IMPACT OF URBANIZATION ON SUSTAINABLE ENVIRONMENT IN KERALA - A STUDY BASED ON THRISSUR DISTRICT

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Under the Faculty of Humanities

By

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CERTIFICATE

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I, Dhanya John, do hereby affirm that this written account entitled **"IMPACT OF URBANIZATION ON SUSTAINABLE ENVIRONMENT IN KERALA- A STUDY BASED ON THRISSUR DISTRICT"** is a bonafide record of research done by me under the guidance of Dr. K. M. Francis, Associate Professor (Rtd), and the co-guidance of Dr.Sabu P. J, Assistant Professor, Research and Post graduate Department of Economics, St. Thomas' College (Autonomous), Thrissur. I also declare that this thesis has not been submitted by me earlier for the award of any degree, diploma, fellowship or any other similar title.

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"It is a great pleasure to express my gratitude to all who supported and encouraged me for carrying out this study. I humbly place my sincere gratitude to my family and parents. Their whole hearted support and blessings have renewed me every day, all the way on the journey through my Doctor's. I dedicate this thesis to my family".

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DHANYA JOHN

(Researcher)

"The 'Environment' Is Where We Live; And 'Development' Is What We All Do In Attempting To Improve Our Lot Within That Abode, The Two Are Inseperable".

Our Common Future (WCED, 1987)

Abstract

Urbanization is a worldwide phenomenon in more developed as well as less developed regions. The World Urbanization Prospects in its studies revealed that the rate of urbanization is higher in less developed regions than highly developed regions of the world. Urban issues are becoming of critical importance around the world, and urbanization is expected to continue with close to half of the world's population already living in urban areas and some cities now reaching unprecedented size. The over populated Cities of India are characterized by over population and the related environmental problems which are the main contributors of health risks. The present study of the impact of urbanization on sustainable environment in the state of Kerala is an attempt to analyze the devastating effects of environmental degradation in urban areas with special attention to its health impacts on urban households. The problem of environmental degradation in the context of growing urbanization based on a detailed study of Thrissur city area specifies the attention on issues of environmental pollution and its impact on health conditions of urban people.

The study concentrated on urban Kerala exhibits the environmental degradation in urban areas of the state which ultimately influences the health and living conditions of households. The magnitude of water pollution in the state is high which pulls up the urban households to diseases/ health hazards. Due to such health issues the households have sufferings physically along with economic burden. Similarly, the magnitude of air pollution in the state is also high which produces respiratory diseases and related uncomfortable situations to households. The generation of solid waste in the state is marked as high and the wastes generated in cities are not collected and treated property due to inefficiency in administration. The growth of motor vehicles and construction activities in cities bring air and noise pollutions and associated health hazards. It is important to note that, all these environmental issues and related health hazards are affecting more the poor or slum households rather the rich urban households.

The sustainable urban development will consider economic, social and environmental aspects simultaneously and will inherit all the resources to future generations without damage. The use of Contingent Valuation Method and Logit Regression Model implied the attitude of people and their willingness to pay for better environment conservation methods. They showed their willingness to use public transport networks to avoid noise and air pollution levels, proper waste treatment at the household and city level and are willing to conserve the existing water resources. Hence, the government authorities should adopt environment protection measures; which incorporates the support from the citizens for environmental friendly city life. This policy fructifies sustainable urban development.

CONTENTS

Chapter Number	Chapter Name	Page Number
1	DESIGN OF THE STUDY	1-14
2	THEORETICAL BACKGROUND AND REVIEW OF LITERATURE	15-59
3	TRENDS AND PATTERN OF URBANIZATION AND ITS IMPACT ON ENVIRONMENTAL QUALITY	61-101
4	PROFILE OF THE SAMPLE CITY	103-119
5	SOCIO – ECONOMIC PROFILES AND HOUSING CHARACTERISTICS OF SAMPLE HOUSEHOLDS	121-148
6	AN ANALYSIS OF THE IMPACT OF URBANIZATION ON ENVIRONMENTAL CONDITIONS OF SAMPLE HOUSEHOLDS	149-222
7	FINDINGS AND SUGGESTIONS	223-238
	BIBLIOGRAPHY	239-254
	APPENDIX –I	255-263
	APPENDIX –II	264

LIST OF TABLES

TABLE. No.	TABLE NAME	PAGE. No.
3.1	Proportion of Urban Population and Rate of Urbanization of the World-The More Developed Regions and the Less Developed Regions 1950 - 2050	63
3.2	Rate of Urbanization by Major Areas	64
3.3	Total Urban and Rural Population 1950-2050	65
3.4	Trends in Urbanization in India	67
3.5	Urban Rural Population Growth Differentials	68
3.6	Population of India by Sex and Residence: 2011	69
3.7	Total Number of UAs/Towns in India	70
3.8	Growth of Population of Million Plus Cities	72
3.9	Million Plus Cities in India since 1951	73
3.10	Position of India's States and Union Territories based on Percentage of Urban Population 2011	75
3.11	Sector wise Annual Growth of GSDP (at 2004-05)	77
3.12	Trends in Development Indicators, 2011	77
3.13	Population and its Growth from 1901-2011 in Kerala	78
3.14	Trends in Urbanization in Kerala 1951-2011	79
3.15	Classification and Growth of Towns in Kerala and India According to their Status	80
3.16	Trend and Pattern of Urbanization across Districts in Kerala (2011)	81
3.17	Ranking of Districts by Percentage of Urban Population in Kerala 2001-2011	82
3.18	District Wise Classification of Towns in Kerala	83
3.19	Urbanization and Growth of Slums in India	85
3.20	Number of Statutory and Slum Reported Towns in India & Kerala (2011)	86

TABLE. No.	TABLE NAME	PAGE. No.
3.21	Slums in Kerala (1985, 1996)	87
3.22	Slum Population in Kerala – 2011	88
3.23	Source Wise Drinking Water Availability in Kerala – 2011	90
3.24	District Wise Indication of Contaminated Water	92
3.25	Composition of MSW in India and Regional Variation, 2012	94
3.26	Waste Generation Scenario in Kerala – 2006	94
3.27	Solid Waste Generation in Kerala	95
3.28	Physical Composition of Solid Waste in Kerala	95
3.29	Growth of Motor Vehicles in India, 2000-2011	96
3.30	Growth of Motor Vehicles in Kerala 2008-09 to 2012-13	98
3.31	Air Quality in Important Cities in Kerala 2012-20 (Annual Average mg/m^3)	98
3.32	Summary of Health Effects of Basic Air Pollutants	99
3.33	Ambient Air Quality Standard in Respect of Noise	100
3.34	Average Noise Levels in the Metropolitan Cities	100
3.35	Effects of Noise Pollution in Human Health	101
4.1	Annual Rainfall (mm) Received in Thrissur District	104
4.2	Distribution of Towns in Thrissur District as on 31-12-2009	105
4.3	Total Number of Villages and Towns – 2011	105
4.4	Population Statistics of Kerala and Thrissur – 2011	106
4.5	Area and Density of Population in Kerala and Thrissur – 2011	107
4.6	Sex Ratio of Kerala and Thrissur – 2011	107
4.7	Cities and Urban Population in Thrissur District	108
4.8	Socio- economic Profile of Thrissur City – 2011	110
4.9	Growth of Population of Thrissur City	110

TABLE. No.	TABLE NAME	PAGE. No.
4.10	Educational Facilities in the City	112
4.11	Health Care Facilities in Thrissur City	112
4.12	Industries in Thrissur City	113
4.13	Zone Wise Water Supply Coverage of Households	113
4.14	Status of Sewerage Network and Service Levels in Thrissur City	114
4.15	Solid Waste Generation and Collection Report of Thrissur City	115
4.16	Total Number of Power Connections in Thrissur City	116
4.17	Roads and Street Lightings	116
4.18	Range of Air Quality Index and its Interpretations	117
4.19	Environmental Pollution Aspects in Two Cities	118
5.1	Name and Frequency of Sample Zones	122
5.2	Sex Wise Distribution of the Respondents	123
5.3	Age Distribution of the Respondents	124
5.4	Literacy Status of the Respondents	126
5.5	Classification of Educational Levels of the Respondents	128
5.6	Religion Wise Distribution of the Respondents	129
5.7	Marital Status of the Respondents	130
5.8	Family Size of the Respondents	131
5.9	Occupational Distribution of the Respondents	133
5.10	Wealth Possession of the Respondents	134
5.11	Annual Household Income of the Respondents	136
5.12	Annual Expenditure on Food Items of the Respondents	138
5.13	Annual Expenditure on Non – Food Items of the Respondents	140

TABLE. No.	TABLE NAME	PAGE. No.
5.14	Monthly Savings of the Respondents	141
5.15	Type of House of the Respondents	143
5.16	The Nature of Houses of Respondents	144
5.17	Availability of Water According to the Location	145
5.18	Availability of Electricity According to the Locations	147
6.1	Environmental Problems Due to Urbanization	152
6.2	Environmental Pollution at Different Income Levels of the Households	154
6.3	Biological Water Quality Criteria	157
6.4	Quality of Water According to the Locations	157
6.5	Responses Towards Water Borne Diseases	159
6.6	Name of the Water Borne Diseases Affected by the Respondents	161
6.7	Monthly Cost incurred on Water Borne Diseases	163
6.8	ANOVA (Water-Borne Diseases)	164
6.9	Total Number of Respondent Affected by Air pollution	167
6.10	Main Contributors of Air Pollution	168
6.11	Name of the Air Borne Diseases Affected by the Respondents	170
6.12	Work Loss Days (Air Pollution) of the Respondents	173
6.13	Monthly Cost incurred on Air Borne Diseases	174
6.14	Monthly Cost of Air pollution and Air Borne Diseases	175
6.15	ANOVA (Air-Borne Diseases)	176
6.16	Chi-square Test of Water and Air Pollution Diseases and Health Cost	177
6.17	Causes for Increasing Municipal Solid Waste	180
6.18	Major Sources of Solid Waste Generation in the Sample Area	182

