Industrial revolution and subsequent growth of rapid industrialisation have caused serious threats to sustainable development of both developed and developing countries. While modern industries extracted various natural resources, other raw materials and energy from the environment to produce material goods and services, such uses and production processes have resulted in large scale emissions of wastes into the environment causing severe threats to traditional agrarian practices, suppressing the values of rural and urban property and reducing the quality of human life. Although most of the developed countries had responded to this social menace by developing a variety of technological, economic and legal regimes for regulating the polluting behaviour of firms, the developing countries have not attained sufficient progress in regulating industrial pollution and its influences on their economy and society due to lack of technological alternatives, failures of markets, institutions, government policies, mass poverty and illiteracy. The urge for attaining rapid industrialisation and the immediate transfer of benefits to local population subdued environmental concerns of sustainable development.

Environmental economists, who examined the impacts of industrialisation on the natural environment and human health in India have raised these contradictions of
industrialisation and argued for their immediate redressal through appropriate legal, fiscal and institutional regimes (Shaman, D., 1996; Kuik, O. J. et al., 1996; Sankar, U., 1998; Murty, 2000). Realizing the need for evolving a sustainable economy through appropriate environmental engineering, the Government has formulated a number of policies and enacted legislations. Despite these initiatives, the process of industrialisation continues to inflict damages to human health and property values in many parts of the country (Parikh, et al., 1994; Abu backer, 1994; Cropper, 1997), including the State of Kerala which was believed to be least affected by industrial pollution.

In India, the policy of rapid industrialization led to the growth of many big industrial cities. At the same time, however, outdoor air pollution has been constantly growing in these agglomerations due to concentration of industries and increased use of vehicles. Documents of Central Pollution Control Board disclose that the suspended particulate matter (SPM) in urban residential areas exceeded critical limits in many metros/cities.

There were a number of legislations passed for protection of environment before and after independence. Some of these are the Indian Forest Act of 1865, Elephant Preservation Act of 1879, Bengal Smoke Nuisance Act of 1905, Bombay Smoke Nuisance Act of 1912, Motor Vehicles Acts of 1938 etc. Existing Legal institutions for environmental management in India are the result of a spate of environmental laws enacted by the Indian Parliament in the aftermath of the UN conference on the Human Environment in Stockholm, in 1972. The important air pollution prevention laws in India are: (1) Water (Prevention and Control of Pollution) Act, 1974; (2) Water (Prevention and Control of Pollution) Cess Act, 1977; (3) Air (Prevention and Control of Pollution) Act, 1981; (4) Environment (Protection) Act, 1986; (5) Ambient Air Quality Standards, 1986; (6) The motor vehicle act 1938, amended in 1938; (7) Public liability Insurance Act 1991; (8) Environmental Audit Notification, 1992; (9) Environmental Impact Assessment Notification 1994 etc.

A recent study undertaken by the Indira Gandhi Institute of Development Research, Mumbai estimated that for every 10 microgram per cubic meter increase in atmospheric sulphur dioxide concentration, the annual social and health costs exceeds Rs.10 crores in Mumbai. The study also indicated that property values fell with an increase in suspended particulate matter in Chembur (Parikh et al., 1994).

The state of Kerala, the southern tip of India, is rich in natural resources and poor in industrial performance. It is generally accepted by the authorities that, Kerala is not highly polluted, compared with other states. Spenger, Thom, team leader of Indo Dutch project, Kerala State Pollution control Board, argued that based on the available data, the state's overall environmental status is acceptable. (Ernakulam Public hearing, 1999)
1.1 Statement of the Problem

A four decades long industrial development of the State of Kerala has brought in many changes on the use of natural resources and environment. The initial phase of industrialization in Kerala was based on natural resources like fisheries, cashew, coconut, coir, timber, and bamboo and other small forest produce, handlooms, minerals etc. Most of these industries were evolved as "clusters" where raw materials were abundant in supply. This scenario has changed since the second five-year plan with the active participation of the State towards industrialization. The industrial revolution led to the emergence of large factories with mass production capacities and majority of them located around river basins and in urban centres where population density is high. The number of working factories has increased to 18621 in 2001 compared to 9104 in 1980 (Government of Kerala, Economic Review 2000; 1980) Recent statistics of the Central Pollution Control Board reveals that Kerala ranks fourth in the case of industrial units closed down due to pollution (Govt. of India, Economic Survey, 2000-03). Another major causal factor of air pollution, the number of vehicles, has been growing at a rate of 10 percent per annum, leading to a concurrent increase in air pollution.

