more attention to PM_{10} and $PM_{2.5}$ particles.

As due to the different air pollutants because of vehicles can have effect at all of the three levels:

a) Local Level – (for ex: ambient air, smoke affecting visibility, noise etc.)
b) Regional Level – (for ex. Acidification, smog etc.); and
c) At global Level – (i.e. Global Warning)

The number of other external effects also accompanies with the vehicle such as noise, congestion, accidents, road wear and tear, and 'barrier effects'.

3.2 Vehicular Air Pollution – Causes of Emissions

The vehicular pollution sources aren't similar, as there exists a complete range of technological mix. This mix could be in a terms of fuel used – gasoline or diesel or natural gas; or engine type – 2-stroke or 4-stroke and/or a combination of all of these.

3.2.1 Emissions from Gasoline Vehicles[27]

The Gasoline powered engines are of 2 types and i.e. 2-stroke and 4-stroke. The fumes discharges from gasoline-run vehicles comprise of CO, HC, NOx, SO2, and fractional oxides of aldehydes, other than particulate matters counting lead salts. The inadequate

[27] 36 Supra at pg.

burning of fuel due to an awkwardness noticeable all around fuel proportion leads to discharges of CO and HC particularly from 2-stroke motors. The Nox, in any case, are framed because of high ignition temperature and accessibility of oxygen and nitrogen in the burning chamber, though aldehydes result from the halfway oxidation of HC. In urban areas, majority of the pollution is emitted by vehicles consuming gasoline especially 2 and 3-wheelers, having predominantly 2-stroke engine.

3.2.2 Emissions from the Diesel Vehicles

As the diesel motors inhale just the air, which is being blow by gasses from the crankcase (comprising fundamentally of air and HC) are somewhat low. Because of its low instability, evaporative emanations from the fuel tank can likewise be disregarded. The low centralization of CO and un-blazed HC in the diesel fumes are remunerated by high centralization of NOx. Diesel motors additionally discharge smoke particles and oxygenated HC, including aldehydes and smell creating mixes having high aggravation esteem.

The Smoke from the diesel engines comes in three different kinds; Firstly the white smoke emitted during cold start idling and at low loads; secondly the blue smoke from the burning of lubricating oil and additives; and lastly the black smoke, a product of incomplete combustion. Black smoke which is the most obvious type of vehicular air pollution, consists of irregular shaped agglomerated fine soot/particulates and the formation of which depends on injector nozzle parameter and upon the type of combustion chamber (direct or indirect injection).Black smoke is a particular problem with diesel engines that are not well tuned, which is generally the case with the developing nations.

3.2.3 The Impacts of Fuel quality on emissions

As it is not an oblivious fact that so much of pollution control depends upon the quality of the fuel. Thereby the characteristics that regulate the fuel quality also becomes very necessary. A high Reid pressure[28] on account of fuel motor causes a high evaporative outflow while an increment in the thickness brings about a concurrent increment in CO and HC in the depletes. In like manner on account of diesel vehicles, a higher thickness causes higher smoke, CO and NOx outflows, while upgrading the cetane number of

[28] The Reid vapour pressure (RVP) means the absolute vapour pressure of a petroleum production pounds per square inch (or kilopascals) at 100°F or 37.8° C.

ignition quality brings down the smoke emanation. The sulphur substance of diesel has been seen to have a direct bearing on the SPM and SO_2emissions (CPCB, 1999).

3.2.4 Emission Caused by Congestion

Congestion causes a twofold impact. In the first place the time expense of a vehicle kilometre ascents quickly with expanded clogging. This is on account of the expansion of a vehicle to an effectively gathered system expands travel time for some different travellers. Since the normal rate has diminished to levels that are far beneath the ideal working vehicles speed, this prompts increment in rate of outflows every kilometre – therefore the two impacts are interrelated. A reduction from40 km/h to 20 km/h doubles the emissions of CO and volatile organic compounds (VOCs) for a car fitted with a catalytic converter. Since VOCs and CO are 250% higher under congested conditions than during free-flowing traffic, poor air quality is the consequence.

3.3 Harmful Effect of Vehicular Pollution and Health Hazards

The pollution caused by various motorized vehicles, mostly in urban areas, has the very ill effect. Table 1 is in itself explanatory to such statement.

Table 1. Main Pollutants and Health Effects

Pollutant	Health Effect
SO_2	Acid rain, damage to lungs, eyes and skin
SPM	Bronchitis and Asthma, Damage of lungs
NO_x	Form Smog damage to respiratory system and eye irritation
Pb	Nervous system slow down and brain development is retarded; slow reaction time
CO	Toxic causes blood poisoning
HC	Cancer

Source: - Delhi Environmental Status Report: Pollution Monitoring and Technical Corporation Division, New Delhi

As Studied, these following important facts are worth-mentioning to grip the health problems generated by the air pollutants[29]:

- A study reveals that the cases of the respiratory diseases and allergies has almost doubled since 1990.
- Around 80-90 % lead in ambient air is attributed to the composition of leaded petrol. Unleaded petrol contains high level of benzene, which may cause lung cancer.
- The level by which the air pollution, in cities like Kolkata, Mumbai, Delhi, Chennai, has been increasing with such a tremendous rate that the WHO has suggested the tourists to limit their visits.
- A report by World Bank underlines that nearly more than 40,000 people die prematurely per year in India due to health problems caused by air pollution.

3.4 Global Atmospheric Impacts

The major global atmospheric impacts from the transport sector, are the emission of CO_2 and the leakage of CFC. The Kyoto protocol was originally intended to set the limit on these emissions for most of the developed nations of the world but the US decline to sign on to the protocol. The CO2 and some detected gases are collectively known as greenhouse gases. It has generally been believed by the scientific community that the emissions of these gases will cause the warning on the planet and this shall lead to melting of some middle-latitude glaciers and upper latitude ice cover, and the melting along with thermal expansion of the ocean and lastly will only result into the rise of sea level[30].

The significant concern as to CFCs is that they were making openings in the ozone layer encompassing the planet. The gaps expanded the measure of bright radiation coming to the surface, which would prompt issues going from unsettling influences to

[29] Ashok Kumar, *Sustainable Transport Environment in Indian Megacities: Problems and Remedies,* Department of Geography, University of Mumbai, 8-9 (2005).

[30] Transportation Research Board: The Executive Committee, *Integrating Sustainability into the Transportation Planning Process*, 40-42 (2004).

the sea nourishment anchor to an increment in human skin malignancies and eye sicknesses.

It would be misdirecting to feel that the issues of the ozone layer have been fathomed. Emanations of CFCs set up a chain response that proceeds with today. We can't be sure when it will stop, in spite of the fact that a few decades has been recommended by many.