TABLE. No.	TABLE NAME	PAGE. No.
6.19	Major Diseases Due to Solid Waste Pollution	183
6.20	Work Loss Days of the Respondents Due to Solid Waste Pollution	185
6.21	Annual Cost Incurred on Solid Waste Pollution	186
6.22	Annual Cost of Solid Waste Pollution and WLD of the Respondents	188
6.23	Major Causes for Noise Pollution	191
6.24	Health Issues Due to Noise Pollution	193
6.25	Level of Noise Pollution in the Sample Areas	194
6.26	Work Loss Days of the Respondents Due to Noise Pollution	196
6.27	The Annual Cost Incurred Due to Noise Pollution (In Rupees)	197
6.28	Annual Cost of Noise Pollution and WLD of the Respondents	199
6.29	Chi- square Tests of Solid Waste and Noise Pollution and Health Cost	200
6.30	Willingness to Pay for Improved Quality of Water in the Sample Areas	203
6.31	Bidding Amounts for Improvement in Quality of Water According to the Sample Zones	205
6.32	The Logit Regression Model (Improvement in Water Quality)	208
6.33	The Regression Model (Logit) Related to WTP for Improved Water Quality	208
6.34	Willingness to Pay for Better Quality of Air in the Sample Areas	210
6.35	Bidding Amount for Better Quality of Air According to the Sample Zones	211
6.36	The Logit Regression Model (Better Air Quality)	212
6.37	The Logit Regression Model for Better Quality of Air	212
6.38	Willingness to Pay for Better Solid Waste Management in the Sample Areas	214

TABLE. No.	TABLE NAME	PAGE. No.
6.39	Bidding Amounts for Better Solid Waste Management According to the Sample Zones	215
6.40	The Logit Regression Model (Waste Management)	216
6.41	The Logit Regression Model for Better Waste Management System	216
6.42	Willingness to Pay for Reduction in Noise Pollution	217
6.43	Bidding Amounts for Noise Reduction According to the Sample Zones	218
6.44	The Logit Regression Model (Noise Reduction)	220
6.45	The Logit Regression Model for Reduction in Noise Level	220

LIST OF FIGURES

FIGURE. No.	TITLE	PAGE. No.
2.1	Environmental Kuznet's Curve	20
3.1	Rate of Urbanization by Major Areas	64
3.2	Trends in Urbanization in India	68
3.3	Population of India by Sex and Residence: 2011	69
3.4	Total Number of UAs/Towns in India	71
3.5	Million Plus Cities in India Since 1951	74
3.6	Population and its Growth from 1901-2011 in Kerala	78
3.7	Trends in Urbanization in Kerala 1951-2011	80
3.8	Trend and Pattern of Urbanization across Districts in Kerala (2011)	82
3.9	Urbanization and Growth of Slums in India	85
3.10	Source Wise Drinking Water Availability in Kerala – 2011	91
3.11	District Wise Indication of Contaminated Water	93
3.12	Growth of Motor Vehicles in India, 2000-2011	97
4.1	Map of Thrissur District	103
4.2	Map of Thrissur City	109
4.3	Growth of Population of Thrissur City	111
5.1	Sex Wise Distribution of the Respondents	123
5.2	Age Distribution of the Respondents	125
5.3	Literacy Status of the Respondents	127
5.4	Religion Wise Distribution of the Respondents	129
5.5	Marital Status of the Respondents	131
5.6	Annual Household Income of the Respondents (In Rupees)	137
5.7	Annual Expenditure on Food Items of the Respondents (In Rupees)	139
5.8	Monthly Savings of the Respondents (In Rupees)	142

5.9	Type of House of the Respondents	143
5.10	Availability of Water According to the Locations	146
5.11	Availability of Electricity According to the Locations	147
6.1	Environmental Problems Due to Urbanization	153
6.2	Photographs of Water Pollution in Sample City	156
6.3	Quality of Water According to the Locations	158
6.4	Responses Towards Water Borne Diseases	160
6.5	Name of the Water Borne Diseases Affected by the Respondents	162
6.6	Photographs of Air Pollution in Sample City	166
6.7	Total Number of Respondents Affected by Air pollution	167
6.8	Main Contributors of Air Pollution	169
6.9	Name of the Air Borne Diseases Affected by the Respondents	171
6.10	Monthly Cost Incurred on Air Borne Diseases (In Rupees)	174
6.11	Photographs of Solid Waste Pollution in Sample City	179
6.12	Causes for Increasing Municipal Solid Waste	181
6.13	Major Diseases Due to Solid Waste Pollution	184
6.14	Annual Cost Incurred on Solid Waste Pollution (In Rupees)	187
6.15	Photographs of Noise Pollution in Sample City	190
6.16	Major Causes for Noise Pollution	192
6.17	Level of Noise Pollution in the Sample Areas	195
6.18	The Annual Cost Incurred Due to Noise Pollution	198

LIST OF CHART

7.1	Concept of Sustainability in Urban and Regional Development	237

ACRONYMS

Abbreviation	Description
CDP	City Development Plan
CO	Carbon Monoxide
COI	Cost of Illness
CPCB	Central Pollution Control Board
CSP	City Sanitation Plan
CVM	Contingent Valuation Method
GDP	Gross Domestic Product
KSPCB	Kerala State Pollution Control Board
LDR	Less Developed Regions
MDR	More Developed Regions
MSW	Municipal Solid Waste
NOX	Nitrogen Oxides
SPM	Suspended Particulate Matter
TMC	Thrissur Municipal Corporation
ULB	Urban Local Bodies
WHO	World Health Organization
WLD	Work Loss Days
WTP	Willingness to Pay

CHAPTER– 1

DESIGN OF THE STUDY

CHAPTER - 1

DESIGN OF THE STUDY

1.1 Introduction

Urbanization is the process of population moving towards towns and cities from rural areas, and taking up the culture and work prevailing in the urban areas. According to the Encyclopedia of Social Sciences (1971); “urbanization is characterized by movement of people from small communities concerned chiefly or solely with agriculture to other communities generally larger, whose activities are primarily centered in Government, trade, manufacture or allied interests”. In simple words, “urbanization usually refers to the process of concentration of people in the densely populated settlements where majority of the people derive their livelihood from non-primary occupations” (Chaudari, 2001). It is treated as an index of modernization and one of the chief ingredients which reflects growth. It is also considered as a process which reveals itself through temporal, sectoral and spatial changes in the demographic, social, economic, technological and environmental aspects of life, in a given society. Urbanization is an inevitable part of economic development as it is intrinsically connected with the development process of countries. The process of urbanization is viewed for taking societies to higher levels of social formation.

The word ‘Environment’ is derived from the French word ‘Eviron’ which means surroundings. The surroundings where we live includes biotic factors like human beings, plants, animals, microbes, etc and antibiotic factors such as light, air, water, soil etc. Thus environment is viewed as a complex of many variables, which surrounds man as well as the living organisms. The environment includes water, air, & land and the interrelationships which exist among and between water, air & land and human beings and other living creatures such as plants, animals and micro organisms (Kalavathy, 2004). Inshort, environment consist of an inseperable whole system constituted by physical, chemical, biological, social and cultural elements, which are interlinked individually and collectively in myriad forms. It is a known fact that, without environment there is no life. But today, the environment is being

polluted massively. All unplanned human activities have the possibility of polluting the environment by contaminating water, air and soil.

Now, urbanization is a worldwide phenomenon in more developed as well as less developed regions. The World Urbanization Prospects in its studies revealed that the rate of urbanization is higher in less developed regions than highly developed regions of the world. Urban issues are becoming of critical importance around the world, and urbanization is expected to continue with close to half of the world's population already living in urban areas and some cities now reaching unprecedented size (United Nations, 2011). It has resulted in increased pollution of land, water, air and other natural resources. Urban population growth in developing countries resulted in soil degradation, pollution and contamination of natural waters, deteriorating air quality and growing dependence on expensive and diminishing fossil fuels become increasing concern (Rattan, et al: 2002).

In India, the percentage of urban population to total population is 31.16 percentage and urban areas account for about 60% of the GNP of the country (Census report, 2011). The urban areas in the country have sufficient infrastructure facilities and employment opportunities than the rural areas and this attracts still more people to urban areas. This results in higher rate of migration to urban areas and more pressure on urban infrastructure. The excessive usage of resources ultimately results in the release of large amounts of wastes and pollutants. Cities of India on a large face many environmental problems like the declining and contaminated water supply, inadequate housing & drainage facilities, severely inadequate sanitation facilities, accelerating air & noise pollution and enormous quantities of solid wastes. The over populated Cities of India are characterized by over population and the related environmental problems which are the main contributors of health risks. Almost all the cities of India are facing severe environmental crisis due to congestion, increasing number of vehicles on roads, dumping wastes on rivers and road sides etc. The over population in cities is one of the major reason for in growing number of slums, and subsequent pollution problems.

In Kerala like other states of India, the urban issues are not apart from city life. About half of the total population of the state is urban population and the cities which are in the higher ranking of urbanization are Ernakulam, Thrissur and Kozhikkode. All the

cities are recorded high density of population and this is the reason for high amount of environmental pollution and associated health hazards. The explosive growth of motor vehicles and resulted congestion in roads, inappropriate drainage and sewage system, increasing amount of municipal solid wastes without proper treatment system etc are the major issues of urbanization in the state. The higher amount of pollution is ultimately resulting in health risks in the form of various diseases and related economic issues in urban areas of the state. Thus, urban areas today faces a grave ecological crisis caused by the pollution of water, air noise and land as there is higher depletion of natural resources. Hence, the linkage between urbanization and environment is needed to be given more emphasis in studies. What we needed to introduce is sustainable urban development rather mere economic growth in cites. For us, sustainable development is both a challenge and an opportunity. The obstacles in context or urbanization and modernization are however great and making the concept of sustainability precise, is difficult. It is not possible to argue that there should be zero use of natural resources for development; successful development will inevitably involve some amount of depletion of natural resources, resulting in environmental damage. Further, policies and programs of accelerating environmentally responsible development will not happen by themselves. It is therefore, important to seize the current opportunity to bring about real if not radical, change in the developmental approaches.