Moreover, traditional industries and new industries using modern technologies extract natural resources and environmental assets on large scales without paying the relevant price for such uses. It is unfortunate to note that most of the large-scale chemical and petrochemical industries, some in the public sector too, have started
polluting the environment. These in turn have led to the degradation of air, water and land, directly affecting livelihood and human health. The 'Kerala Model of Development' has also been silent on these environmental and ecological issues due to its overemphasis on the role of the social sectors and quality of life. However, serious analytical studies on the impact of air pollution on Kerala economy, especially on the health of the people and on the changes in property values are not available.

This study attempts to overcome this limitation by

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5 It is reported that potential air pollutants like suspended solids, dissolved fluorides, and phosphates, free ammonia, ammoniac nitrogen, carbon powder, hexavalent chromium, acidic chemicals like SO₂, CO₂, Cl₂, HCl, etc., are emitted by these factories to the environment beyond the level of tolerance. It may be noted that some of these pollutants recorded by the experts of Pollution Control Board (PCB) and National Environmental Engineering and Research Institute (NEERI) are found to be harmful in many ways to the life and property of human population.

6 Impacts are categorized in terms of human health, welfare (e.g., gains or losses apart from those associated with health, such as project related fishery yields), and environmental, including such ecological consequences as species preservation and diversity, and global impacts (i.e., large scale consequences, such as, climate change). [Asian Development Bank; 1996] see Freeman, M. III (1979) for some of these effects of air pollutants. pp: 18-23.

7 Franke, R (1995) argued that environmental degradation is a major problem in Kerala. For instance, fishing resources seem to be declining in certain areas during the past decades. Similarly, salinisation, water logging, polluted rivers, and severe forest cover loss have lead to soil erosion, especially on the slopes of the Western Ghats Mountains. With its heavy population density and large number of micro environments packed together in a small, but varied landscape, Kerala is particularly vulnerable to ecological degeneration. Until fairly recently, it does not appear that the Kerala model focused attention on these issues.

8 Antony, C.A (1998) has conducted a financial estimate of environmental pollution control and abatement schemes in Eloor-Edayar industrial belt of Cochin. He analysed the financial, economic, social and political implications of polluted environment in the study area in an Environmental Impact Assessment framework. Some of the impacts of pollution and its abatement measures were also examined. The study concluded that the environment in the study area is heavily polluted and spread over 1,10,000 people and 65,000 domestic animals and birds. Agriculture and human health were seriously affected by pollution in the industrial belt. However, the study hasn't used any proper valuation methods (observed behaviour or hypothetical methods), which are used to capture use, non-use and option values of an environmental good, especially when markets fail. The stressor-impact information provided in the study was useful, but the benefits or losses (in health or property values) to households or society at large, due to a change in environmental quality were not estimated and evaluated in the study.
undertaking a detailed analysis of the economic impacts of air pollution on human health and property values around the Cochin industrial agglomeration in Kerala.

1.2 Research Questions

This study aims to answer the following questions:

1. What is the relationship between air pollution, human health and property values and

2. How has it affected the prices of property and the health of human population in and around the industrial agglomeration

1.3 Objectives

More specifically, the study proposes the following objectives

1. To provide a systematic descriptive documentation of the nature of air pollution of the Cochin industrial agglomeration.

2. To estimate willingness to pay for morbidity reduction due to air pollution in observed and hypothetical markets.

3. To estimate the value of welfare loss in the purchase of property due to reduced air quality.
1.4 Economic Impacts of Air Pollution: Framework of Analysis

Industrial sector in Kerala is one of the major productive and wealth creating sectors. However, it remains as a major polluter, resulting in the degradation of the health of local population and reduction in property values. Pollution is defined as 'an undesirable state of the natural environment being contaminated with harmful substances as a consequence of human activities' (Cognitive Science Laboratory: Princeton University). Air pollution is the 'contamination of the atmosphere by substances that, directly or indirectly, adversely affect human health or welfare. It results from human activities, both deliberate releases (as from smokestacks) and fugitive emissions (as dust blown from streets or fields), and from natural sources, including sea spray, volcanic emissions, pollen, etc'. (National Institute for the Environment, Washington D.C) The problem of pollution and its management is found in history and is well debated in various disciplines. Economic definition of pollution is dependent upon both physical effect of waste on the environment and the human reaction to that physical effect. In economic parlance, there has been an