3.5 The Statistics[31]

Categories	CO_2	CO	NOx	SO_2	PM	HC
Bus	28748.16	207.26	679.73	79.24	31.36	51.72
Omni Buses	8508.42	60.94	200.53	23.45	9.28	15.11
2-Wheeler	8701.08	719.64	62.15	4.25	16.36	464.49
LMV(Passenger)	4378.10	370.29	92.93	2.11	14.52	10.16
LMV(Goods)	44654.58	442.04	110.94	123.02	17.33	12.13
Cars and Jeep	23901.22	212.30	22.14	5.67	3.22	38.01
Taxi	2367.08	10.23	5.68	117.05	.80	1.48
Others	5705.22	57.41	64.54	32.19	3.98	8.96

Fig. 3.1 Emission from different vehicles in India

Source: CPCB Website

[31] Shivastava R.K., Saxena Neeta and Gautam Geeta, *Air Pollution due to Road Transportation in India: A review on Assessment and Reduction Strategies*, J. of Environmental Research and Development, Vol. 8 No.1, 73-74 (2013).

City	Pollution load in metric tons per day			
	CO	NOx	HC	PM
Delhi	421.84	110.45	184.37	12.77
Mumbai	189.55	46.37	89.93	10.58
Kolkata	137.50	54.09	47.63	10.80
Chennai	177.00	27.30	952.64	7.29
Bangalore	207.04	29.72	117.37	8.11
Hyderabad	163.95	36.89	90.09	8.00
Kanpur	28.73	7.25	11.70	1.91
Agra	17.93	3.30	10.28	.91

Fig.3.2 Estimated pollution load in Indian Cities

Source: Auto Fuel Policy Report

CHAPTER: IV

THE TRANSPORT SECTOR: EVOUTION OF NATIONAL URBAN TRANSPORT POLICY

India's transport sector is huge and diverse; it furnishes to the needs of 1.1 billion people. In 2007, the sector contributed about the 5.5% to the nation's GDP, through road transportation contributing the lion's share. The good physical connectivity in the urban and rural areas is very much indispensable for economic growth. Since early 1990s, the India's growing economy has witnessed a growth in demand for transport infrastructure and services. Though, the sector has not been able to keep pace with increasing demand and is showing to be a drag on the economy. Several major improvements in this sector, are required to backing the country's present economic growth and to minimise the poverty.

A scarcity of suitable infrastructure and the services has been acknowledged as one of the most imperative roadblocks in the sustainable development in the Indian cities. India is on-going on a plan to confront the various challenges showed by fast urbanization and motorization by quickening the supply of infrastructure and services. As being a part of this overall plan, the Government of India has introduced the some vital policies and initiatives:

4.1 The Need for a National Policy[32]

Though the concern for the management of the urban areas (and thus urban transport) rests with the State governments, a Central policy has been considered as very much necessary for the sustainable transportation, such as:

1. Numerous key agencies that would play a vital role in the urban transport planning work under the Central government, but without any accountability to the State government.
2. The Various Acts and Rules, which have the important implications in dealing with the urban transport issues, are being administered by the Central Government.
3. There exist a need to guide State level action plans within an overall framework.
4. The starting of the JnNURM has given the opportune stage to giving critical money related backing from the Central Government for interests in urban transport foundation. In that capacity, this offers an open door for a significant national strategy that would manage Central budgetary aid towards enhancing urban portability.
5. A need exists to build capacity for urban transport planning as also to develop it as a professional practice.
6. A need exists to take up coordinated capacity building, research and information dissemination to raise the overall level of awareness and skills.

In lieu of the urban areas to be able for supporting the required level of economic activity, they must accommodate the simple and supportable stream of goods and people. Unluckily, the flow of goods and people has been facing various problems. Among them the most prominent are the following[33]:

i. Getting to employments, instruction, entertainment and comparative exercises is getting to be progressively tedious. Billions of man hours are lost with individuals "stuck in activity". The essential explanation behind this has been the dangerous development in the quantity of engine vehicles, coupled with confinements on the measure of street space that can be given. Case in point, on a normal, while the number of inhabitants in India's six noteworthy cities

[32] B.I. Singal, *National Urban Transport Policy*, Ministry of Urban Development (GOI), 3-4 (2014).
[33] Urban Transport: Reading Material, State Institute of Urban Development, Mysore, 39-58 (2014).

expanded by around 1.9 times amid 1981 to 2001, the quantity of engine vehicles went up by more than 7.75 times amid the same period.

ii. The expense of travel, particularly for poor people, has expanded significantly. This is to a great extent on the grounds that the utilization of less expensive non-mechanized modes like cycling and strolling has ended up greatly unsafe, since these modes need to have the same right of path with mechanized modes. Further, with populace development, urban communities have had a tendency to sprawl and expanded travel separations have made non-mechanized modes difficult to utilize. This has made access to jobs, especially for poor people, significantly more troublesome.

iii. Travel in the city has gotten to be more dangerous with mishap rates having gone up from 1.6 lakh in 1981 to more than 3.9 lakh in 2001. The quantity of persons slaughtered in street mishaps has likewise gone up from 28,400 to more than 80,000 amid the same period. This again has had a tendency to effect the poor all the more extremely the same number of those executed or harmed have a tendency to be cyclists, people on foot or asphalt occupants.

iv. The increment in the use of personal vehicles has led to the incensement in air pollution.

Unless the above issues are cured, poor portability can turn into a real dampener to financial development and reason the personal satisfaction to crumble. A strategy is, hence, required on the way to deal with managing this quickly developing issue as additionally offer a reasonable course and a structure for future activity.

4.2 The Various Objectives of the Policy[34]

The goal of this strategy is to guarantee sheltered, reasonable, fast, agreeable, solid and maintainable access for the developing number of city inhabitants to occupations, instruction, entertainment and such different needs inside our urban communities. This is tried to be attained to by:

i. Integrating the urban transportation as an important parameter at the urban planning stage rather than being a consequential requirement.

[34] Sanjeev Kumar Lohia, NUTP and JnNURM- Government of India Initiatives to strengthen Public Transport, 6-10 (2015).

ii. Improving the access of business to markets and to the various factors of production.
iii. While encouraging greater use of public transport and non-motorized modes by offering Central financial assistance for this purpose.
iv. Bringing approximately a more just allocation of road space with people, rather than vehicles, as its main focus.
v. Boosting the integrated land use and transport planning in all cities so that the travel distances can be minimized and access to livelihoods, education, and other social needs, especially for the marginal segments of the urban population is improved.
vi. Allowing the establishment of quality focused multi-modal public transport systems that are well integrated, providing seamless travel across modes.
vii. Establishing institutional mechanisms for enhanced coordination in the planning and management of transport systems.
viii. Establishing compelling administrative and requirement components that permit a level playing field for all administrators of transport administrations and improved wellbeing for the vehicle framework clients.
ix. Introducing Intelligent Transport Systems for traffic management.
x. By reducing the pollution levels through changes in the traveling practices, better enforcement, stricter norms, technological improvements, etc.
xi. Addressing concerns of road safety and trauma response.
xii. Building capacity (institutional and manpower) to plan for sustainable urban transport and establishing knowledge management system that would service the needs of all urban transport professionals, such as planners, researchers, teachers, students etc.
xiii. By raising finances, through innovative mechanisms that tap land as a resource, for investments in urban transport infrastructure.
xiv. Promoting the use of cleaner technologies.
xv. Associating the private sector in activities where their strengths can be beneficially tapped.
xvi. Taking up pilot projects that demonstrate the potential of possible best practices in sustainable urban transport.