1.2 The Study Area

The present study of the impact of urbanization on sustainable environment in the state of Kerala is an attempt to analyze the devastating effects of environmental degradation in urban areas with special attention to its health impacts on urban households. As per data released by the Government of India for Census 2011, Thrissur is an Urban Agglomeration which exhibits higher percentage of urban population. Hence, the study area which is selected for the purpose is Thrissur urban area. According to the Census report of 2011, in Thrissur district, there are 7 cities which comes under the district administration namely; Thrissur municipal corporation, Kodungallur, Kunnamkulam, Chalakkudy, Chavakkad, Irinjalakkuda and Guruvayoor. Among these cities, the major share of urban population is from Thrissur city (Thrissur MC). On the basis of the reports of the State Pollution Control Board and Thrissur City Development Plan, there are severe environmental problems in the

city because of careless usage of environmental goods. Pollution of water resources, increasing levels of air and noise pollution, and problems related with municipal solid wastes are the major problems in the city. Hence, the study about these issues with special attention to their health impacts on households will highlight the problems of environmental pollution in each and every city of Kerala.

1.3 Definition of Related Concepts

The meaning and definition of concepts related with the study are explained as;

1.3. (i) Urbanization

The term urbanization is defined as the process by which large numbers of people become permanently concentrated in relatively small areas, forming cities. It refers to the population shift from rural areas to urban areas, the gradual increase in the proportion of people living in urban areas, and the way in which each society adapts to this change (United Nations Population Fund, UNFPA).

1.3. (ii) Environment

The term environment means surroundings and circumstances affecting person's life (Julia Elliot, 2006). It is the sum total of all conditions and influences which affect the development and life of organisms on earth (Anil K De,2004). Thus environment is the surroundings, in which a living being operates, including air, water, natural resources, flora and fauna.

1.3. (iii) Pollution

Any change or addition in the environment which contributes to its deterioration or is contamination with substances which make it less favorable or harmful for organisms is called pollution. It is caused when a change in physical, chemical or biological conditions in the environment harmfully affects the quality of human life including animals, plants etc. Pollutants, the components of pollution can be either of foreign substances/ energies or naturally occurring contaminants.

1.3. (iv) Environmental Pollution

Environmental pollution refers to the accumulation of materials in the air, water and soil in sufficient concentration to have a direct or indirect negative effect on people and their environment. It is the act of introduction by man, of extraneous substances or energy into the environment that induces unfavorable changes (Kannan Krishnan, 1991).

1.3. (v) Environmental degradation

'Degradation' as a concept invokes the ecological concept of 'carrying capacity'. Carrying capacity is the ability of an environment to sustain the resource demands of a species or a community without losing its ability to regenerate its resources. Degradation usually means that carrying capacity is reduced by some natural or human phenomenon (Nancy Nicholson, 2002)

1.3. (vi) Water Pollution

Water pollution is defined as the presence in ground water of toxic chemicals and biological agents that exceed what is naturally found in the water and may pose a threat to human health and/ or the environment. In other words it refers to hazardous and toxic waste materials disposed into water resources such as dams, lakes, rivers and seas; which then lead to a negative effect on living things found in water and which can also affect human health.

1.3. (vii) Air Pollution

The contamination of the atmosphere, caused by the accidental or deliberate discharge of a wide range of toxic airborne substances is known as air pollution. Air pollution consists of gaseous, liquid, or solid substances that, when present in sufficient concentration, for a sufficient time, and under certain conditions, tend to interfere with human comfort, health or welfare, and cause environmental damage.

1.3. (viii) Land Pollution

It is the deterioration (destruction) of the earth's land surfaces, often directly or indirectly as a result of man's activities and their misuse of land resources. Land is polluted by municipal and domestic sewage, industrial affluence, sludge and

fertilizers. Land pollution reduces the fertility of land and destroys the wild life, plants and human.

1.3. (ix) Noise Pollution

Normally sound level about 80 decibels cause noise pollution. Noise pollution is generally defined as regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms. According to the World Health Organization, sound levels less than 70 dB are not damaging to living organisms, regardless of how long or consistent the exposure is. Exposure for more than 8 hours to constant noise beyond 85 dB may be hazardous.

1.3. (x) Sustainable Development

The term "sustainable development" was brought into common use by the World Commission of Environment and Development (Brundtland Commission) in its seminar report of 1987, named as "Our Common Future". The Brundtland Commission defined the term as "meeting the needs of the present generation without compromising the needs of the future generation".

1.4 Statement of the Problem

The present research study is implied to deal with the impact of urbanization on sustainable environment in Kerala - A study based on Thrissur District.

The welfare of the humanity largely depends on the environment he lives through. Man is dependent on the environment for his socio- economic activities. But human beings are reflecting careless attitude towards the usage of environmental goods. Man has been indiscriminately and selfishly exploiting and interfering with nature and as a consequence, the living conditions of the people are in serious threat. The environment where we all live needed to be protected for achieving sustainable environmental conditions in cities. Cities and urban population are the main contributors of environmental degradation. Cities of Kerala also exhibit such careless attitude towards environment. Thrissur district, one of the highly urbanized districts of Kerala, reflects massive environmental pollution in the form of chemical spewing of vehicles, endless dumping of solid wastes along the streets and river, contaminating of water sources etc. Here, the problem of environmental degradation in the context of

growing urbanization based on a detailed study of Thrissur city area specifies the attention on issues of environmental pollution and its impact on health conditions of urban people.

1.5 Significance of the study

Today economics is not mere economic growth or economic development. Infact, the economic thought is more concerned about sustainable development which incorporates economic, social and ecological aspects. Hence, for progressive economic development environmental aspects should be considered into focus. We live in a world wherein natural resources are limited, and the demand for such resources are unlimited. Water, air soil, minerals, etc. are all a part of our life supporting system and without them life itself would be impossible. Hence the economies all over the world are aimed to achieve sustainability in development. The success of sustainable development depends upon the conditions of natural environment and healthy population. Negative impacts on natural environment will adversely influence the human health and sustainable development. The unplanned and unscientific urban growth is considered as the main reason behind the problem of environmental pollution in the form of water contamination, air pollution, noise pollution and solid waste pollution. Many activities related to urban development is aggravating the environmental issues which creates sustainability issues.

Cities in India are growing rapidly with higher urban population. Similarly, Kerala also exhibits high rate of urbanization as about half of the total population of the state is living in cities (Census Report, 2011).Thus environmental degradation is a burning issue especially in cities of Kerala where there is high density of population and hence, the protection of environment today is the concern of the people as well as the authorities. It is emphasized that urbanization and environment are interlinked. The failure to manage the environment will lead to unsustainable urban development which will have serious implications on the present and future generations. Many scholars have acknowledged this issue by conducting studies in varied dimensions. From the available literature on the topic of environment degradation and urban development, it is clear that there is not a single study on this topic related to Kerala cities especially Thrissur district. Thus, this research has its own uniqueness as it is an attempt to examine the effect of environmental pollution on health conditions of

people and tries to suggest remedial measures to have an environmental friendly city life.

1.6 Research Questions

On the basis of the available literature reviews and other information the following research questions are framed.

1) What are the main environmental problems due to urbanization in cities?
2) What are the detrimental effects of urbanization on natural water, air and noise level in cities?
3) What are the problems generated by solid waste pollution in cities?
4) What are the impacts of environmental degradation on health status of people in cities?

1.7 Objectives of the Study

The main objectives of the present study are;

1) To study the growth of urbanization in India and Kerala.
2) To examine the socio- economic conditions of the households in the study area.
3) To study the impact of urbanization on the quality of water, land and air in Thrissur district.
4) To measure the impact of environmental pollution on health status of the households.
5) To estimate the household's willingness to pay for improvement in the quality of environmental goods in Thrissur district.

1.8 Hypotheses

The hypotheses of the study are;

1) The higher rate of water and air pollutions, leads to the higher amount of health cost in the sample areas.
2) The higher levels of solid waste pollution and noise pollution, lead to the higher amount of health cost in the sample areas.

1.9 Methodology

Present study which is related to the problem of environmental degradation in the context of growing urbanization has been verified and analyzed with the help of primary as well as secondary data, selection of appropriate sample, and the use of statistical and econometric tools. All these components of methodology are explained below.

1.9. (i) Sources of data

For analysis and verification of objectives, both primary and secondary data are used in this study. The necessary secondary data have been collected from census reports of various years, publications of Central as well as State Pollution Control Board, reports of World Urbanization Prospects (U N), publications of Kerala Transport Commissioner and Kerala State Urban Development Plans. Similarly, data from City Development Plans, Kerala Water Authority, City Sanitation Plans and various publications of Thrissur Municipal Corporation are also used.

The objectives of the study have been verified with the help of primary data collected through interview schedules administered to the respondents in selected sample area of Thrissur city. Indepth interviews and direct observation are also used for collecting primary data from the respondents.

1.9. (ii) Sampling Design

The present study on urbanization and environment is based on multi- stage proportionate random sampling method. In the first stage, for making a study about the impact of urbanization on environment, Thrissur district was chosen purposively. The reason behind the selection of Thrissur district is that, the city is in the second position in ranking of urbanization of districts in Kerala (Census, 2011). Similarly, among 55 million plus cities in India, Thrissur occupies the top position in growth rate (894.1%) during 2001-2011 as per the census report of 2011. Hence, the urban areas of the district are not free from severe environmental problems. In the second stage, Among the 7 cities of the district, Thrissur city (Thrissur Municipal Corporation) is selected. This is because; the major share of urban population among the cities of the district is from Thrissur City, as per the census report of 2011. In Thrissur city (TMC) there are 55 corporation wards and they are classified under 6

zones. In the Third stage, among the 6 zones, 3 zones were selected because these zones are having higher number of wards. The names of the zones are The Central zone, Ayyanthole zone and Koorkancheri zone. In the last stage, on the basis of the number of wards, 83, 72 and 70 sample respondents have been randomly selected from the three zones and the total sample size is 225.

