# Chapter 1

## INTRODUCTION

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1.1 CONCEPT AND DEFINITION OF SUSTAINABLE DEVELOPMENT

Sustainable Development is the most popular term of the era and has taken the centre stage of multidisciplinary thoughts. The term sustainable means the ability to sustain or continue forever. It is a condition of continuous and everlasting existence.

The concept of sustainable development attained worldwide attention after the publication of the Report of the World Commission on Environment and Development (WCED 1987) ‘Our Common Future’. It spelt out the need for sustainable development that would meet the needs of the present generation without compromising the needs of the future generation. Adoption of the ethics of care, respect and responsibility towards nature is a pre-condition for the successful implementation of the policy of sustainable development (Telang 1997).

There are umpteen numbers of definitions of sustainable development. Monto et al. (2005) in their book on the Sustainability and Human Settlements, compiled the various definitions of sustainable development. Some of the definitions are as follows:

As early as 1915 Canadian Conservation Commission has opined that each generation is entitled to the interest of the natural capital, but principal should be handed over unimpaired. According to IUCN, WWF and UNEP (IUCN et al. 1980) Sustainable Development is earmarked by the maintenance of essential ecological processes, life support systems, preservation of genetic diversity and sustainable utilisation of species and ecosystems, while Allen (1980) underlines the importance of achieving satisfaction of human needs and improvement of the quality of human life. But major challenge of the coming decades is to learn how long term large scale interaction between environment and development can be better managed to increase the prospects for ecologically sustainable improvements in human well being (Clark and Munn 1986). This necessitates an approach that will permit continuing
improvements in the quality of life with a lower intensity of resource use, thereby leaving behind for future generations an undiminished or even enhanced stock of natural resources and other assets (Munasinghe and Lutz 1991). The concept of sustainable development combines two basic notions, economic development and ecological stability. Ecologically sustainable economic development can be thought of as the process of related changes of structure, organisation and activity of the economic-ecological system, directed towards maximum welfare which can be sustained by the resources to which that system has access (Braat 1991). Schultink (1992) put forth the definition of Sustainable Development as the development and management of natural resources to ensure or enhance the long-term productive capacity of the resource base and improve the long-term wealth and well-being derived from the alternative resource use systems with acceptable environmental impacts.

However, the attainment of the efficiency of the total environment around man greatly contributes to sustainable development. The total environment comprises of mostly the physical environment, social environment and economic environment. Physical environment is usually referred to as the ‘environment’ in the Economy-Environment-Society tripod. The efficiency can be determined by the total output with respect to the total input.

1.2 CONCEPT OF ENVIRONMENTAL EFFICIENCY

Environmental efficiency is the term introduced in this thesis in which environment means the ‘total environment’ and the various dimensions of it being the physical environment, social environment and economic environment. Environmental efficiency of development management system aims to reduce the spare capacity and losses, so that output is attained with minimal wastage. This spare capacity is causing diseconomy and wastage is causing environmental hazards.
Major portion of sustainable development can be achieved through the practice of environmental efficiency and it does not advocate to compromise human comfort or convenience. In fact it aims at improving the quality of life, while reducing the consumption in terms of land and energy.

Attainment of Environmental efficiency aims to make everybody in the system happy, so that public acceptance and practicability are more and has a promising future. The basic purpose of development is to enlarge people’s freedom and choices by creating an enabling environment for people to enjoy long, healthy and creative lives. Philosophers like Aristotle (384-322 B.C.), Emmanuel Kant (1724-1804) and Adam Smith (1723-1790) have shaped the idea that human beings are the ultimate end of development and not convenient fodder of the materialistic machine (Haq 1996).

1.3 RELEVANCE OF ENVIRONMENTAL EFFICIENCY IN HUMAN SETTLEMENTS

Nearly every other person on earth already lives in cities. By 2030, 60 % of the world population is expected to live in cities, as per the estimates of UN Population Division which is reported in the State of World Cities report (UN-Habitat, 2004). ‘Cities are engines of economic growth’, say economists. Lion’s share of the GDP of the world is produced in cities. This is due to the high population density in the cities which enables better functioning of labour markets, lower transportation costs, faster diffusion of knowledge, larger economies of scale in production and due to a critical mass of adjacent consumers. Cities are centers of good as well as bad. World cities are major contributors of global warming, Chloro-Fluro Carbons (CFCs) causing ozone layer depletion and acid rains. Also cities are the major consumption centers of natural resources and energy.
There comes the importance of environmentally-efficient development management system at the human settlements to make it more livable for all the sections of society and for the future citizens as well, while maintaining a sustainable globe where land, water and ecosystems are protected.