4.3 Proceeding towards Realizing the Objectives

4.3.1 ***Incorporating Land-Utilize and Transport Planning*:**

Urban areas in India shift extensively as far as their populace, territory, urban structure, geography, financial exercises, wage levels, development imperatives, and so forth. Likewise, the outline of the vehicle framework will need to rely on upon these city particular highlights. Further, transport arranging is naturally connected to land utilization arranging and both need to be created together in a way that serves the whole populace but minimizes travel needs. To put it plainly, an incorporated ground breaking strategy needs to disguise the highlights of supportable transport frameworks. In growing such plans, consideration ought to likewise be paid to channel the future development of a city around a pre-planned transport arrange instead of add to a vehicle framework after uncontrolled sprawl has occurred.

Transport arrangements ought to, along these lines, empower a city to take a urban structure that best suits the land imperatives of its area furthermore one that best backings the key social and monetary exercises of its occupants. Sadly, then again, transport arranging has not got the degree of consideration it ought to have in drawing up vital improvement and area utilization plans. The Government of India would, subsequently, advance the advancement of such coordinated area utilize and transport plans for all urban communities. To empower this, all urban advancement and arranging bodies in the States would be obliged to have in house transport organizers and also representation from transport prevailing voices in their administrations.

The Government of India would broaden support for the readiness of such coordinated area utilize and transport arrangements, to the degree of half of the expense included in growing such plans, gave the city likewise exhibits its ability to act as per them. So as to make models for conceivable learning and replication, the Government of India would completely bolster pilot examines in a couple test urban communities, of distinctive qualities and in diverse districts of the nation. As a major aspect of this work out, every city would likewise be urged to recognize potential halls for future advancement and afterward create a vehicle framework that would support development

around itself. For instance, spiral halls rising up out of the city and reaching out up to 20-30 kms. that could be saved for future improvement. Such hallways would need to be shielded from infringement by setting up physical obstructions along such saved passages and physically developing streets on short extends even before settlements come up. This would suggest that extends of the hallway would come up first to guide the area of the settlements and not permit undue sprawl to occur.

A plan as of now exists under which the Central Government gives fractional budgetary backing to movement and transport ponders in urban communities. This would be adjusted to upgrade the degree of Central Government backing furthermore make these studies more wide based to incorporate transport arranging with area utilization arranging, remembering anticipated populaces.

4.3.2 Impartial allocation of the Road Space[35]:

At present, street space gets dispensed to whichever vehicle possesses it first. The centre is, subsequently, the vehicle and not individuals. The outcome is that a transport conveying 40 individuals is designated just over two times the street space that is apportioned to an auto conveying stand out or two persons. In this process, the lower pay gatherings have, successfully, wound up paying, as far as higher travel time and higher travel costs, for the lopsided space assigned to individual vehicles. Clients of non-mechanized modes have had a tendency to be crushed out of the streets because of genuine dangers to their security.

In the event that the centre of the standards of street space allotment were to be the individuals, then significantly more space would need to be distributed to open transport frameworks than is assigned at present. The Central Government would, accordingly, energize measures that dispense street space on a more impartial premise, with individuals as its core interest. This can be attained to by saving paths and hallways solely for open transport and non-mechanized modes of travel. Correspondingly paths could be saved for vehicles that convey

[35] Policy Summary, Low-Carbon Mobility in India and the Challenges of Social Inclusion: Bus Rapid Transit (BRT) Case studies in India, UNEP Riso Centre, 6-7 (2012).

more than three persons (prominently known as High Occupancy Vehicle Lanes). Past experience has been that such held paths are not regarded by drivers and consequently lose significance. To encourage better requirement of such path discipline, suitable procurements would be presented in the Motor Vehicles Act and different instrumentalities to empower stringent punishments for infringement.

On the off chance that the centre of the standards of street space portion were to be the individuals, then considerably more space would need to be allotted to open transport frameworks than is distributed at present. The Central Government would, accordingly, energize measures that dispense street space on a more impartial premise, with individuals as its core interest. This can be attained to by saving paths and passageways solely for open transport and non-mechanized modes of travel. Thus paths could be saved for vehicles that convey more than three persons (prominently known as High Occupancy Vehicle Lanes). Past experience has been that such saved paths are not regarded by drivers and accordingly lose significance. With a specific end goal to encourage better implementation of such path discipline, suitable procurements would be presented in the Motor Vehicles Act and different instrumentalities to empower stringent punishments for infringement.

4.3.3 Significance of the Use of Public Transport:

It is extraordinary that open transport possesses less street space and causes less contamination every traveller km than individual vehicles. All things considered, open transport is a more manageable manifestation of transport. Along these lines, the focal government would advance interests openly transport and additionally measures that make its utilization more alluring than previously. Towards this end, the Central government would support all State capitals and also different urban communities with a populace of more than one million to begin getting ready for high limit open transport frameworks. In doing as such, they ought to take a gander at different demonstrated advances far and wide, including the utilization of accessible conduits, they ought to embrace an innovation that would best suit the city prerequisites in the following 30 years. Extensive city wide plans ought to be drawn up including trunk and feeder passageways and also great reconciliation with

individual modes, rural movement, and so on. High cost trunk course frameworks ought to, through suitable centre point talked game plans be coordinated with feeder frameworks that empower higher ridership on such trunk frameworks.

For the effective promotion of such investment, the Central Government would:

a) For providing around 50% of the expense of planning the complete city transport plans and the detailed project reports.
b) Offer equity participation and/or viability gap funding to the extent of 20% of the capital cost of public transport systems.
c) Offer 50% of the cost of project development whenever such projects are sought to be taken up through public-private partnerships, so that a sound basis for attracting private partners can be established. The remaining cost of such project development would have to come from the city development authority/State government and a project developer.

Some allied issues that need to be addressed in this context are:

4.3.4 Quality and Use of Public Transport[36]

In this way, charges for open transport have been determined to the reason that this mode of travel is utilized by poor people, who have no different method for meeting their travel needs. In that capacity, passages have been kept low as a measure of social value. This has brought about most open transport frameworks being not able to recoup their working expenses. It has, indeed, supported ineffectively worked frameworks that have been monetarily supportable just through genuine bargains on the nature of the administration they render. In the present day connection, on the other hand, open transport fills another social need.