脚 www.cogsci.princeton.edu/cgi-bin/webwn

10 www.cnie.org/nle/AgGlossary/letter-a.html

11 There are records of Romans complaining about the 'stink of money chimneys' (Schoenbaum and Rosenberg 1991). Spanish explorers landing in the sixteenth century noted that smoke from the Indian campfires hung in the air of the Los Angeles basin (Ruff E. Larry 1972). Pollution control laws in other parts of Europe dates from the Middle Ages. These issues and many more contemporary issues like biodiversity degradation, global warming, climate change etc. have been analysed both by natural scientists, engineers and social scientists. Dorfman (1972) argued that pollution must be understood in economic terms. Approaches to pollution based on technology, politics, law and ethics are bound to have disappointing results, because they ignore the fact that pollution is an economic problem. pp: 3
uncompensated loss of human welfare due to the imposition of an external cost\textsuperscript{12} related to emissions into the air (Turner, Kerry; 1994). Environmental economists argue that the damages due to air pollution depend on the assimilative ability of the environment. If the emission loads exceed absorptive capacity, pollutants accumulate in the environment (Hanley, \textit{et al.}, 1997), causing damages to the material well-being of the society.

It was Pigou (1920) who first analysed the impact of pollution by distinguishing between the private costs and social costs. The polluting firm, most often, externalises its costs of abatement causing divergence between the private and social costs. When these costs diverge, markets fail to perform efficiently. The divergence between costs and benefits is the fundamental cause of pollution of all types (Dorfman and Dorfman; 1972). Market failure occurs when prices understate the full range of services provided by an asset or simply do not send signals to the market about the value of an asset. One of the most important sources of market failure is the presence of externalities or spillovers\textsuperscript{13}. There are many other cases of market failure for environmental assets, such as, incomplete markets, non-

\textsuperscript{12} i.e., health damage, increase in mortality or morbidity etc.

\textsuperscript{13} Externalities refer to the costs or benefits imposed by the consumption or production activities of individuals on the rest of the society for which no payment is made. Such costs are outside the market system and are not reflected in relative market prices. (Hanley \textit{et al.}, 1997). Through industrial pollution, society incurs significant costs by reducing the assimilative capacity of the environment. These costs are external costs and thus pollution becomes an externality. (Tietenberg, 1988)
Pollution externalities alter natural ecosystems and human life in many ways. For instance, air pollution influences natural vegetation, productivity of land, other economic activities, human health, property prices and very many varieties of ecosystem services. Although all these issues demand detailed critical examination, the major focus of our thesis, however, is on how air pollution influences human health and property values.

The incidence of air pollution on human health ranges from morbidity\textsuperscript{14} to mortality. (Murty and Kumar, 2002). Morbidity can be classified in a variety of ways based on the duration or intensity of illness as chronic or acute, on the degree of impairment of activity which decides the inability of the affected person to undertake normal work or on the type of symptoms that varies from person to person. The degree of impairment of activity is an important way of measuring morbidity. There are several categories of degrees of activity impairment, namely, Restricted Activity Days\textsuperscript{15} (RAD), Bed Disability Days\textsuperscript{16} (BDD) and Work days

\textsuperscript{14} Morbidity is defined by the U. S. Public Health Service as, 'a departure from a state of physical or mental well being, resulting from disease or injury, of which affected individual is aware (Peterson, 1975).

\textsuperscript{15} Restricted Activity Days are those on which a person is able to undertake some, but not all, activities (Freeman, 1993)
Lost\textsuperscript{17} (WDL). Following the guidelines suggested by the United States Department of Health, the present study clubs these three categories under one head, RAD (U S Department of Health, 1964).

Mortality, on the other hand, refers \textit{to a well defined event – death – which for ceremonial and legal reasons almost always is noted and made part of an official record} (Freeman, 1993). Both morbidity and mortality have attained considerable importance for estimating willingness to pay for improved health. However, this work is concentrated on morbidity alone because it has varying degrees of illness or injury, with multi dimensional impacts.

The second issue examined in this inquiry is on the relationship between air pollution and the value of residential property. This relationship depends mainly on various environmental, structural and neighbourhood characteristics they possess. Environmental characteristics include the factors which determine environmental quality, such as, SO\textsubscript{2}, NO\textsubscript{X}, and SPM, distance to lake or river etc. Structural characteristics include plot size, number of rooms, garage space, type of flooring, type of roofing, age of house etc. and neighbourhood characteristics include level

\textsuperscript{16} Bed Disability Days are those in which a person is confined to bed, either at home or institution (Freeman, 1993).