1.4 INTRODUCTION OF THE STUDY AREA

The study area is the Greater Kochi Metropolitan Area lying inside the Greater Kochi Resource Region in the State of Kerala. Hence it is necessary to introduce the State of Kerala, Greater Kochi Resource Region and the Greater Kochi Metropolitan Area—Kochi Urban Agglomeration.

The State of Kerala

Geography

Kerala State, wedged between the Laccadive Sea and the Western Ghats, is lying between north latitudes 8°15'54" and 12°45'30" and east longitudes 74°53'37" and 77°3'34". Humid equatorial tropical climate is prevalent in Kerala. Kerala’s coastal line extends to 580 km and the width varies from 35 km to 120 km. Kerala can be divided into three topographically distinct regions: the eastern highlands, the central midlands and the western lowlands. Eastern Kerala consists of high mountains and valleys immediately west of the Western Ghats' rain shadow. Out of the 44 rivers flowing through the region, 41 of them are west flowing and others are east flowing. Kerala’s western coastal belt is relatively flat, with a network of canals, lakes, estuaries and rivers.

Climate

With 120–140 rainy days per year, Kerala has a wet and maritime tropical hot humid climate influenced by the seasonal heavy rains of the southwest and northeast monsoons. Kerala’s rainfall averages 3,107 mm annually, while the mountains of eastern Idukki district receive more than 5,000 mm of orographic precipitation, the
highest in the state. The mean daily temperature of the state ranges from 19.8 °C to 36.7 °C (Wikipedia).

**Biodiversity**

The State of Kerala is synonymous for its rich biodiversity. Agasthyamalai Biosphere Reserve, Periyar Tiger Reserve and Silent Valley are only some among them in the eastern hills. Almost a fourth of India's 10,000 plant species are found in the state. Its 9,400 sq. km of forests include tropical wet evergreen and semi-evergreen forests, tropical moist and dry deciduous forests and montane subtropical and temperate (shola) forests. Altogether, 24% of Kerala is forested (Sreedharan 2004). Two of the world's Ramsar Convention listed wetlands—Lake Sasthamkotta and the Vembanad-Kol wetlands—are in Kerala (Ramsar Convention Bureau 2001). Kerala's fauna are notable for their diversity with 102 species of mammals, 476 species of birds, 202 species of freshwater fishes, 169 species of reptiles and 89 species of amphibians (Economic Review 2004). These are threatened by extensive habitat destruction, including soil erosion, landslides, salinity intrusion and resource extraction (Wikipedia).

There are 14 revenue districts which are lying in the three historical regions of Thiruvithamkoor, Kochi and Malabar. Kerala's 14 revenue districts are subdivided into 63 taluks, 1453 revenue villages and 999 panchayats.

**Transport**

Kerala has 145,704 kilometers of roads (4.2% of India's total). This translates to about 4.62 kilometers of road per thousand population, compared to an all India average of 2.59 kilometers. Virtually all of Kerala's villages are connected by road. Traffic in Kerala has been growing at a rate of 10–11% every year, resulting in high traffic and pressure on the roads. Kerala's road density is nearly four times the national average and Kerala's annual total of road accidents the nation's highest (Kumar, 2003).
Demography

Kerala is home to 3.44% of India's people at 819 persons per sq. km. and its land is nearly three times as densely settled as the rest of India, which is at a population density of 325 persons per sq. km. Kerala's rate of population growth is India's lowest, and Kerala's decadal growth (9.42% in 2001) is less than half the all-India average of 21.34%. Kerala's population more than doubled between 1951 and 1991 by adding 15.6 million people to reach 29.1 million residents in 1991. The population stood at less than 32 million by 2001 (Census Report 2001). Kerala's coastal regions are the most densely settled leaving the eastern hills and mountains comparatively sparsely populated.

Tourism

Kerala is one of the most popular tourist destinations in India and popularly known for its eco-tourism initiatives and named as ‘God’s own country’, one of the ‘ten paradises of the world’ and ‘50 places of a lifetime’.

The Greater Kochi Resource Region

The Ministry of Environment and Forests, Government of India has identified certain regions for which carrying capacity based development planning studies were conducted/initiated. Carrying capacity study for the national capital region of Delhi and carrying capacity study for the Greater Kochi Region are two among them.