It aides decrease clogging and air contamination, if clients of individual vehicles can be induced to move to open transport. Their needs are, then again, for enhanced quality and less for low passages. It is, in this manner, important to consider diverse sorts of open transport administrations for distinctive fragments of workers. The individuals

[36] Chetan Vaidya, *Urban Issues, Reforms and Way Forward in India*, Working Paper No. 4/2009, DEA, Ministry of Finance, GOI 9-15 (2009).

who place a premium on expense are the poorest segments of society and need to be given reasonable costs. The expense of giving open transport to them needs to be financed by different areas of society.

Nonetheless, there is another section that values time spared and comfort more than cost. This section is relatively better off and would move to open transport if fantastic frameworks are accessible to them. The expense of giving open transport to them require not be financed and can be met from the charge incomes. In that capacity, the Central Government would energize the procurement of distinctive levels of administrations – an essential administration, with financed tolls and a premium administration, which is of superb however charges higher passages and includes no appropriation.

As such, passages for open transport have been determined to the reason that this mode of travel is utilized by poor people, who have no different method for meeting their travel needs. As being what is indicated, charges have been kept low as a measure of social value. This has brought about most open transport frameworks being not able to recuperate their working expenses. It has, indeed, empowered inadequately worked frameworks that have been fiscally practical just through genuine bargains on the nature of the administration they render.

In the present day setting, notwithstanding, open transport fills another social need. It aides diminish blockage and air contamination, if clients of individual vehicles can be influenced to move to open transport. Their needs are, nonetheless, for enhanced quality and less for low admissions. It is, consequently, important to consider distinctive sorts of open transport administrations for diverse sections of workers. The individuals who place a premium on expense are the poorest segments of society and need to be given moderate costs. The expense of giving open transport to them needs to be financed by different areas of society. Then again, there is another fragment that values time spared and comfort more than cost. This fragment is similarly better off and would move to open transport if superb frameworks are accessible to them.

The expense of giving open transport to them require not be financed and can be met from the toll incomes. All things considered, the Central Government would empower the procurement of distinctive levels of administrations – a fundamental administration, with financed admissions and a premium administration, which is of top notch yet

charges higher passages and includes no appropriation. To encourage this, the Central Government would offer backing under the NURM for premium administration foundation, for example, enhanced transport stations and terminals, enhanced traveler data frameworks, utilization of keen transport frameworks for observing and control, rebuilding of State Transport Corporations, and so forth.

To guarantee that the tolls charged are reasonable and sensible, the Central government would oblige that an administrative power be set up by the State Government to, between alia, direct the costs to be charged by diverse sorts of open transport administration.

4.3.5 The technologies for a Public Transport:

There is a wide range of open transport innovations. Toward one side are high limit, yet high cost, advances like underground metro frameworks and at the other are low limit transport frameworks running on an imparted right of way. Inside these extremes are a scope of middle conceivable outcomes, for example, transports on devoted privileges of way, raised sky transport and monorail frameworks, electric trolley transports, and so forth. While some of them are best over high thickness trunk halls others demonstrate helpful as feeder frameworks or sub-frameworks that serve restricted subareas inside a city. Thus, there are cases of accessible conduits being exploited for open transport as likewise frameworks like ropeways that suit uneven territories. While the high limit rail frameworks and transports on imparted privileges of way are the main ones went for in India, a few of the others have demonstrated effective in different parts of the world. Electric trolley transports have been running in San Francisco. New Bus Rapid Transit Systems (BRTS) have gotten to be extremely mainstream in urban communities like Bogota (Colombia) and Curritiba (Brazil).

4.4 The Transport Sector: The JN National Urban Renewal Mission[37]

The starting of the Government of India focal help support, the JnNURM gave an auspicious stage to giving critical money related backing to interests in urban transport framework. The NUTP strategy gives an important approach directing focal money

[37] Jawaharlal Nehru National Urban Renewal Mission, Modified Guidelines, Ministry of Urban Development, GOI (2011).

related help towards enhancing urban versatility and subsequently personal satisfaction in urban communities crosswise over India. After its dispatch a noteworthy choice was made to order that all urban transport activities getting money related help from the JnNURM project are to adjust with the tenets and regulations expressed under the NUTP.

The NUTP has distinguished a wide range of open transport innovations running from high limit and high cost advancements like the underground metro frameworks to high limit and ease transport quick travel frameworks.

Initiative - Jawaharlal Nehru National Urban Renewal Mission (JnNURM) was released by the India's Prime Minister, Dr. Manmohan Singh in December 2005 and managed by the Indian Ministry of Urban Development and Ministry of Poverty Alleviation to bolster state and neighbourhood interest in urban advancement. The general goal of the Mission is to "make monetarily gainful, productive, impartial and responsive urban communities." It is to energize change and quick track arranged improvement for distinguished urban areas with a managed concentrate on effectiveness in urban foundation and administration conveyance systems, group cooperation and responsibility of all ULBs/ Para state offices.

The JnNURM joins an offer of money related backing for framework extends under an expense imparting game plan to the states and neighborhood governments, which is connected to a deliberately organized administration show, that incorporates both focal help and required and discretionary changes. The span of the mission is for a long time, beginning in 2005-06 with a distinguished necessity of INR 1, 20,536 crore (USD 28 billion) of interest in 63 urban communities the country over.

To fit the bill for JnNURM subsidizing, a three-layered application with the accompanying data is obligatory; in the first place, it obliges every qualifying city to set up a City Development Plan (CDP) laying out their vision for the city throughout the following 20-25 years; second, a Detailed Project Report (DPR) enumerating their budgetary needs; and in conclusion, a timetable for the execution of urban changes for their particular city.

The primary objective of the JNNURM is to create economically productive, efficient, equitable and responsive cities. In line with this objective, the Mission focuses on:

- Securing linkages between asset creation and maintenance for long-run project sustainability
- Accelerating the flow of investment into urban infrastructure services
- Planned development of cities including the peri-urban areas, outgrowths, and urban corridors
- Integrated development of infrastructure services
- Renewal and re-development of inner city areas; and
- Universalisation of urban services so as to ensure their availability to the urban poor.

4.4.1 The JnNURM Reform Agenda

To be undertaken at the state level, the mandatory reforms are:

i. Effective implementation of decentralisation initiatives as envisaged in the Constitution (Seventy-Fourth) Amendment Act, 1992;
ii. Reform of Rent Control laws, by balancing the interests of landlords and tenants;
iii. Repeal of Urban Land (Ceiling and Regulation) Act, 1976;
iv. Rationalization of stamp duty to bring it down to no more than 5 per cent within seven years;
v. Enactment of a public disclosure law;
vi. Enactment of a community participation law , so as to institutionalise citizens' participation in local decision making; and
vii. Association of elected municipalities with the city planning function.