1.9. (iii) Methods and Models of the study

Contingent Valuation Method- For the purpose of valuation of environmental goods, The Contingent valuation Method (CVM) is used in the study. The usage of this method is based on certain preferences for a proposed change in quality of environmental goods. Generally, environmental economists consider environmental goods as public goods with non- excludability and non- divisibility properties along with strong externalities. The major two approaches for valuation of the environmental goods exist in literature are the direct and indirect approaches. The CVM is a direct method in which people are asked directly to state or reveal their strength of preference for a proposed change.

The first published reference to CVM was made in 1947 by the Berkley Economist, Ciricacy Wantrup and it was designed and implemented in 1963 by Davis, an Environmental economist. The CVM method is a useful technique which can be applied for expressing the 'hidden preferences' of people through surveys. Thus in the area of expressed or stated preferences, CVM is the dominant approach.

The CVM is a direct method that involves questions to sample respondents about their Willingness to Pay (WTP) either for protection of good environment or removal of pollution, or Willingness to Accept (WTA) to compensate for degradation of environment or continuance of pollution. In other words, The WTP is the maximum amount of money which can be paid by the individuals for a higher level of utility. CVM operates the WTP/WTA through surveys and basically there are 4 methods of eliciting the responses through surveys regarding the maximum WTP. These methods are;

a) The direct- open- ended question method
b) The bidding game
c) The payment card

d) The take- it or leave- it method

The sample respondents are directly asked about their WTP for environmental effects in two ways;

i. The open ended format – and/ or
ii. The dichotomous choice – yes/ no format

Here, the dichotomous choice which is also known as close ended format questions are used for the study of WTP. The usage of bidding games is aimed to attain the willingness of the household respondents. In this method the respondents are asked to mention a bid amount, he or she is willing to pay for a service described by the interviewee.

Thus, the CVM is used in the present study and for analysis of the responses of the households on the need for protecting environmental goods in the context of growing environmental degradation in the city.

The Logit Regression and ANOVA Models-For the purpose of analysis of the collected data along with tables, pictures and graphical representations various tests like chi- square, ANOVA and Logit Regression Model are also used in this study. ANOVA is used to study about the variances in pollution levels in the sample areas.

The Logit Regression is used to analyze the mean willingness to pay of the households for improvements in the quality of various environmental goods.The logit model is based mainly on the cumulative probability function and it deals with a dichotomous dependent variable on a well established theoretical background. Logit regression model is a uni/multivariate technique which allows for estimating the probability that an event will occur or not through prediction of a binary dependent outcome from a set of independent variables (Roopa, 2000).

The logit regression model is specified as;

$$P_i = E\left(y=\frac{1}{x^t}\right) = \frac{1}{1+e^{-\beta 0+\beta 1 x 1}}$$

Where;

Pi = Probability that Yi = 1

Xi = Set of independent variables.

Y= Dependent variable

β0 = Intercept which is constant

β1 = Coefficient of price that the households are willing to pay for improvement in the quality of environmental goods

The mean willingness to pay of the households is given as;

$$\text{Mean WTP} = \frac{1}{|\beta 1|} \text{ in } (1+\exp \beta 0)$$

Where β1 and β0 are coefficient estimates obtained from the logistic regression and mean WTP is the mean willingness to pay of households for improvement in environmental goods.

The regression logit model that is specified after identifying the factors which influence the willingness to pay of the households can be expressed as:

$$Y = \frac{1}{1+exp^{z}}$$

Where Y = the response of the household to the willingness to pay question which is either 1 if 'Yes' or O if 'No'. The variable Z is defined in equation as;

$$Z = \beta 0+\beta 1x1+\beta 2x2+\ldots\ldots+ \beta 6x6$$

Where β0 is a pure constant and the parameter β1……..β6 are the coefficients of the explanatory variables x_1……x_6.

Along with the logit regression analysis the Chi-square and the Pseudo-R square are also used to measure the goodness of fit of the model.

1.10 Scope of the Study

Environmental degradation is expected to have considerable impacts on natural resource systems, and thereby changes in the natural environment can affect human sustenance and economic activities. The present research work focuses on the impact of environmental pollution on the health status of the people. The study is concentrated on the city of Thrissur district, which can be taken as an introductory area to the interested researchers to explore scientific and systematic knowledge regarding the causes and consequences of environmental degradation. The research

also made a modest attempt to suggest remedial measures to improve upon the situation of environmental pollution. Due to the constraints of time and resources, not all the factors of environment are considered. The interdisciplinary nature of the research work acts as a medium to have diversified research work in the pollution analysis especially in the field of urbanization.

1.11 Limitations of the Study

The present research work which shows the relationship between urbanization and environment in Kerala has few limitations. They are;

i. The study is concentrated on the consequences of environmental degradation on health status of people. But there are other consequences which are not expressed in detailed manner.
ii. There are considerable changes in population, number of auto vehicles and industrial expansion during the passage of time. These aspects could not be covered properly by the study.
iii. The sampled respondents are the households only. Other sections of the city like consumers, industrialists, officials etc are not considered for primary data collection.
iv. Time inconveniences from the part of the sampled households are other limitation of the study.

1.12 Chapter Scheme

This thesis is divided into 7 chapters. **The first chapter** is the introductory chapter which includes statement of the research problem, significance of the study, research questions, subsequent objectives and hypotheses of the study, methodology, sources of data collection and tools of analysis, limitations of the study etc. **The second chapter** deals with the theoretical background of the study and literature reviews.

The third chapter deals with the trends and pattern of urbanization and its impact on environmental quality of the country, the state and the district. **The fourth chapter** gives a detailed profile of the sample city (Thrissur City) with special attention to its population statistics, socio- economic profile and other aspects of living conditions.

The fifth chapter exhibits the socio- economic profiles and housing characteristics of sample households of Thrissur city which includes educational aspects, income details, expenditure details, housing facilities etc**. The sixth chapter** is an analysis of

the impact of urbanization on environmental conditions of the sample respondents. It gives a detailed picture of different types of pollutions in the city, their impact on health status of people, and statistical and econometric analysis of the data**. The last chapter** gives the summary, findings of the study and suggestions for environmental protection.

CHAPTER- 2

THEORETICAL BACKGROUND AND REVIEW OF LITERATURE

CHAPTER- 2

THEORETICAL BACKGROUND AND REVIEW OF LITERATURE

2.1 Introduction

The perception and issues of development in economics have been central focus of discussion on all over the world. Appropriate eco–friendly economic policies will be the relevant ones for today's dynamic world. Development is a basic feature of any nation and without development no society can progress. At the same time, it is true that development is not possible without some adverse effect upon the ecology and environment. Rapid growth of urbanization is the modern trend which is present in more developed as well as less developed regions of the world. People on a large are moving towards cities in search of better living conditions and other comforts of life. This resulted in high population pressure in urban areas and subsequent environmental problems. Hence, Environmental problems associated with urban development have given rise to the concept of sustainable urban development.

Sustainable development is a balancing concept between ecology and development. It demands an integrated development and simultaneous preservation of environment. It contemplates economical, ecological and social sustainability. The urban development should concentrate on establishing a pattern of development which is viewed to reduce the detrimental effects of urbanization and enhance the attitude of conservation of environmental goods. In other words, sustainable urban development is a process, in which development can be sustained for generations. It means improving the quality of human life while, at the same time living in harmony with nature and maintaining a balance with the life supporting the eco system. It is viewed that due to uncontrolled urbanization, environmental degradation is occurring very

severely and causing many problems in urban areas like water contamination, excessive air pollution, noise pollution and problems related with solid & hazardous wastes. Hence there is an urgent need for studying the relationship between urbanization and environment on the basis of review of existing literatures.

2.2Urbanization and Environment Theories

The economics of urban sustainability is more than environmental economics, because it includes the development of an economy and society, not just management of environmental issues. To understand the importance of healthy environment in development of a city, and a nation as a whole it is important to understand the theories and concepts related to the emergence of urbanization and environmental degradation.

The debate about whether Earth's limited natural resources will continue to provide life support to humanity's burgeoning population began with the famous work named 'An Essay on the Principle of Population' by the English Political Economist Thomas Malthus in the early 1800's (Dixon and Fallon,1989). In his work, Malthus framed the basic tenet of environmentalism – that "because human population, when unchecked, tends to grow in a geometrical ratio, and subsistence for man in an arithmetical ratio". Hence, population needed to be checked by "misery, vice and moral restraint" (Eblen and Eblen,1994).

Smith (1776) and Ricardo (1817) in their theories were concerned with the economic valuation of three most important factors of production: land and the natural environment; capital, by which they meant the development of land and nature; and labour, through which land is transformed into real assets. Then, Marx in 'Das Capital' (1867) focused on the key factors of labour and capital and considered land as an unimportant factor (Cambridge Biographical Encyclopaedia, 2000).

It was until after World War II or in the early 1950's that land rejoined capital and labor to form a complete economic picture. This is the base of modern environmental economics, which reemphasizes the

importance of land as an economic factor. By 'land' today's environmental economists mean 'ecosystems' (Rogers, Jalal and Boyd, 2008).

The Limits to Growth (The Club of Rome, 1972) was the first prominent work which analyses whether the current paradigm of world economic development is 'Sustainable'. Meadows and their team at the Massachusetts Institute of Technology concluded that since the world is physically finite, exponential growth of population, industrial production and pollution must eventually hit a limit. Similarly 'A Blue Print for Survival', a distinguished British Panel wrote that our 'industrial way of life with its ethos of expansion' is not 'sustainable'. Hence, a stable society would cause minimum ecological disruption, practice maximum conservation, and maintain a constant population (Editors of The Ecologist, 1972).

The concept of sustainable development evolved between 1972 and 1992 through a series of international conferences and initiatives. The United Nations Conference on the Human Environment at Stockholm in 1972 created the doctrine of 'Global Trusteeship' upon which the doctrine of 'Sustainable Development' would later be founded (Boyle, 1995).