The core team entrusted with the carrying capacity study of Greater Kochi Region delineated 13182 sq. km. area including Greater Kochi Metropolitan area as the potential region which is the watershed of Vembanadu estuary system through which seven major rivers of Kerala viz. Chalakudy, Periyar, Moovattupuzha, Manimala, Pampa and Achenkovil are flowing towards west and fall in the backwaters (Greater Kochi Carrying Capacity Study Report 2002).
District- wise break-up of Greater Kochi Region identified is as follows:

- Ernakulam 2407 sq. km.
- Kottayam 2204 sq. km.
- Idukki 5019 sq. km.
- Thrissur(part) 64.19 sq. km.
- Pathanamthitta(part) 2452.67 sq. km.
- Alapuzha(part) 1036.09 sq. km.

The delineated area accounts for 34% of the geographical area of Kerala.

Boundaries are

- North Chalakudy river
- West Arabian Sea
- East Western Ghats
- South Achenkovil river

Area of the Greater Kochi Resource Region is only 39% of the area of National Capital Region. Most urbanised national capital territory of Delhi inside national capital region is 1483 sq. km., while the Greater Kochi Metropolitan Area inside Greater Kochi Resource Region is only 732 sq. km (Map 1.1 and Map 1.2).
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The Greater Kochi Metropolitan Area—Kochi Urban Agglomeration

The Greater Cochin Development Authority (GCDA) having a jurisdictional area of 732 sq. km was constituted in the year 1976 and it consists of Cochin Corporation, six adjoining municipalities and 33 panchayats.

The concept of urban agglomeration (UA) was introduced in the Census of India in 1981 onwards. An urban agglomeration is a continuous urban spread, constituting a town and its adjoining urban outgrowths or two or more physically contiguous towns together and any adjoining urban outgrowths of such towns. In 2001 Census (Census Report 2001) two more conditions were added to the concept of urban agglomeration.

1. The core town or at least one of the constituent towns should necessarily be a statutory town.
2. The total population of the constituent units i.e., towns and outgrowths of an urban agglomeration should not be less than 20000 as per the 1991 Census population figures.

Population of Kochi Urban Agglomeration (included mostly in GCDA) area as per the Census of India 1991 is 1140605 spread in an area of 373.27 sq. km. (Census Report, 1991). Kochi was thus included in the list of 23 million plus cities of India in 1991. In 1994, for giving special attention to island panchayats Goshree Island Development Authority (GIDA) was formed by taking out eight island panchayats from Greater Cochin Development Authority jurisdictional area. In 1995, Government of Kerala declared the Greater Kochi Metropolitan Area (Map 1.2) extending to 732 sq. km. and consisting of Cochin Corporation, six adjoining municipalities and 33 panchayats and which contain the Kochi Urban Agglomeration 1991. This is the original jurisdictional area of the Greater Cochin Development Authority. Thus, Greater Kochi Metropolitan Area consists of two development authorities namely Greater Cochin Development Authority (632 sq. km.) and Goshree Island Development Authority (100 sq. km.) (Map 1.3).

As per the 2001 Census Kochi Urban Agglomeration area has increased to 452.64 sq. km. with a population of 1355972 which is mostly inside the metropolitan area.
Map 1.3
GREATER KOCHI METROPOLITAN AREA
IN ERNAKULAM DISTRICT

Legend

<table>
<thead>
<tr>
<th>Color</th>
<th>GCDA</th>
<th>GIDA</th>
<th>GKMA=GCDA+GIDA</th>
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Scale 1:500000
1.5 GREATER KOCHI IN THE GROWTH TRAJECTORY

Greater Kochi attains the status of an international city once the International Container Transshipment Terminal (ICTT) starts functioning here in full swing. Cochin Port has entered into an agreement with M/s Dubai Port International (DPI) to set up a Container Transshipment Terminal at Greater Kochi on Build-Operate-Transfer basis and the construction work is going on. Also many unique economic ventures are coming up in port-based special economic zones in Greater Kochi to contribute to the ICTT function. Some of the above ventures are as follows:

1) LNG degasification plant
2) Ship repairing yard
3) Bunkering yard
4) Cruise terminal
5) Marina

Greater Kochi can no longer remain in low profile due to the above economic functions allocated to it. The surging metropolis is to be steered with sound development management techniques to contain the developmental momentum for a sustainable Greater Kochi.