4.4.2 NUTP and JnNURM

The connecting of the NUTP and the JnNURM gave the essential draw from the Center, along these lines inspiring states and specifically medium estimated urban communities or Tier II urban communities crosswise over India to endeavour to outline and actualize

the BRTS and other manageable open transport arrangements and non-mechanized foundation ventures. Prior to this, open transport and specifically, transport based open transport was not seen as a distinct option for enhance portability. In keeping with the over two projects, urban areas changed their tasks, at first conceptualized as street foundation ventures, into BRTS activities bringing about vast scale limit expanding on all parts of arranging, innovation and operations

CHAPTER: V

SUSTAINABLE DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

In many developed nations, the special attention is being given to the sustainability of existing and emerging land use and the patterns of transportation. This image reflects the significant impacts on the environment because of the current pattern of transportation and the complex connections between the transportation, land use, and the activity systems. In this way, the sustainable transportation can be seen as transportation that meets mobility needs and along with that preserving and enhancing human and ecosystem health, social justice and economic progress for now and for the future. Thereby the planning for sustainable development aims to accomplish all the three objectives simultaneously and in a just manner, with considering access as well as mobility in the process.[38]

The CO_2 or Carbon dioxide reduction, which has been the main theme of Kyoto Protocol and other agreements, is an essential objective which has to be confront upon, however, the sustainability as being transformed into a much broader concept having economic, social, environmental dimensions the aim should be partially modified as according.

Sustainable development in urban and country territories must go as an inseparable unit; provincial urban linkages can be certain in both formative and ecological terms. Urban advancement adds to the development of benefit and general society wide financial improvement; the co-area efficiencies in urban economies are critical for manageable monetary improvement. Urban communities are for the most part considered to think

[38] Elizabeth Deakin, *Sustainable Development and Sustainable Transportation: Strategies for Economic Prosperity, Environmental Quality, and Equity*, University of California at Berkeley (Institute of Urban and Regional Development), 6-8 (2003).

elevated amounts of non-renewable asset use, however they additionally have an enormous potential for the diminishment in the utilization of non-renewable assets.

The major problem which lies is to identify one or more strategies within a market framework that are proficient enough of simultaneously generating effective and sustainable spatial structures and multimodal transport systems, and of accommodating significant economic and population growth. The problem of urban expansion over surrounding non-urbanized land is a worldwide phenomenon. Urban encroachment on fragile ecosystems as a result of intense land pressures and poor land- use planning constitutes a future threat. The urgent need to identify and protect these ecosystems is obvious.

The need to plan for sustainable transport is clear. An unnatural weather change postures critical difficulties for urban areas. The transport segment alone, concurring to the World Resources Institute (2005), represents 24.1% of CO_2 secretions around the world, yet its significance in neighbourhood driving, connecting the worldwide arrangement of urban areas, and empowering monetary communications is critical. "The solutions" for keeping up worldwide, national, provincial, and neighbourhood communications while encouraging sustainable development has yet to be discovered; no technique for supportable transportation frameworks consented to by all partners crosswise over nations so far exists.[39]

5.1 Issues and Challenges

5.1.1 Vehicular Growth and Pollution in Urban Cities

With fast urbanization and monetary development, motorization has been accelerated in cities of developing countries. As for exemplify this; in specifically the Asian region, the number of motor vehicles per one thousand people has more than tripled in the past 30 years. To own a private car or a motorized two-wheeler is a major ambition for people in these cities, in particular, where public transport service is often inadequate and unsafe.

[39] Eva Kassens, *Sustainable Transportation: An International Perspective*, MIT J. of Planning, Vol. 9, 7-8 (2009).

On the other hand because of such uncontrolled motorisation, the air and noise pollution have been increasing by leaps and bounds over the past few decades and particularly due to the enormous raise in personal mode of transportation. In majority of the Indian cities the private mode of transport is expanding at the rate of 10-18 percent every year. With the expanding urbanization and industrialization, the vehicle interest has additionally expanded therefore.

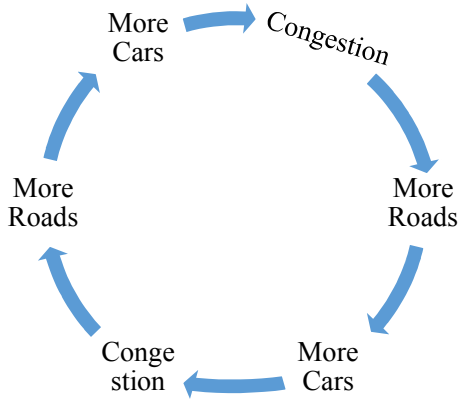


Fig 5.1 Vicious Circle of Car-oriented Transport Development

Sadly, city chiefs in creating nations are taking after the same auto arranged transport advancement designs made by numerous urban communities in created nations previously. Fatefully, many cities in developed countries are now trying to recover from a car-dominated development era by halting the building of more infrastructures for private vehicles and re-allocating road space for public transport and non-motorized transport. The major problem in the Urban Transportation lies in the Congestion of the vehicles. The more shall be the congestion the more will be the pollution. The only solution which remains with our society is either to opt the past method for transportation, as according to John Evelyn's idea of providing the nature with sufficient time to recover itself or to build our way out of the congestion by providing enough road space for a better traffic flow.

This cycle in Fig. 5.1 indicates how the increment of foundation to ease travel interest will have evidently positive outcomes in the short term, however a few months after the fact there will be a much more prominent clogging than some time recently, accordingly expanding the issue as opposed to solving it.

5.1.2 Road Safety

Road Safety or in other words the cautiousness from getting being indulge into any road accident, has to be the primal objective of the urban managers. The significance of focussing on road safety has reached such a mark that 2011-2020 has been defined as "the Decade of Action for Road Safety" by the WHO. [40]

Some recently occurring facts which has come into the limelight:[41]

- About 90 % of the death on the roads occur in low-income and middle income countries, which have only 48 % of the world's registered vehicles;
- Almost less than 1/3rd of countries have taken the necessary measures as for ex. Creation of low-speed zones for reducing the speed in urban areas;
- About more than 1.3 million people dies annually on the road in all over the world and another 20~50 million people are injured;
- Pedestrians, cyclists, and riders of motorized two-wheelers and their passengers almost account for around 46% of global road traffic deaths. This proportion is greater in low-income countries than in high-income countries.
- The Motorcyclists signify a large proportion of urban fatalities (around 25%). The expected partial has shifted from motorcycles to small cars and i.e. is undoubtedly a big concern in Urban Transportation system. As because, although small cars provide more protection to the occupants but they are expected to be more harmful than the motorcycles to pedestrians, bicyclists, and other motorcyclists unless and until the vehicle fronts are designed to be more tolerant.
- The other big concern is the Night time driving in India, as it is substantially riskier than the daytime driving. The major ground for such occurrence is the driving under the influence of alcohol and the fatigue of truck drivers.