\textsuperscript{17} Work days Lost are those on which a person is unable to engage in ordinary gainful employment (Freeman, 1993).
of traffic, distance to central business district, distance to nearest industrial zone, slope of property etc.

In absence of ownership and efficient pricing, special techniques are needed to analyse economic impacts of environmental changes. One of the popular approaches\textsuperscript{18} to analyse the economic impacts of air pollution on the health of human population and residential property values is centred on identifying and monetising the relevant costs and benefits of an environmental change. Monetary values of changes in human health that are associated with environmental changes are estimated either using ‘indirect observed’ approach [household production function] or the ‘hypothetical market approach’ [Contingent Valuation Method (CVM)] (Murty, 2000). While a standard production function approach is adopted in the former method to estimate the willingness to pay (WTP) for restricted activity days affected by air pollution, the latter method resorts to hypothetical markets for the elicitation of values\textsuperscript{19}.

\textsuperscript{18}The methods of estimating values for environmental goods are mainly classified into two: ‘Physical linkage methods’ and ‘Behaviour linkage methods’. Physical linkage method assumes that there is some sort of technological relationship between environmental good and the user. This relation ship may be either technological or biological. The behaviour linkage methods are mainly classified into two: ‘observed behaviour’ and ‘hypothetical’. The important observed behaviour methods are Simulated markets, Travel Cost, Hedonic Property Value, Avoidance Expenditures, and Referendum Voting etc. Major hypothetical methods are Bidding game (willingness to pay questions), Contingent Ranking, Contingent Referendum etc. (Mitchell and Carson, 1989). Some other methods are also applied in valuation of health damage, such as, Cost of Illness, Human Capital Approach, Value of Statistical Life (United Nations; 1997)

\textsuperscript{19} A detailed review of such studies is given in chapter 2.
1.4.1 Air Pollution and Health: The Production Function Model

Environmental pollution reduces people's well being through the following ways. (1) Medical expenses associated with treating pollution-induced diseases including the opportunity cost of time spent for obtaining the treatment, (2) Lost wages (3) Defensive or averting expenditures associated with attempts to prevent pollution-induced disease, (4) Changes in consumption pattern, (5) Disutility associated with the symptoms and lost opportunities due to diseases and (6) Changes in life expectancy or risk of pre-mature death. (Freeman, M, 1993). Therefore, the welfare loss due to air pollution could be estimated in terms of increased morbidity.

Economists have used a number of approaches to determine the monetary value of reduced morbidity. A formal model used for deriving values of reduced morbidity, based on health production function, was first developed by Grossman (1972). Cropper (1981) introduced a pollution variable into the function and later Harrington and Portney (1987) extended the model to examine explicitly the relation between willingness to pay (WTP) and a reduction in pollution. Alberini and Krupnik (2000) have applied this model to estimate willingness to pay to avoid health damages. The model used here is a variant of Harrington and Portney (1987).

More specifically, the health production function is expressed as

\[ S = s(C, M, H, K) \]
Where, 

\( S \) = Number of Sick Days  
\( C \) = Environmental Quality  
\( M \) = Mitigating Activities  
\( K \) = Stock of Social Capital (such as education, sex....)  
\( H \) = Stock of Health Capital  

The Utility function of the individual can be defined as: 

\[ U = u(Y, S, C, L, I) \]

Where, 

\( Y \) = any private good, taken as numeraire  
\( L \) = leisure  
\( I \) = Income  

Individual’s budget constraint is written as, 

\[ I = I^* + P_w(T - L - S) = Y + PmM \]

Where, 

\( P_w \) = wage rate  
\( I^* \) = non labour income  
\( T \) = total time available  
\( Pm \) = price of mitigating activities  

Individual maximizes Utility (2) subject to the budget constraint, 

\[ \text{Max } Z = u(Y, S, C, L, I) + \lambda \left( I^* + P_w(T - L - S) - Y - PmM \right) \]
Estimating the demand function for mitigating activities, one obtains the marginal willingness to pay as:

\[ MWTP, \quad \frac{\partial I}{\partial C} = P_w \frac{\partial S}{\partial C} + P_m \frac{\partial M}{\partial C} - \frac{\partial U/\partial S}{\lambda} \frac{\partial S}{\partial C} \]

1.4.2 Air Pollution and Property: The Hedonic Model

The welfare benefit in property values due to reduced air pollution is estimated using the hedonic property value model. The model used here for observing the relationship between air pollution and property value is based on Freeman (1979). Following Freeman, Pearce and Turner (1990) and Bateman (1993) Parikh et al. (1994) have applied the model to estimate property values. Based on this basic model, the study also estimates Marshallian consumer surplus, as a measure of welfare benefits from reduced levels of air pollution. The model is specified below.