The term 'sustainable development' was first appeared in the World Conservation Strategy drafted by the United Nations Environment Program (UNEP) and the International Union for the Conservation of Nature (IUCN) in 1980 (Eblen and Eblen, 1994). The most important step towards sustainable development is the publication of an international report titled "Our Common Future" by the World Commission on Environment and Development (WCED or Brundtland Commission) in 1987. This Commission defined Sustainable Development as "development that meets the need of the present without compromising the ability of future generations to meet their own needs" (Le Blanc, et.al, 2012:1). According to this report, the major objective of development should be to ensure the satisfaction of human needs and aspirations of a material kind.The Rio Declaration on

Environment and Development is considered as the cornerstone of Sustainable Development. The Earth Summit held in Rio De Janerio in 1992 was one of the defining moments for sustainable development as the member States agreed to launch a process to develop a set of Sustainable Development Goals (SDGs) that could be a useful tool for pursuing focused and coherent action on Sustainable Development (United Nations 2012: 15, Le Blanc, et.al, 2012: 17). The Summit framed 'sustainable development as the overarching policy of the 21st century (Keating, 1993). Hence, after three Earth Summits held under the auspicious of United Nations Conference on Environment and Development (UNCED) in 1992, 1997, and 2002, the sustainable development has become a universal theme to describe the amalgamation of environmental opportunities and human wisdom.

Twenty years later was celebrated the United Nations Conference on Sustainable Development (Rio+ 20), held in June 2012, was the agreement by member States to launch a process to develop a set of sustainable development goals (SDGs) that could be useful tool for pursuing focused and coherent action on sustainable development (Le Blancet. al, 2012: 16).

2.2. (i)Theoretical Framework of Urban Sustainability

Since the last few decades, many scholars have begun to turn their attention to strategies that balance improvements in the urbanization process and the environment. Many theories viewed that urbanization, economic development and environment are linked by a series of positive and negative effects.

During the end of the 19th century, the British scholar, Howard, developed the Garden City Theory which attempted to employ rational planning to coordinate the development of urbanization and the urban ecological aspects. Later, Li addressed the casual relationship between urbanization and its resulting environmental pressure and concluded that the relationship between urbanization and environment is representing a U-shaped curve. Similarly Halkos observed an inverted

U-shaped relationship between environmental efficiency and percapita GDP.

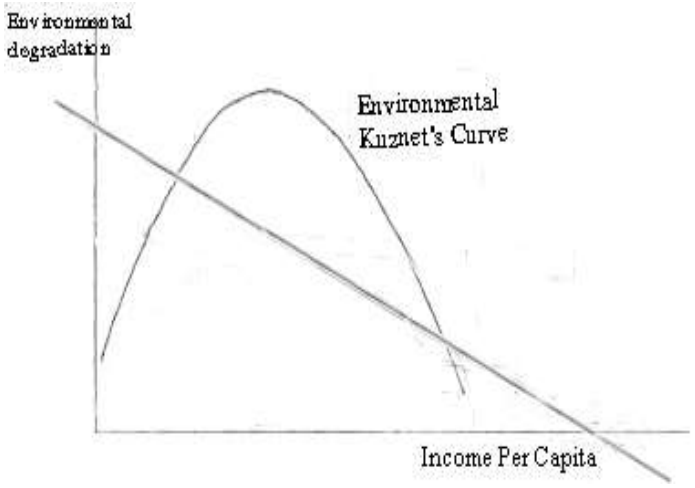
Today urban planners and theorists around the world are behind the concept of 'Urban Sustainability'. 'Sustainability' is regarded alternatively as either the proper means or the proper end of urban development.

The analytical study of Goldstein(1990) examines the urbanization issues of densely populated cities of developing countries. In the developing countries where there are densely populated cities, the impact of urbanization on education and health is relevant in one side; but on the other there are certain connected conditions such as environmental degradation, economic inequality, and housing issues. Environmental problems pose serious health hazards to urban population in these countries. Pollution in the form of emissions from motor vehicles & industries, insufficient water supplies, water pollution, inadequate solid waste management etc are leading to the proliferation of disease vectors, contaminated food and noise.

The Environmental Kuznets Curve of Simon Kuznets (1995) is considered around the world as the perfect theory that clearly specifies the relationship between economic growth and environmental situation. The theory explains the dilemma of urban cities that, with slow economic growth many environmental problems arises and this expresses the nature of relationship between environmental quality and economic growth. The Curve suggests that the increase in economic activities would cause the environmental degradation until a point of inflexion, from where environmental degradation started decreasing. This implies that the environmental impact indicator is an inverted U-shaped function of income per capita or economic growth.

Figure 2.1

Environmental Kuznet's Curve



Some Scholars define 'Urban Sustainability' in terms of 'economic sustainability' of a city without considering social aspects (Ewers and Nijkamp, 1990). Environmental activists link 'Urban Sustainability' to social principles of futurity, equity and participation (FoE, 1994). Hence, the Agenda 21 the Earth Summit pact is considered as the most remarkable step towards the idea of urban sustainability as it proposes a number of concrete measures to achieve sustainability in the socio economic realm. These include equity, entrepreneurship and technology transfer (Keating, 1993). Similarly, Kahn in 1995 expressed the idea that the paradigm of 'sustainable development' described in Agenda 21, rests on three conceptual pillars. These are 'economic sustainability', 'social sustainability' and 'environmental sustainability' and these three must be integrated and interlinked. Thus the comprehensive coordination of these three conceptual pillars will ensure urban sustainability.

2.3 Review of literature

The relation between environment and urbanization is relevant, as far as sustainable development is concerned. Positive and negative impacts of urbanization are central theme of study for many decades.

The literature on environment and urbanization are immense, but fragmented in nature. It is often found concentrated on very specific issues of environment. The literature available on environmental economics, are much less developed and it is only in recent times that economists are involved in the analysis of environmental problems. Here an attempt is made to review the available literature on the topic concerning urbanization and related environmental issues focusing sustainable development.

Environmental entitlement as well as economic entitlement is essential for improving the livelihood of the people in a sustainable way. According to Sen (1984),the perception and issues of development in economics have been the central focus of debate, and discussion over a long period of time and reasonably now it is viewed as 'freedom of choice' which may be realized through expansion of people's entitlements and capabilities.

The World Commission on Environment and Development –WCED (1987), provided a balanced approach by defining sustainable development that "meets the needs of the present without compromising the ability of future generation to meet their own needs", which accepts obligation to pay attention on improving the economic condition of the poor for better environment. Further, recognizing the importance of people and their roles both in economic and ecological consideration, Douglas (1984) distinguishes between sustainability concepts - "food self-sufficiency" (an economic perspective)," stewardship" (an ecological perspective), and "community" (a sociological perspective).

Brian and Kanaley (2006) argued that across developing Asia, there is an increasingly urgent need for large- scale urban environmental improvement programs and for strengthening urban governance and the capacity of local institutions to plan, implement and finance infrastructure provision and service delivery. They put forward seven Sustainability Criteria to analyze sustainability in urbanization. Good governance, improved urban management, financing& cost recovery, effective and efficient infrastructure and service provision, social and environmental sustainability,

innovation& change, and leveraging international development assistance- are the criteria given by them for judging urban sustainability.

World Urbanization Prospects (2014) Revision highlighted the fact that the global urban population is projected to grow by 2.5 billion urban dwellers between 2014 and 2015, with nearly 90 percent of the increase concentrated in Asia and Africa. The report also argued that trends in urbanization are integrally linked to sustainable development. With good planning and governance, the increasing contribution of people in urban settlements can facilitate economic and social development. The impact of consumption and production on environment can also be lowered by this. However, rapid and unplanned urban growth threatens unsustainable development when the necessary infrastructure is not developed or when policies are not implemented to protect the environment and ensure that the benefits of city life are equitably shared.

Tietenberg and Lewis (2012) emphasized that new sustainable forms of development are possible, but they will not automatically be adopted. Economic incentive policies can facilitate the transition from unsustainable to sustainable activities. Solution for the threat to sustainability is possible with an association of market forces. These forces should be channeled in directions that enhance the possibilities of sustainable outcomes. Hence, thinking and acting in unconventional ways will help the world community to achieve sustainable development.

The report of the UN(2007) expressed the need for indicators of sustainable development. The Commission of Sustainable Development (CSD) by the United Nations has identified revised indicators of sustainable development. They are: poverty, governance, health, education, demographics, natural hazards, atmosphere, land, oceans- seas& coasts, fresh water, bio diversity, economic development, global economic partnership, and consumption& production patterns.

The report of EPA (1997) revealed the fact that, a large amount of anecdotal information can envisage which identifies hydrologic impacts on streams. This is caused by increased impervious area such as roads, driveways, parking lots and rooftops in urban development. The study observed the fact that urbanization negatively affects streams and results in water quality problems such as loss of habitat, increased temperature, and loss of fish populations.

Viederman (1996) stated that, “sustainability is a community’s control and prudent use of all forms of capital to ensure, to the degree possible, the present and future generations can obtain a high degree of economic security and achieve democracy while maintaining the integrity of the ecological system upon which all life and production depends.

The idea of sustainable development was tossed by Brundtland Commission (1987) and popularized by World Bank and United Nations Environment Program. The definitions of ‘Sustainable development’ therefore are many, depending on the nature of the problem addressed is the view developed by Arnold (1989). For this concept, no single definition is yet available which everybody accepts and hence ecologists, conservationists and economists all have different views is given by DeGroot (1987).

Barbier (1987) viewed that the totality of sustainable development is yet difficult to grasp analytically. He defined sustainable development as one which is directly concerned with increasing the material standard of the living of the poor at the grass root level which could be quantitatively measured in terms of increased food, real income, educational services, health care, sanitation and water supply, emergency stock of food and cash etc… and only indirectly concerned with economic growth at the aggregate, commonly national level. In more specific terms, sustainable development aims at reducing the absolute poverty of the world’s poor through providing lasting and secure livelihoods that maximize resource depletion, environmental degradation, cultural disruption and social instability.