The road injuries are the leading cause of death for people aged between 15-29 years across the globe and the rates are comparatively higher than the death rates due to HIV/AIDS. Apart from this, the more shocking fact is that the half of those killed in

[40] World Health Organization and FIA Foundation (2010). Decade of Action for Road Safety 2011-2020. http://www.decadeofaction.org/

[41] WHO (2011b). 10 Facts on Global Road Safety. http://www.who.int/features/factfiles/roadsafety/en/index.html

traffic accidents are pedestrians, cyclists, passengers, passengers in public transport[42]. On the other hand the share is even larger in developing countries because due to the lack of road safety infrastructure for the pedestrian and cyclists.

Table 2: The Road accident statistics of India: 1970-2004

Year	Total no. of road accidents (in numbers)	Total no. of persons killed (in numbers)	Total no. of regd. Motor vehicles (in thousands)	No. of accidents per ten thousand vehicles	No. of persons killed per ten thousand vehicles
1970	114 100	14 500	1 401	814.42	103.50
1980	153 200	24 000	4 521	338.86	53.09
1990	282 600	54 100	19 152	147.56	28.25
1991	295 131	56 278	21 374	138.08	26.33
1992	275 541	60 113	23 507	117.22	25.57
1993	284 646	60 380	25 505	111.60	23.67
1994	325 864	64 463	27 660	117.81	23.31
1995	351 999	70 781	30 295	116.19	23.36
1996	371 204	74 665	33 786	109.87	22.10
1997	373 671	76 977	37 332	100.09	20.62
1998	385 018	79 919	41 368	93.07	19.32
1999	386 456	81 966	44 875	86.12	18.27
2000	391 449	78 911	48 857	80.12	16.15
2001	405 637	80 888	54 991	73.76	14.71
2002	407 497	84 674	58 924	69.16	14.37
2003	406 726	85 998	67 007	60.70	12.83
2004	429 910	92 618	72 718	59.12	12.74

Source: (MORTH, 2010)

On the basis of the data shown in the Table no. 1 it can very well be noted that the continuously increment in the no. of Motor vehicles are amounting to the large no. of fatalities. Thereby, it is one of the major obstacle in achieving the dream of sustainable transportation and for that promotion of Non- motorized vehicles is very much necessary.

5.1.3 Poverty: The Concern for Sustainable Urban transportation

The percentage of people which has been estimated to be below poverty lines is generally higher in rural as compare to the urban areas of the developing world. However, indisputably the quantities of individuals living at then again beneath the subsistence levels in the recent are much bigger and are likely to become under anticipated rates of urbanization. Moreover, inclines recommend that, although still small in many countries, the contribution of urban to overall poverty usually grew in the 1980s and 1990s.

"Poverty must be seen as the deprivation of basic capabilities rather than merely as lowness of income"

Amartya Sen, 1999

[42] World Health Organization, Global Status Report on Road Safety, WHO (Geneva), 34-36 (2009).

Almost in many developing countries, the urban transport planning has always been aimed at boosting the economic growth, particularly for that of the inner-city areas. Whether it to be a road extensions, new expressways or inner-city underground railways they are primarily meant to serve those participating actively in the business life. The for the most part anticipated profit additions are spoken to chiefly fit as a fiddle of time kept in financial expense advantage examinations (surveyed in the fiscal terms as circumstance expenses of monetary power generally lost by the normal client) to meet the prerequisites of the global benefactor associations. Moreover, figures regularly expect an (occasionally unrealistically high) increment in every capita salary[43].

Still, the above-mentioned benefits of this kind do not in any manner affect the lower income strata and the needy poor, for in these section of the population, only a very small, if any, contribution can be made to the economy. This is reason why transport projects serving the "poor" majority of the urban population in developing countries can hardly pay for themselves using the traditional monetary assessment criteria.

There are numerous more outings being brought by people with higher salary than by those of lower wage, basically on the grounds that low-pay groups doesn't have the limit (in time or cash) to travel more. This weighs intensely on their ability to get access to employments, education, health and all different administrations that a city can give, lessening their interest in the public eye in general[44].

The lower income groups due to high and inequitable fares, lack of public transport where they resides and the lack of safe and high quality infrastructure such as sidewalks etc. obstruct them to fully get the accessibility in this sector. Moreover, the negative impacts from the unsustainable transport sector also affect the poor disproportionately. The question which arises in many minds is how urban transport and traffic planning can directly target the needs of the poor without jeopardising the economic and ecological sustainability. Thereby, such situation possesses a great threat to the social development and general equity in cities.

[43] Ralf M. Kaltheier*, Urban Transport and Poverty in Developing Countries*, German Society for Technical Cooperation (GTZ), Division 44, Eschborn, 6-8 (2002).
[44] Thynell, M., *Social Change and Urban Transport*, GTZ SUTP Technical document No.2, 23-24 (2009).

5.1.4 Energy Security & Greenhouse Gas Emissions

"Urban transport represents one of the fastest growing sources of greenhouse gas emissions that contribute to global climate change"- UNCRD, 2009

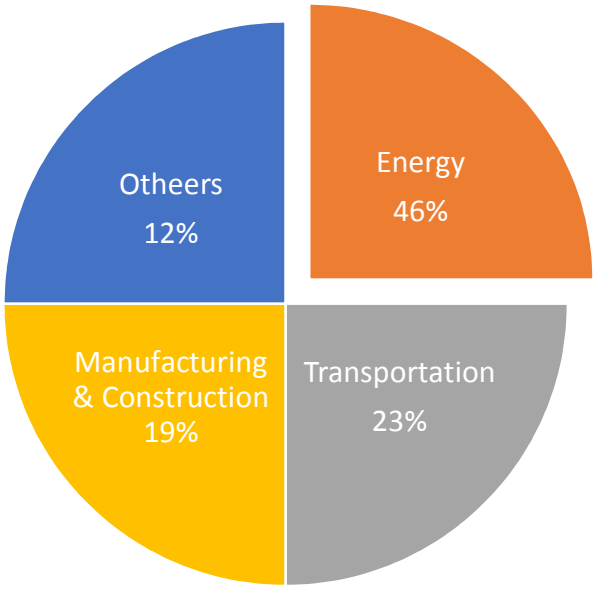


Fig. 5.2 Global CO_2 Emissions by Different Sectors.

Source: UNEP, 2010

On relying upon Fig. 5.2[45] it can very well be seen as the Transport is the second largest sector causing the global carbon dioxide (CO_2) emissions from the fossil fuel combustion. Of the 23% of worldwide CO_2 discharges from the vehicle segment, street transport represents 73%, took after by universal delivery and global flight. Notwithstanding, the vehicle segment is not sufficiently getting consideration in worldwide environmental change moderation endeavours, regardless of the way that, as indicated by UNFCCC in 2011.

The road transport leads the transport activities in India while carrying about 60% of cargo (ton-km) and 87% of passenger (pass-km) transport in 2005 and contributing to about 95% of the emissions from cargo transport and 92% of emissions from passenger

[45] United Nations Environment Programme (UNEP) (2010). 2009 Annual Report - Seizing the Green Economy. UNEP, Nairobi

transport. Further, the share of road based freight and passenger transport has also been steadily increasing over time.