Consider the price of a residential location \((\Phi)\) as a function of structural \((S_i)\), neighbourhood \((N_i)\) and environmental characteristics \((Q_i)\).

\[ \Phi = \Phi(S_i, N_i, Q_i) \]

The utility function of the individual who occupies the house is,

\[ u(X, S_i, N_i, Q_i) \]
If there is an improvement in environmental characteristics from $q_j^0$ to $q_j^1$, the value the individual places on such improvements ($Bij$) could be estimated by integrating the implicit price function with respect to $q_j$.

$$Bij = \int_{q_j^0}^{q_j^1} bij(q_j, Q_i^*, S_i, N_i, G_i) dq_j$$

Where, $G_i$ is the socio-economic characteristics.

The value obtained by integrating the inverse demand function with respect to the implicit price is interpreted as the consumer surplus.

The inverse demand function assumes the form,

$$imprice = e^{a_0} G_i^{a_1} S_i^{a_2} N_i^{a_3} Q_i^{a_4}$$

Consumer surplus is calculated by integrating the inverse demand curve with respect to the implicit price and calculating the definite (Reimann) integral by observing the old and new level of $Q_i$, planned by the policy maker.

1.5 Methodology

This study begins with a detailed description of the basic characteristics of the selected industrial agglomeration including the nature and incidence of air pollution caused by industrialisation of Kerala economy in the recent past. It then concentrates on the identification, quantification and analysis of the major economic impacts of air pollution in the study area.
1.5.1 The Study Area

The study is conducted in the Cochin industrial belt in the state of Kerala (see map 3.5 in chapter 3). Cochin Industrial agglomeration is a geographical space, consisting of the Cochin Corporation, the Kalamassery Municipality and three panchayaths, viz, Vadavucode- Puthercruz, Thiruvankulam and Ellor. This area has been identified as the industrial capital of Kerala and hence inhabits a large number of factories both in the private and public domain. The Central Pollution Control Board in collaboration with the State Pollution Control Board identified Cochin as one of the problem areas in the country. It ranks first in both number of vehicles and number of registered factories (see chapter 3 for details). It is also reported that potential air pollutants like suspended solids, dissolved fluorides and phosphates, free ammonia, ammoniac nitrogen, carbon powder, hexavalent chromium, acidic chemicals like $\text{SO}_2$, $\text{CO}_2$ $\text{C}_12$, HCL, etc. emitted by these factories in to the environment are one of the highest compared to other districts of the State and are even beyond the level of tolerance. It is further noted that most of these pollutants recorded in this area are found to be harmful in many ways to the life and property of human population (Pollution Control Board (PCB): 2000; National Environmental Engineering and Research Institute (NEERI), 2000).

1.5.2 Population and Sample

The universe of the study Cochin industrial agglomeration, constitute, 130780 households including 695357 number of population. The households chosen to
participate in the survey was selected using a two stage stratified sampling procedure. In the first stage, the agglomeration is divided into six strata according to the distribution of air quality monitoring stations of the State Pollution Control Board. These stations are Ambalamugal, Eloor, Port Trust, CSIR Complex, Ernakulam North and Irumpalam. From these regions 100 households with in a radius of 1000 meters from the respective monitoring stations have been selected for intensive examination in the second stage. The figure 1.1 explains the sampling procedure adopted.

*Figure: 1.1
Sampling procedure*
1.5.3 Variables and Collection of Data

The study is based on both secondary and primary data. The National Ambient Air Quality Monitoring data has been collected from the publications of Central Pollution Control Board. These data were used as the measure of air pollution. Details regarding study area are collected from the records of respective local parishayath/ municipality/ corporation and zonal office of Pollution Control Board at Cochin. Other relevant secondary data, regarding pollution health impacts, epidemiological data etc. are collected from various published and unpublished sources, institutions such as State Pollution Control Board (PCB), National Environmental Engineering Institute (NEERI), NGOs such as, Kerala Sashtra Sahitya Parishat, Green Peace, Periyar Malineekarana Virudha Samithy and Industrial units.