Bohringer and Loschel (2006) have emphasized the three dimensions of sustainability impact – economic, environmental and social which require good policy designs from the government. These three dimensions are subject to trade offs. Hence what we need is to develop a computable general equilibrium model to measure the impacts of policy designs related to economic, environmental and social impacts of sustainability. The study gives appropriate computable general equilibrium models for government agencies in order to assess the impact of sustainability.

Holling (2000) viewed that sustainable development and management of global and regional resources is a combination of ecological, economic and social problems. But the actions to integrate all these problems (aspects) have short- changed one or more. Sustainability policy designs by the conservation point of view often ignore the needs for adaptive economic development. Similarly policy designs driven by economic interest ignored the uncertainty of nature and its protective actions. Those driven by social interests are aimed for community development and empowerment without considering the imagination and initiative of local groups. Thus these views are having partial prescriptions like regulation and control, get the prices right, empowerment, stake holder ownership etc.. Hence he viewed policies by the government, private foundations, international agencies and NGOs which consider all the three aspects simultaneously.

Mulder and Bergh (2002) expressed the view that sustainable development is the prominent concept of modern scenario as it envisages the interactions between the economy and environment, as well as a generally accepted goal of environmental policy. In order to understand the economic problems and transformation of economic system towards sustainability, an evolutionary approach is required which focuses the attention on irreversible, path – dependent change and long run mutual selection of environmental and economic processes and systems. This study provides an overview to such evolutionary contributions to environmental economics along with suggestions for including co-evolution of economy and environment, sustainable consumption, endogenous preference change, and climate change modelling.

Hwang and Tan (2010) have pointed out the need for green building construction suitable for sustainable construction. Such type of construction of green buildings in Singapore, are subject to problem such as lack of proper project management. This study aims to identify common obstacles encountered during management of green construction projects based on survey and interview results from 31 industry experts. It also proposed some solutions to overcome the barriers. The findings of this study revealed that project cost is the main barrier in green building construction management. However a project management framework for green building construction should be developed to overcome the barriers. They also suggested that promotion of sustainable construction in future projects will be the best option that the world require.

Manal, Salloum and Karam (2008) have pointed out the development of an action plan to establish a decentralized environment and sustainable development monitoring network through local authorities using agreed upon environment and development indicators. This is done in collaboration with the Labanese Environment and Development Observatory at the Ministry of Environment, the Faculty of Health Science at the University of Balamand. After several workshops and applying a participatory approach, appropriate list of indicators were identified. A total of 110 indicators were generated and they are grouped into four major categories. They are (1) population and socio-economic; (2) economic activities; (3) environment; and (4) sustainable development activities and policies.

Giddings, Hopwood and Brien (2002) have stated that sustainable development is usually presented as the intersection between environment, society and economy. But these are conceived of as separate entities. Usually the economy given priority in policies and the environment is viewed as apart from humans. In reality they are interconnected; the economy dependent on society and the environment while, human existence and society are dependent on and vice versa. So the differentiation of environment, society and economy leads to narrow techno- scientific approach.

Sauve (1996) suggested that the whole education process should be reshaped for sustainable development. The study viewed that according to UNESCO's recent documents, sustainable development is the "ultimate goal of the Man- environment relationship". Hence this article presents certain theoretical tools that can be used to undertake a critical analysis of constructs like environment, education and sustainable development. It also suggested introduction of environmental education for development of responsible societies.

Anand and Sen (2000) made an attempt to integrate the concern for human development in the present with that in the future. They viewed economic stability as a matter of intergenerational equity. They argued for a concept of ethical "universalism" between generations. The study also explores the relationship between distributional equity, sustainable development, optimal growth and pure time preference.

Kasemir, Asselt, Durrenberger, and Jaeger (1999) have made an attempt to provide an Integrated Assessment (IA), an approach aiming at providing decision support on

complex environment- related problems. They argued that integrated assessment should synthesize inter disciplinary scientific insights with a wide variety of societal views. This paper also argues that the sustainability issues cannot be fully described or solved in any unique way. Hence multiple perspectives are included in integrated assessments and this paper also discusses some new avenues in integrated assessment modelling. They also recommended the application of a well-established social scientific tool, namely focus groups, in integrated assessments.

Harishima (2000) argued that the core issue of environmental governance is the way that societies deal with environmental problems. For proper identification of environmental problems, interactions among formal and informal institutions and actions within the society, is essential. This study aimed to review and survey the current state of environmental governance in Asian developing countries in a comparative manner, with special reference to case studies of China, Thailand and India, the most influential countries in each sub-region of Asia. This study also highlighted the fact that although many positive trends have found recently in environmental governance of Asian countries, their environmental governance systems have not yet developed satisfactorily at the national level.

Imura, et al (2005) analysed the urban environmental issues and trends in Asia and observed an overview of the linkages between population growth, urbanization, economic development, and environmental issues in Asian cities. The study focused on the areas of transport planning and air pollution, solid waste management, water supply, and sanitation. It highlighted the major environmental issues faced by cities in the region. The present paper viewed that from the perspective of the environmental Kuznet's Curve hypothesis, it should be possible for governments to continue to pursue economic growth while reducing environmental impacts with appropriate policies.

Satterthwaite (1997) presented a framework for assessing the environmental performance of cities in relation with meeting of sustainable development goals. The study considers how the environmental goals fit with the social, economic and political goals for sustainable development. It also highlights the need for national as well as international frameworks to encourage city-based consumers, enterprises and governments to progress towards the goal of sustainable development.

Kals and Maes (2002) highlighted the relationship between emotional aspects and sustainable development. They suggested changes in individual behavior patterns and decision making processes to establish national and world wide sustainable development. It is argued that environment-specific cognitions and emotions are decisive for sustainable behaviour and environment endangering decisions. Cognitions like environment-specific control beliefs, ecological responsibility attributions, environment- specific moral emotions, such as indignation about insufficient sustainable political decision-making, are the most powerful predictors for sustainable behavior. Hence emotional perspective on sustainable behavior needs to be included on the level of model building as this will ultimately lead to sustainable development.

Naess (2001) expressed the idea that based on the Brundtland Commission's report on the processes in the UN Committee on Environment and Development, a sustainable urban development would require more ambitious policies in order to limit energy consumption, reduce pollution and to protect natural areas and arable land. In this concern, re-use of urban areas and effective utilization of building sites is the suitable strategy to be adopted. The study highlights the need for planning which is oriented towards long-term goals, and utilization knowledge about the environmental consequences of different solutions. This is considered as the suitable planning for sustainable urban development as it includes equity and environmental values of sustainability.

Adiseshiah (1989) defined the concept of sustainable development as "the development which meets the basic needs of all, particularly the poor majority for employment, food, energy, water and housing, and ensures growth of agriculture, manufactures, power and services to meet these needs. In that sense, sustainable development merges economics and environment both in theory and decision making".

Parikh et al, (1991) highlighted that urban populations interact with their environment. Urban people change their environment through their consumption of food, energy, water, and land. And in turn, the polluted urban environment affects the health and quality of life of the urban population. The author also pointed out that people who live in

urban areas have very different consumption patterns than residents in rural areas. Urban populations consume much more food, energy, and durable goods than rural populations. Many of the effects of urban areas on the environment are not necessarily linear. Bigger urban areas do not always create more environmental problems. And small urban areas can cause large problems. Much of what determines the extent of the environmental impacts is how the urban populations behave- their consumption and living patterns- not just how large they are.

Brennan (1999) expressed the view that currently, 81 million persons are added annually to the world's population (95 percent of them in developing countries). Similarly between 1995 and 2030, the world's urban population is projected to double from 2.6 to 5.1, by which time three- fifth of the world's population will be living in urban areas (United Nations 1998b). This article also highlights the trends in urban growth, particularly in the developing world. The author also tried to find out the critical linkages between urbanization, public health and habitat, population growth, the environment and international security. Apart from this, the study addressed issues like migration to the urban centers, the immediate environmental and health impacts of urban pollution on developing country cities, and the link between crime and security.

Medina (2010) has explained that many cities in Africa, Asia, and Latin America face serious problems in managing their wastes. Insufficient collection and inappropriate final disposal of wastes are the two major problems in cities. Despite spending increasing resources, many cities- particularly in Asia and Africa- collect less than half of the waste generated. Most of the wastes are disposed in open dumps, deposited on vacant land, or burned by residents in their backyards. This leads to pollution problems and risks to human health and the environment. Over one billion people living in low income communities and slums lack appropriate waste management services. Given the rapid population growth and urbanization in many cities, the management of wastes tends to further deteriorate.

Newman (2006) has examined the environmental impact of growing urbanization. The author introduced three approaches to understand the environmental impact of cities, namely pollution impact, ecological footprint, and sustainability assessment. Although the pollution impact model provides some perspective on local impact, and the ecological footprint model on global impact, only the sustainability assessment approach allows us to see the positive benefits of urban growth and provides policy options that can help cities to reduce their local and global impact while improving their livability and opportunity, which continue to drive their growth. This approach is then applied in the city of Sydney.

Raja(1986) revealed that, the history of urbanization in Indian subcontinent goes as far back as about 2500BC.It is viewed that in the Indus valleys like the Valley's of Tiger, Nile and Euphrates the urban communities were flourished on a large. The Indus valley experienced early urbanization associated with the first agricultural revolution.

Kundu (1994) made a study about the pattern of urbanization in India with special reference to small and medium towns. He exhibits some interesting features of urban growth in India across the size categories. Till the nineties, Class I cities in developed states grew at a faster rate compared to small and medium towns. Whereas small and medium towns grew at a similar of higher rate than that of Class I cities in the less developed states. During nineties, many of the less developed states like Assam, Bihar, Himachal Pradesh, Orissa, and Rajasthan experienced high urban growth in Class I cities as compared to smaller towns. During 1981-91, million plus cities grew at a rate of 3.25 percent and in 1991-2001, it marked to 2.88 percent.