The Urban passenger transport deserves the special attention in present era as it contributes to fuel consumption and the Greenhouse gas emissions is rapidly growing. The reason being the rapid increase in the growth of personal vehicles, increased urbanization, increase per capita trip rates of motorized transportation. The National Capital has the largest number of the passenger cars in the country. The number of cars has been increasing in Delhi at the rate of 900 cars/day and it has the large bus fleet running on CNG. The cities like Ahmedabad and Pune shows similar level of emissions from cars, MTW and three wheelers. The emission from busses is comparatively much less from the other vehicles.

At present, the total number of transport-related projects funded by the Clean Development Mechanism is few. Though, a new possible source of funding is Nationally Appropriate Mitigation Actions of NAMAs. This is a tool developed by the UN Framework Convention on Climate Change (UNFCCC) to yield more projects which can anyhow mitigate the climate change and can also improve knowledge on emissions in cities and among the countries throughout the world. This opportunity has also been identified as a possible "game changer" in climate change mitigation, especially for the transport sector since previous practises such as CDM have proven very typical to adjust to the nature of transport projects[46].

5.2 Transportation Strategies for Sustainable Development in India

The concept of welfare state is a fairy tale when it is about theory but when it comes to implementation or practice of this concept of welfare state; it is near to impossible since the government as the guardian of citizens is endowed with innumerable and countless functions. It is believed that a welfare state takes care of its citizens from cradle to grave.

[46] Carlos Felipe Pardo, *Sustainable Urban Transport*, Shanghai Manual- A Guide for Sustainable Urban Development in the 21st Century, 9-10 (2011).

Vehicle / Fuel Technological Changes:

i. **Improvement in the Efficiency of Convention Vehicles**
   i. Supplier offerings / Manufacturer Innovations
   ii. The Responses to the Government regulation and Incentives: CAFE Standards, taxes, R&D Partnerships, Subsidies
   iii. Response to consumer demand

ii. **The Improvements in the Road / Vehicle Operations**
   i. **The Improvements in the Conventional traffic Flow**
      - Flow metering
      - Ramp metering
      - Traffic Signal Timing
      - Bottleneck Removal
   ii. **Improvements in the Intelligent Transportation System**
      - Smart vehicles
      - Routing and Scheduling Enhancement
      - Smart Highways
      - Accident / Incident Management
   iii. **Driver Education**
   iv. **Improved Logistics and Fleet Management**

iii. **Demand Management:**
   i. **Modal Substitution**
      - Ridesharing, Transit, Paratransit, walking, Biking Improvements and incentives
      - Rail Subsitutes for Truck
   ii. **Telecommunication Substitution**
      - Telecommuting
      - Teleconferencing
   iii. **Pricing Incentives / Disincentives**
      - Increase in the Gas Tax
      - Vehicle Registration / Licence Fee Base on Fuel Efficiency
   iv. **Land Use – The Transportation Strategies**
      - Compact development
      - Mixed Use Development

Table 3.[47] The Strategies for transportation Management: A Tentative List

The Table no. 3, shows a partial list of the transportation strategies that can very well be adopted in Indian Policies for supporting the sustainable development. These strategies have been grouped into numerous categories which is based on the component of the transport system: vehicles, guide ways and operations, and demand.

[47] Elizabeth Deakin, *Sustainable Development and Sustainable Transportation: Strategies for Economic Prosperity, Environmental Quality, and Equity*, University of California at Berkeley (Institute of Urban and Regional Development), 8-9 (2003).

The category 1 of the strategies would reduce the adverse environmental impacts of motor vehicles by means of technological change in vehicles and fuels. For the short period, this would most likely focus on strategies for improving the efficiency of conventional vehicles in order for reducing the emission of pollutant and greenhouse gases. But for the long time run the introduction of new vehicle technologies and new fuel might be an option and could also lead to quitter, safer and cleaner vehicles.

The second Category of strategies involves the improvement in the roadways and vehicle operations. Improvements in the traffic flow such as ramp metering, signal timing, flow metering, and bottleneck removal all have the potential to cut the energy use, reduction in the greenhouse gas emission, and lower noise levels somewhat by smoothing the flow of traffic and while reducing the stop & go driving. Driver education could also results in the reduction of emission by training the driver to avoid heavy accelerations and decelerations and to be mindful about the fuel consequences of high speeds. The Information technology may enhanced the routing and scheduling can also reduce the fuel needed for transport of both Passengers and freight.

In the Third category the Demand management is the strategy for managing the transportation system. There are several subcategories of demand management which are currently in use. The form of Demand management can be modal substitution, pricing, telecommunication substitution, land use etc. The Modal substitution means that as for ex. replacing car trips with transit, paratransit, ridesharing, biking and walking for personal travel and substituting rail for truck and air freight.

5.2.1 Economic Considerations

The one single issue that has been raised many times in the past is about the various strategies for sustainable transportation is: What will be their economic consequences be? As because environmental consideration have been viewed as a constraints on the expansion of the transportation system and along with that as a potential brakes on economic growth. The major widespread concerns are that the environmental protection is expensive and that economic losses could easily result from interference with market preferences for auto mobility and suburban living.

A broader view of these issues has been emerged recently. The work documenting the social and environmental effects of transport has made it clear that the consumers are typically paying only a portion of the total costs of their transportation choices. And at the same period of time, there has been increasing recognition that many transportation projects has not been analysed on the economic basis and thereby may not be cost-effective.

The Emerging view was that the economic development and environmental protection are both the desired objectives along with the social justice; and that the transportation planners should be chasing strategies that encompasses upon all counts.

5.3 Key issues for Sustainable Transportation Planning[48]

In this section the issues that would have to be addressed in designing and carrying out the sustainable transportation strategies which can consistently and simultaneously support the economic development, protect the environment and improve the social justice. The wide range of the issues which lies from the uncertainties about the nature and severity of environmental problems to the debates over the transportation strategies which is most pragmatic and efficacious.

5.3.1 Uncertainties about the Problems

The very most uncertainties which persist about the nature and severity of many environmental problems, counting the transportation related problems, the greenhouse gas emissions, and the noise pollutions. The qualms also persist regarding the economic benefits of transportation infrastructure investment. These kind of uncertainties make it hard to congress the political support which is needed for action.

5.3.2 Scope and Timing of Technology Change

The technological advancement in the automotive industry and in the other sector of the economy has the considerable potential for reducing the air pollution, the greenhouse gas emissions, congestion, and the variety of other negative externalities of the automobile. For exemplify this it can be understand as the aggressive technology

[48] Stellon Cyon, *Sustainable Urbanization and transportation in China: The Case for territorial development planning*, Ambio, Vol. 28, No. 2, 198-199 (1999)

deployments, whether in the form of changes in the conventional vehicles or through the introduction of radically different vehicle and the fuel technologies could also produce the needed reductions in greenhouse gas emissions for the next several decades.