The primary data on averting/mitigating activities (medication, doctor visits, use of folk medicines, installing air purifier etc.), workdays lost, number of sick days, family details, averting and mitigating costs, factors affecting property values, sales price of residential property, health status, habits, hospital admissions, and other socio economic variables, such as, education, household income etc. are collected using a structured schedule (see Appendix 1 for schedule).
1.5.4 Primary Survey

A primary survey covering family details, environmental quality, factors influencing human health, other socio economic variables, willingness to pay for avoided heath risks and factors affecting property values was conducted among 600 households at six centres in the Cochin industrial agglomeration during the period of June 2001 – January 2002 in a face to face interviewing method. To estimate their WTP to avoid symptom days, five symptoms (coughing, itching and smarting eyes, breathing trouble, acute bronchitis and asthma attack) were given. The descriptions of these symptoms were given in five separate cards and were distributed. After giving a detailed picture of the exposure-response functions in the area, people were asked to choose one of the symptom slip, which ranked as the worst one in the light of previous disease experience. The first part of the question explicitly reminds people about their costs on mitigating and averting activities and how it affects their family budget constraint. Then they were asked, their willing to pay Rs. 200 to eliminate these symptom days. Rs. 200 was obtained as an average minimum cost of illness from the preliminary survey. In the next iteration, to obtain their maximum WTP, people were asked to bid an amount to avoid the symptoms for 1-7 days for the next 12 months. If the answer was in the affirmative, people were asked to increase amounts from Rs. 200 to a maximum, using the bids and if the answer was in the negative, the amount was reduced by a certain rate down to what the respondent was actually willing to pay.
The survey was conducted among 100 respondents each from six strata of the sample.

1.5.5 Estimation

SPSS and E-views were used for statistical calculations.

1.6 Scope of the study

Industries pollute environment and the society incurs significant loss of welfare from this, due to reduced assimilative capacity of the environment. This study highlights that air pollution generates costs which are external to the industry (Tiessenberg: 1988). As emphasised in the beginning of this chapter, pollution being an externality creates serious damages to human health, agriculture, livestock, fisheries and property values. It is unfortunate, however, that such issues are often marginalised in academic discourses on development, even while environment-friendly industrialisation policies are formulated.

Our study has some definite advantages in understanding the manner in which air pollution affects the economic activities of one of the most important industrial agglomerations of the state of Kerala. For instance, the welfare losses due to the incidence of air pollution have been estimated using established environmental economic methodologies. These results can be used for evolving environment-friendly industrialisation strategies for Kerala economy. In fact, a number of
people's science movements and the civil society have been demanding such redressal packages for the sustainable development of Kerala\(^\text{20}\).

At the same time, this study is probably the first attempt to conceptualise and quantify the environment-economy interaction of air pollution in Kerala. It may however, be mentioned that our study concentrates only on the economic impacts of air pollution on human health and property values while many other parameters remain outside the domain of our limited scientific inquiry. More detailed formulations and studies are therefore required to understand these processes in order to formulate policies for a sustainable Kerala model of development.

### 1.7 Plan of the Thesis

The thesis is divided into six chapters. The first chapter introduces the study, a framework for analysis and the underlying methodology adopted in the study. The second chapter reviews the relevant literature. It aims to establish the complex interaction among air pollution, human health and property values. In the third

\(^{20}\) A number of local people's movement, such as, Periyar Malineekarana Virudha Samithy, Karimugal Carbon Malineekarana Virudha Samithy etc., leading NGOs such as, Kerala Peoples Science Movement (KSSP), Green Peace etc. and many other grass root agencies have raised issues and concerns regarding various environmental problems faced by the state. They are often organizing demonstrations and agitations against the government and polluting industries. They are demanding immediate reallocation of institutional and policy options towards sustainable development. Pollution-health issues, along with deforestation, paddy conservation, disruption of backwater ecosystem, sand mining, depletion of resources, such as, fisheries, water resources, and allocation of private property rights to public goods and services such as bridges, health have raised serious discussions regarding sustainability of Kerala pattern of development. They are demanding immediate reallocation of institutional and policy options towards sustainable development.
chapter we outline the status of air pollution in the Cochin industrial agglomeration. The fourth chapter presents an analysis on the influence of air pollution on human health in the study area. An attempt is also made in this chapter to quantify these relations using production function and contingent valuation methods. This is followed by a detailed analysis of the impact of air pollution on property values in chapter five. Chapter six provides the summary and conclusions of our study.