For us (In India) in the views of Gopal Iyer (1996) sustainable development is both a challenge and an opportunity. The obstacles are however great and making the concept of sustainability precise, is difficult. It is not possible to argue that there should be zero use of natural resources for development; successful development will inevitably involve some amount of depletion of natural resources,

resulting in environmental damage. Further, policies and programs of accelerating environmentally responsible development will happen by themselves. It is, therefore important to seize the current opportunities to bring about real and effective change in the country.

Agarwal (2010) has examined the issue of environment from the ethical point of view. The author argued that environment and climate change are the biggest challenges facing humanity. Ethics can be defined as a set of standards that society places on itself which helps to guide actions, options and behavior. The author commends that environmental problems raise fundamental questions of ethics and philosophy. Mere technical solutions to problems are insufficient. The sustainability of physical prosperity without moral values is examined in this article. He also argued that spiritual values are the prime requirements for sustaining moral values. Hence, the author suggested collective approach by citizens and nations for problem solving in an increasingly independent world.

Munasinghe (1993) has addressed the concept of sustainable development and discussed three approaches of the same.

- Economic – maximizing income while maintaining a constant or increasing stock of capital.
- Ecological – maintaining resilience and robustness of biological and physical system; and
- Social-cultural - maintaining stability of social and cultural systems.

Shrivasthava (1994) viewed that all strategies for sustainable development should have the basic theme of environmental stability, ecological balance, food, fodder, fuel wood, security, employment generation, raising income level and removing regional disparities. Moreover it is viewed that, to ensure the sustainable development of the economy environmental degradation should not increase with time but be reduced or at least remain constant if it increases, we will more

further away from sustainability; while if it decreases we will be more closer to it.

Duraiappah (1996) examined the poverty- environmental degradation nexus. The study is viewed to analyze the literature reviews of this area. In this paper a formal structure of analyzing the complex web of factors related to the link between poverty and environment is formulated and used to review the existing literature on the links of poverty and the degradation of four natural resource sectors. This paper also analyses the role of conflicts between different agents (income groups) in the poverty-environmental degradation nexus. The study also examines the presence of feedback loops between poverty and environmental degradation.

Chaudhary (1995) has made a detailed and beautiful case study about Global population growth, Economic development, and Environmental Impact with special reference to India. The study discussed about the challenge of sustained economic development without environmental damage that both developed and developing economies face today. Sustained economic growth is a necessary condition for eradication of poverty and increase in human welfare. In general, there is a positive relation between economic problems and environmental problems. The nature of environmental problems depends upon the level of economic development, the nature of industrialization, the degree of urbanization, and the effectiveness of public policies. This study also focused on the problem of global warming between 1991 and 2001, with special reference to India.

Nadkarni (2000) has studied about the nexus between poverty, environment and development. The study reveals the fact that the rates of growth of the country's GNP have jumped from below 3 percent up to the 1980's to above 5 percent during the 1990's. But this jump enough has not been enough to make a substantial impact on poverty. Along with direct, target-oriented programs, economic development is a suitable strategy for eliminating poverty. Hence more resource

allocation which is environment friendly is necessary for proper development.

Mawdsley (2004) made a study about India's middle classes and the environment. She argued that recently there has been increased interest in urban environmental issues, and to some extent, in India's (variously defined) 'Middle Classes'. This article reviews a range of literatures such as environmental, social-cultural, and political in order to draw out themes and arguments concerning the relationships between India's middle classes and the complex meanings and material aspects of the environment. The importance of recognizing diversity and dynamism within the middle classes in relation to the environment is also explained in this article. The study also highlights the need to develop situated understandings of what constitutes 'the environment' amongst different middle class groups; and underlines the ways in which environmental issues reflect.

Roy (1998) studied about the social crisis arising out of energy& material shortage and resulting ecological imbalance; that is going to hit the entire world. The improper and unscientific disposal of solid wastes generated by the urban folk, poses a serious threat to the habitat. For a balanced and economic urban solid waste management, technological innovations are necessary. The study focused on the socio-economic analysis of the traditional methods of urban solid waste management. It also highlighted the strategies for economic solid waste management in the Indian context.

Amis (1995) aimed to examine the nature of urban poverty in India and the policy response. The study focused the importance of an employment creation or environmental improvement approach to poverty alleviation. It also explores the policy responses aimed at creating employment and increasing incomes as well as environmental improvement initiatives. It highlighted the independent nature of environmental problems in India. Hence, the recommendations made by the Planning Commission's Task Force (1983) and the National

Commission of Urbanization (1988) made tremendous changes in urban policy developments.

Singh (2003) expressed that it is true that in no way development is possible without some adverse effect upon the ecology and environment. Environmental problems associated with development have raised several questions regarding the type and nature of development, and this has given rise to the concept of sustainable development.

In Oxford Dictionary, the term 'sustainable' means to nourish, to encourage and able to sustain. Sustainable development may describe as an integration of development and environmental imperatives. Development and environment must step together. In other words, development and environment should not be at the cost of each other, but there should be development while taking care of and ensuring the protection of environment. Thus, according to Websters (1975) sustainability meant 'to give support' or to 'keep up'.

Aggarwal (1995) expressed the idea that economists have also provided a definition of sustainable development as being an economic process in which the quantity and quality of our stocks of natural resources (like forests) and the integrity of biogeochemical cycles (like climate) are sustained and passed on to the future generations unimpaired. AIR (1996) revealed that 'sustainability' is a characteristic or state that can be maintained indefinitely whereas, 'development' is defined as the increasing capacity to meet human needs and improve the quality of human life.

In views of Singh (2014) the goal of sustainable development is to improve the quality of life. What we can do, is take good care of it. For instance, we encourage the use of natural gas like CNG as a fuel and can adopt natural, organic farming practices on a wide scale. Moreover Good Land (1995) pointed out that sustainable development should based on three components – (i) Social system, (ii) Environment or Ecological system and (iii) Economic system. Sustainable

development can be achieved when these three components are balanced and weighted equally at the same time.

World Bank Report (1998) viewed that urbanization and rising incomes, which lead to more use of resources and therefore more waste, are the two most important trends that factor into rising waste generation rates. In the words of Chaudari (2001) the term urbanization usually refers to the process of concentration of people in the densely populated settlements where majority of the people derive their livelihood from non-primary occupations. One of the chief factors behind the urbanization is the natural growth rate in population.

Rapid urbanization has been a worldwide phenomenon in the 21st century. According to the report of United Nations (2011), the world population is estimated to be 9.3 billion by 2050 from 7 billion in 2011. Between 2011 and 2050, the world population is expected to increase by 2.3 billion, passing from 7.0 billion to 9.3 billion. At the same, the population living in urban areas is projected to gain 2.6 billion passing from 3.6 billion in 2011 to 6.3 billion in 2050.

Satterthwaite (2007) wrote that most of the population growth expected in urban areas will be concentrated in the cities and towns of the less developed regions. Asia, in particular is projected to see its urban population increased by 1.4 billion. Population growth is therefore becoming largely an urban phenomenon concentrated in the Developing world. The Asian Region has been very dynamic as revealed by the diversified level of urbanization. Among the Asian regions, India's urban population is second highest in the world after China and higher than the total population of all countries –HDR(2000).

Button and Pearce (1989) defined sustainable urban growth in terms of "…. the basic hypothesis that sustainable urban development requires the urban environment to be improved as a factor contributing to the quality of life and as a factor contributing to the development of the urban economic base". They define this by urban welfare (i.e. the well being of the urban residents) as a function of quality of life (which

depends on quality of environment) and on urban real incomes (which depends on the economic inputs).

The UNCHS (1990) in its report identifies four sustainable development criteria for judging a settlement;

- The quality of life it offers to its inhabitants;
- The scale of non-renewable resource use (including the extent to which secondary resources are drawn from settlement by product for re-use);
- The scale and nature of renewable resource use and the implications for sustaining production levels of renewable resources;
- The scale and nature of non-reusable wastes generated by production and consumption activities and the means by which these are disposed of, including the extent to which waste's impact on human health, natural systems and amenity.

The UNCHS (1991) in connection with its sustainable cities programme defines a sustainable city as ".....a city where achievements in social, economic and physical development are made to last" and a city which "……has a lasting supply of the natural resources on which its development depends and the lasting security from environmental hazards which may threaten development achievements".

Dattari (1992) pointed out the following seven steps which are considered to constitute the Environmental Planning and Management concept for the urban development to be sustainable.

- Clarifying environmental issues to be addressed;
- Involving those whose cooperation is required;
- Setting Priorities
- Negotiating issue specific environmental management strategies;
- Agreeing on environmental action plans;
- Initiating priority projects; and
- Strengthening environmental planning and management capacity.

Similarly, Anand (1992) defined a sustainable city "one which meets the needs of the present generations with equity, efficiency and improved economic and social opportunities without decreasing the ability of the future generations to meet their own needs equitably and efficiently.

Basu and Rao (2008) explained that, today three billion people, half of the world's population live in cities. Sustainable urban development, including adequate provision of water and sanitation, is inextricably linked to poverty reduction and other Millennium Development Goals, Agenda 21 and the Plan of Implementation of the World Summit on Sustainable development. They also stressed the view that urban poverty will become the most significant and politically explosive problem of the 21st century.

Heynen (2003) has given a different view about urbanization. He argued that the rapid rate of urbanization throughout the world has led to the creation of increasing amounts of waste and this in turn poses greater difficulties for disposal. Urban environmental problems result from intricately inter wined economic, political and cultural processes. This problem is more acute in developing countries such as India, where economic growth as well as urbanization is quite rapid.

Based on the definition of sustainable development, "meeting the needs of present generation without compromising the needs of the future generations", Brundtland Commission (1987) argued that we have not adequately taken care of the needs of the future generation, because various natural resources like water, land, forests etc. have been over exploited locally, nationally and globally.

Similarly Erach(2006) revealed that as populations in urban centers grow, they draw on resources from more and more distant areas. The 'Ecological footprint' corresponds to the land area necessary to supply natural resources to a community and disposal of its waste. At present, the average ecological footprint of an individual at the global level is said to be 2.3 hectors of land per capita. It is estimated though, that

the world has only 1.7 hectors of land per individual to manage these needs thus leading to an unsustainable use of land.