Though, such technology deployments are by no means can assured or may emerge far from their advocates are predicting. With respect to that price, availability, and the performance characteristics all are uncertain but all of these are the important consideration in comparing the technology option to other alternatives. The absence of public policy in the direction for the technological changes, that for sure emerge, may or may not be directed to environmental improvements or other socially beneficial.

5.3.3 Public Opinion and Support for Action

It is not an oblivious fact that the consumer preference is a key driver of transportation and urban development trends. Many of the analysts believe that the changes in pricing policy, for ex. increasing the fuel taxes or full-cost pricing for parking could substantially meld the consumer choice. The changes in the public attitudes might just be forthcoming as public understanding of greenhouse gas issues increment. The changes in travel behaviour driving from the changes in the land use and location, the modes which are offered and chosen, and overall activity patterns also would depend on public support for policy changes in consonance with the individuals, household and business decisions consonant with those changes.

The importance for implementing the public opinion and public support, can easily be derive from research perspective view. As in particular, it would be treasured to study how and to which extent the citizens make connections between their concerns for the environment, the policy which they and their elected officials has adopted and lastly about their own behaviour.

CHAPTER: VI

CONCLUSION

The planning for sustainable transportation give rises to number of issues regarding the definition of sustainability and sustainable transportation, as how it can be possible for achieving the different goals and objectives which has been defined and evaluated, and the type of decision-making process that should be used.

Further, Sustainability requires more comprehensive and integrated planning, which accounts for a broad set of economic, social and environmental impacts, including those that are difficult to measure. Sustainability planning requires adequate stakeholder involvement to allow diverse perspectives and preferences to be incorporated.

Sustainability tends to support transportation planning and market reforms that result in more diverse and economically efficient transportation systems, and more compact land use patterns that reduce automobile dependency. These reforms help increase economic efficiency, reduce resource consumption and harmful environmental impacts, and improve mobility for non-drivers.

Although it is relatively easy to define the general type of policy changes that support sustainable transportation, it may be difficult to define exactly what degree of change is needed. Further the various strategies which has been provided above can very well be adopted and for once again the very meaning of the word Sustainable Development will be embraced by us.

BIBLIOGRAPHY

Conventions, Treaties & Agreements: -

i. UN Framework Convention on Climate Change: The Kyoto Protocol
ii. The Montreal Protocol: The Montreal Protocol on Substances that Deplete the Ozone Layer, 1987
iii. The United Nations Conference on Environment and Development, 1992
iv. The United Nation Conference on Sustainable Development, 2012
v. World Summit on Sustainable Development: The Johannesburg Declaration

Books:-

i. Jennifer A. Elliott, *an Introduction to Sustainable Development*, Routledge Perspectives on Development, Taylor and Francis Group, 8-9 (3rd ed. 2006).

ii. Michael Redclift, *Sustainable Development: Exploring the Contradictions,* ROUTLEDGE: TAYLOR & FRANCIS GROUP, 14-15 (3rd ed. 2002).

iii. Ravinder N. Batta, *Economies of the Road Transport* by; Gyan Publishing House, 2008

Articles / Scholars Papers:-

i. Jacky Grimshaw, *Public Facilities Siting & Transportation Access*, Race, Poverty & the Environment, Vol. 6, No. 1, Special Issue: Transportation & Social Justice, 11-14 (1995); http://www.jstor.org/discover/10.2307/41554214?sid=21105917220811&uid=4&uid=2&uid=3738256
ii. Victoria Transport Policy Institute, Sustainable Transportation and TDM; http://www.vtpi.org/tdm/tdm67.htm (26 December 2010).

iii. Partha Chakroborty, *Sustainable Transportation for Indian Cities: role of intelligent transportation systems*, CURRENT SCIENCE, VOL. 100, NO. 9, 1387 (2011); http://www.currentscience.ac.in/Volumes/100/09/1386.pdf
iv. Todd Litman & David Burwell, *Issues in Sustainable Transportation,* Vol. 6, No. 4 Int. J. Global Environmental Issues, 333 (2006); http://www.vtpi.org/sus_iss.pdf
v. Carlos Felipe Pardo, *Sustainable Urban Transport*, Shanghai Manual- A Guide for Sustainable Urban Development in the 21st Century, 1-2 (2011); http://www.un.org/esa/dsd/susdevtopics/sdt_pdfs/shanghaimanual/Chapter%204%20-%20Sustainable%20urban%20transport.pdf

vi. Amulya K.N. Reddy, Y.P. Anand, Antonette D'Sa (1st June, 2000), *Energy for a sustainable road/rail transport system in India*; Energy for Sustainable Development, Volume IV No. 1, http://amulya-reddy.org.in/Publication/roadrailtransport.pdf.

vii. Dinesh Mohan & Geetam Tiwari, *Sustainable Transport Systems: Linkages between Environmental Issues, Public Transport, Non-Motorised Transport and Safety*; Economic and Political Weekly, Vol. 34, No. 25 (Jun. 19-25, 1999), pp. 1589-1596; http://www.jstor.org/stable/4408103

viii. Sudarsanam Padam & Sanjay K. Singh, Urbanization and Urban Transport in India: The Sketch for a Policy;

ix. http://www.seas.harvard.edu/TransportAsia/workshop_papers/Padam-Singh.pdf.

x. Ashok Kumar (2005), Sustainable Transport Environment in Indian Megacities: Problems and Remedies, Department of Geography, University of Mumbai, Mumbai (India), Demoscope Weekly;

xi. http://demoscope.ru/weekly/knigi/tours_2005/papers/iussp2005s51017.pdf

xii. Ashish Verma, S. Sreenivasulu and N. Dash (10th May, 2011), Achieving sustainable transportation system for Indian cities problems and issues, Current Science, Vol. 100, No. 9, http://www.currentscience.ac.in/Volumes/100/09/1328.pdf

xiii. Akshay Mani, Madhav Pai , Rishi Aggarwal, Sustainable Urban Transport in India: Role of the Auto-rickshaw Sector; EMBARQ, WRI.ORG; http://pdf.wri.org/sustainable_urban_transport_india.pdf

xiv. B.I Singal (Nov. 2010), Towards Sustainable Urban Transport in India, Journeys; http://www.lta.gov.sg/ltaacademy/doc/J10Nov-p13Singal_UrbanTransportIndia.pdf

xv. Dr. Tom V. Mathew (February 19, 2014), Fuel Consumption and Emission Studies, IIT Bombay, available at: http://nptel.ac.in/courses/105101008/downloads/cete_43.pdf

xvi. Guide to Sustainable Transportation Performance Measures (August 2011); EPA United States Environmental Protection Agency; http://www.epa.gov/dced/pdf/Sustainable_Transpo_Performance.pdf