Fig.1.4 Port Based Special Economic Zones, Source: Cochin Port Trust
1.6 SWOT OF GREATER KOCHI

To take stock of the Strengths, Weaknesses, Opportunities and Threats of Greater Kochi is very much adequate for this study of environmentally-efficient development management system. SWOT of Greater Kochi which is gathered through discussions and seeking experts' and stakeholders' opinion. The pro forma circulated for SWOT stocktaking is as per Annexure 1. SWOT gathered are listed below under five different heads:

1. Nature and Resources
2. Infrastructure and service demand
3. People and competencies
4. Political and social
5. Economic and financial

STRENGTHS

S-Nature and Resources

➢ Geographically central location of the state
➢ Proximity to international shipping lane
➢ Potential agricultural area in the region
➢ Scenic beauty of the backwaters and rivers
➢ Plenty of rain, sun and moderate climate
➢ varied ecosystems in the region
➢ Network of canals suitable for city and cargo transport
➢ A place of rich heritage
➢ Attractive tourist spot in the region

S-Infrastructure and Service Demand

➢ Good accessibility by road, rail, air and sea to the rest of the world
➢ Good regional connectivity inside the state
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- All weather port and coming up container terminal
- Landing point for submarine cables
- Presence of wholesale markets for agricultural produce
- Major distribution centre for commodities
- Nodal point for collection and distribution of manpower and cargo
- Coming up LNG terminal, cheaper fuel for industries
- High supply of serviced urban vacant land
- Low rental value compared to other cities of the world

S-People and Competencies

- Good communication skills of the residents
- Low cost of living compared to other international cities
- High literacy level and educated youth throughout the state
- Enterprising nature of the people
- Low attrition rates in employment

S-Political and Social

- Cosmopolitan character of the crowd
- Good Schools/Universities
- Wide-spread banking facilities
- Communal harmony
- Low crime rate
- Cheap and good medical facilities

S-Economic and Financial

- Most tax-generating place in the state
- Higher per capita income in comparison to other cities in the state
- High spending capacity and spending habit of the residents
- NRI mooring point for shopping, investment and stay
WEAKNESSES

W-Nature and Resources

- Unplanned and unregulated development resulting in urban sprawl
- Unviable population concentration for higher order infrastructure
- Non-judicious industrial location
- Non-uniform distribution of stadiums, parks, and open spaces
- Fast run-off due to steep terrain condition of the hinterland
- Deterioration of West Kochi area
- Degradation of river Periyar and the various canals in the city
- Sea erosion, flooding and mosquito menace
- Less productivity of the resource base of the region
- Land acquisition for developmental work highly expensive
- Diminishing Government land

W-Infrastructure and Service Demand

- Disposal of untreated industrial waste into water bodies
- Lack of adequate solid waste management facilities
- Lack of proper storm water drainage in low-lying areas
- Absence of efficient sewage disposal system
- Disposal of sewerage to surface drainage in many areas
- Pressure on road network due to increase in personalised vehicles
- Lack of adequate parking space
- Lack of suitable mode of mass transport and inter-modal facilities
- Deteriorated infrastructure in West Kochi
- Deteriorated bridges across water bodies
- Lack of head room of canals to enable inland navigation
- Silting up of canals
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➢ Lack of high capacity infrastructure to accommodate high residential densities
➢ Non-judicious location of high-rise buildings
➢ Plenty of non-performing serviced vacant land and vacant buildings
➢ Lack of efficient disaster management system

**W-People and Competencies**

➢ Lack of adequate bureaucratic support not being the capital city
➢ Lack of mechanism to create housing for the poor
➢ Lack of coordination between various government bodies
➢ Lack of effective role given to development authorities
➢ Lack of effective legislation for innovative development management
➢ Obsolete Town Planning Act

**W-Political and Social**

➢ Rising Corporation tax rates with diminishing services offered by Corporation
➢ Unscientific taxation formulae
➢ Loss of productive hours due to political unrest for trivial issues and trade unionism
➢ Uncontrolled migrant labour resulting in unauthorised colonies
➢ Low bargaining power of the elected representatives due to lack of population concentration

**W-Economic and Financial**

➢ High morbidity rate of population, prevalence of life style diseases
➢ Distribution of tax collected from the area to the rest of the state and country
➢ Incompetency in utilising the available government funds
OPPORTUNITIES

O-Nature and Resources

➢ Cheaper cost of fuel from LNG plant can revitalise the industrial economy
➢ Harnessing the minus energy of LNG for generation of drinking water
➢ Conservation of ecosystems and agricultural areas in the hinterland
➢ Improve mass transit to reduce traffic congestion
➢ Construction of small dams in the region to reduce fast runoff and salinity intrusion
➢ Development of middle class tourism to attract domestic tourists to enjoy the nature
➢ Encouragement of IT and ITES industries
➢ Encouragement of energy-efficient city planning and energy-efficient building practices

O-Infrastructure and Service Demand

➢ Enlisted as a beneficiary of Jawaharlal Nehru National Urban Renewal Mission
➢ Suburban rail for mass transport
➢ Inland navigation for transport of cargo, city transport and tourism
➢ Continuing investment in port and container terminal facilities
➢ Continuing investment in the development of the International Airport
➢ Development of interstate bus terminal with multimodal interchange facility
➢ Establishment of higher order infrastructure
➢ To develop as a world class service centre
➢ Planned compact high density development

O-People and Competencies

➢ High literacy rates and availability of skilled labour
➢ Return of NRIs with financial capital, experience, new ideas and know-how
Keralites scattered throughout the world for building up business opportunities in their homeland

**O-Political and Social**

- State-wide commitment to develop Greater Kochi as a top class global city
- Formulation of the mandatory Metropolitan Planning Board/Committee
- Re-delineation of effective metropolitan area and region for planned development

**O-Economic and Financial**

- Can attract tourists for rest and relaxation
- Provision of infrastructure on private-public participation
- Can emerge as an international conference centre
- Can be a centre for international and national trade fairs
- Can be developed as centre for hosting events in sports

**THREATS**

**T-Nature and Resources**

- Degradation of rivers and the canals causing unpleasant atmosphere and epidemics
- Sea level rise can affect the high density population near water bodies
- Sea erosion of West Kochi area and land subsidence of the filled-up areas
- Establishment of Vizhinjam container terminal, within-state competition
- Degradation of heritage buildings
- Earthquake zone reclassified as zone III
- Loss of productivity of the ecosystems in the hinterland
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T-Infrastructure and Service Demand

- High susceptibility to fire hazard due to lack of scientific disaster management facilities
- Unscientific land filling and cutting can cause land slide and land subsidence
- Unscientific rainwater harvesting can cause land slides
- Lack of flyovers and bridges causing loss of man hours and fuel repel economic opportunities
- Air pollution causes severe respiratory diseases

T-People and Competencies

- Aging of the resident population as educated youth are working outside the country
- Sedentary habits causing high occurrence of life style diseases

T-Political and Social

- Corruption and high labour militancy
- Increase in crime rate and road accidents
- Lack of parental care for the young generation as one of the parents may be working abroad

T-Economic and Financial

- Decline and degradation of the city resulting in loss of total economy

Going through the SWOT one can see that the strengths and opportunities are immense and they outweigh the weaknesses and threats which can easily be overcome by prudent and effective development management measures.
1.7 BASE CONCEPT, OBJECTIVES AND METHODOLOGY

The base concept from which the entire research problem emerged is as follows:

Lack of spatial planning and effective development management system lead to urban sprawl with non-optimal density of population to support urban infrastructure on the one side causing a lesser quality of life in urban areas. On the other side it causes loss of productivity of natural ecosystems and agricultural areas due to disturbance to the ecosystems. Planned compact high density development with compatible mixed land use can go a long way in achieving environmental efficiency of development management system.

OBJECTIVES

1. To take stock of the research works across the world in the field of sustainable development and to derive the most suitable and pragmatic efficiency index for the evaluation of environmental efficiency of the development management system.

2. To detect the infirmity of the development paradigm of the Macro Study Areas, State of Kerala, the Greater Kochi Resource Region and the Greater Kochi Metropolitan area by a critical analysis of the socio-economic characteristics vis-à-vis urbanisation pattern.

3. Physically examine Greater Kochi Micro Study Area through remote sensing and GIS capabilities, the population increase vis-à-vis built-up area increase across space and time.

4. To examine the modeling and simulation possibilities for the Greater Kochi Micro Study Area to identify the growth trend and possible intervention.

5. To prepare the efficiency map of the Micro Study Area, to evaluate and monitor the environmental efficiency of development management system of the Micro Study Area.
6. To take stock of the ideas, strategies and programs which contribute to environmental efficiency

7. To recommend technical, legal/institutional mechanism to monitor the environmental efficiency of the development management system.

**METHODOLOGY**

![Diagram of research methodology]

- **Research Works Done by UN Agencies and Other Relevant Publications**
- **Derivation of Environmental Efficiency Index**
- **Analysis of Macro Study Area: State, Region, Metropolitan Area/Urban Agglomeration**
- **Secondary Data & Publications**
- **TOPO SHEET 1968, SOI**
- **IRS LISS III MAP, NRSA**
- **Analysis of Micro Study Area: Entropy, Trend, Efficiency**
- **Development Management System Most Preferred Scenario**
- **Stock Taking: Ideas/Strategies/Programs Contributing to Environmental Efficiency**
- **Recommendations: Technical, Legal/Institutional**
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