Again, Singh (1999) has stressed the view that the enormous growth in world economy, reflecting both population growth and rising affluence, is taking place on a finite planet. Consequently, the world is on an economic path that is environmentally unsustainable. This is evident from the indicators given below as;

- Falling water tables;
- Increasing pollution of air and water;
- Food shortages;
- Increasing degradation of land;
- Shrinking/collapsing fisheries; and
- Increasing incidence of natural calamities such as floods and droughts.

Bathwal (2000)has highlighted some important indicators of sustainable development. They are;

- GDP growth rate
- Population stability
- Proportion of urban population
- Clean Air Index
- Government allocation for environmental protection
- Energy Industry
- Renewable energy protection
- Material Intensity
- Environmental awareness of the people etc.

Chopra and Gulati (2001)argued that in India, there are increased migrations of poor people to urban areas in search of jobs. In a study conducted by them in India's arid and semiarid regions, found that out-migration was largely due to the push factors operative at the place of origin such as environmental degradation process and shrinkages of CPRs. Keeping this view Strong (1992) wrote that, sustainable

development involves a process of deep and profound change in the political, social, economic, institutional and technological order, including redefinition of relations between developing and more developed countries. Similarly, Rogers, Jalal and Boyd (2008) have identified factors such as, poverty, pollution, population, participation, policy and market failures (including good governance), and prevention and management of disasters as the key factors governing sustainable development. According to them these can be regarded as the major pillars on which sustainable development rests.

Gregary (1979) has argued that man now recognize that different aspect of environmental quality such as pure air, fresh water and uncontaminated resources tend to be scarce and exhaustible. Here, man's relationship with the environment demands the attention of economists and so they have a growing involvement in the design and implementation of environmental policies to support economic development with sound ecological management.

In Sen's (1992) view environmental problems faced by nations may vary with their stages of development. The extensive exploitation of natural resources for economic development ultimately results in substantial damage to the environment. In fact, environmental pollution and economic development goes together.

Andrew(1996) has pointed out that there is a crucial and potentially positive link between environment and economic development. Some pollution problems noticed during the early stages of a country's development tend to diminish when economy gains adequate resources to abate these problems. This happens because at low level of income, people tend to value development over environmental quality and when income increases they are willing to spend more resources for environmental quality improvements.

Barrow (1999) expressed the view that pollution has been with us since human beings built the first fire, smoke rising from the fire and ashes left on the ground changed the natural environment. The wandering

hunter gathers contaminated the water streams and faced health risks as a consequence of slaughtering animals and living in smoke filled dwelling. The cities are considered as the main symbol of human civilization and centers of incubating growth and innovation. The serious environmental problems faced by them threaten the sustainability of future growth and development.

De and Soni (2009) have highlighted that anthropogenic climate change of post industrial era is expected to impact on all sectors of the society and needs strategic steps to reduce it. The authors made a comparison between mitigation efforts and adaptation measures on this issue. Mitigation efforts include global effort leading to curtailing the emission of green house gases. Adaptation measures on the other hand, compliment the mitigation measures by reducing the impact of global warming. Historically mitigation has received more media attention due to its global canvas; while the adaptation measures have remained in the background. The authors presented certain simple concepts in the field of mitigation through which people can reduce emission by reducing their consumption and demand for energy. They suggested the use of;

- Energy efficient gadgets
- Eco friendly transports, such as cycle for short distances, and bus or car pool for longer distance travel.
- Schools can encourage travels to and from by school buses rather than by individual transport.
- Local products of food and clothing, thus avoiding energy expended in transportation.

The study also expressed the fact that the phenomenal increase in the population during the last fifty years has led to rapid industrialization and high rate of urbanization which have created tremendous pressure on natural resources like land, air, and water. This led to wide spread damage to existing eco system, deforestation, and loss of agricultural land. This resulted in the formation of 'Heat Island' which is an urban effect, and is felt in all major cities in India. Hence action is needed

now, before it becomes too late to repair the damage to climate and environment due to urbanization.

In its report World Bank (1990) highlighted that air pollution is more widespread in its effect than other forms of pollution. Urban growth translates, more vehicles, causing more traffic, more factories, refineries, chemical plants and more people cooking and heating. The pollutants arising from these sources cause damage to vegetation and hence have adverse effect on human health. The largest and gravest source of air pollution in urban areas is the motor vehicles.

Chaplin (1999) examined the political circumstances in India which help to explain why the insanitary living conditions of such a large section of India's urban population have been ignored, and contrasts these with the circumstances which explain successful sanitary reform in Britain in second half of the nineteenth century. She viewed that in India, there is little middle class pressure for sanitary reform as modern medicine and civil engineering have lowered the health risks that might face from the sanitation- related diseases that lower income groups suffer.

Mahadevia (2001) has studied about sustainable urban development in India. She reveals that the mainstream debate on urban development looks either on urban development or sustainable cities, and tends to miss out on people centered approaches to development. The former addresses the issues of economic growth, whereas the latter that of environmental problems, to the exclusion of development concerns of the poor. The new perspective of the sustainable cities in the South is an 'Inclusive Approach', which puts the vision of the poor and marginalized sectors at the centre and includes all the dimensions of development in a holistic and synergetic manner. The paper presents such a vision of sustainable cities in India and describes activities aimed at reaching this vision.

Manivasakam (1995) pointed out that human beings defiled the air, water and soil with pollutants by their unscrupulous behavior, and it

may soon be tilting the balance of natural forces on earth, atmosphere and oceans in a way that could be disastrous for mankind.

Roy and Tisdell (1992) commended that the process of technological change and development by extensive use of non-renewable resources, population growth and greater penetration of market forces had led to detrimental changes in environment and in the structure of rural and urban societies. Again, Macniell etal., (1991) expressed the idea that the world has now moved beyond economic dependence to ecological interdependence. The third world countries and parts of industrialized countries through over exploitation and depletion of natural resources yielded financial gains in short run, but it resulted in a steady reduction of the economic potential over the medium and longer term, and pollution problem that were once local will become global in nature.

Lahiri (1997) found that industrial revolution that had ushered in the last quarter of the 18^{th} century and progressed at an ever increasing pace through centuries, proved to be a vital factor in the hike of urban consumerism and consequent degradation of environment.

Meadows and Renders (1992) examined and explained the obvious causes of ecological degradation with the help of a formula known as PAT formula. The formula denoted as;

$I = PXAXT$where;

'I' is the environmental impact,

'P' is the population,

'A' is the materials through put associated with Affluence, and 'T' is the technology.

The formula showed that environmental degradation is not the result of increased population or increased accumulation or the introduction of less environmentally benign technology. It is the product of all these variables, therefore improvements in any one of the variables has a beneficial environmental impact.

Varshney (1993) has argued that the environmental problems became transnational and trans- generational in character. Therefore what we need is to have an interdisciplinary approach as far as the matter of environment is concerned.

Pearce and others (1993)) in the book entitled "World without end" combined environmental pollution with increase in income so that the amount of environmental goods consumed tend to rise more rapidly as income increases, or environmental goods tend to be consumed more proportionately by the rich than by the poor. This view was accepted and supplemented by Paul (1992) commenced that "the poor tread lightest on the earth, the higher our income the more havoc we wreak. Similarly, Goldman (1994) commended that, "the richer we became, the more we consume and the more we have to throw away".

Foster (1999) highlighted the impact of development on planet as changes in four key areas, viz, population, energy, industrialization and urbanization. In his view, environmental degradation is not a result of increased population, or increased accumulation or the introduction of less environmentally benign technology. It is the product of all these factors. Therefore improvements in any one of these variables can have a beneficial environmental impact and vice versa.

Doria (1990) examined the problem of environmental pollution and divided it into two categories, namely those arising from conditions of poverty and underdevelopment and those arising out of negative effect of the very process of development. The first category affected the natural resources as a result of poverty and inadequate availability of resources. The second category related to the side effects of economic growth.

Kamath(1976) treated urbanization as a menace to the survival of human beings and a crime against humanity. He commended that, urbanization is growing at a tremendous pace leading to a world of agglomerations, mega polis piled on mega polis. He also argued that

as the urban man satisfies his needs and desires, he spoils the environment.

Padam and Singh (2004) have examined the features of urban transport in India and trends of urban population. The paper studied about the quality of past urban population projections and finds that there has been considerable diversity in their quality by geographic region, level of development and size of country. The paper also discussed about the impact of urbanization on environment and quality of life. In the pace of urbanization; provision of infrastructural facilities are required to support the residents, which is lagging behind in many cities. Similarly, the urban environment particularly in large cities is deteriorating rapidly. All cities have severe shortage of water supply, sewerage, developed land, housing, transportation and other facilities. Proper access to drinking water, sanitation, basic health services and education are the main problems in urban areas.

Michael (1993) examined the impact of rapid urbanization in developing economies and expressed the idea that, there is health hazards associated with city life, overcrowding, accumulation of human excrement and household waste, occupational hazards and various forms of social disorder. These adversely affected the urban environment. He also argued that the spread of cities, its effluent and the concentration of human domestic and commercial discharges put more pressures on urban ecosystem.

Dwivedi (2007) has argued that urbanization is a natural consequence of economic changes that takes place as a country develops. The positive role of urbanization is often shadowed by the evident deterioration in the physical environment and quality of life in the urban areas caused by widening gap between demand and supply of essential services and infrastructure. The broad objective of urbanization policy should be to secure balanced development between large, medium sized and small industries, and between rural and urban areas.

Angotti(1993) commended that the environmental problems may be very serious in less developed regions and they are not comparable with those of more developed regions. The air pollution, noise pollution, solid waste disposal and land contamination seen in developed nations were considered less serious than a life threatening situation of drinking water contamination by human waste in less developed nations.

Kasarda and Rondinelli (1990) highlighted that urban environmental problems in less developed countries were more acute and intense than developed nations. The scale and type of environmental problems found in the cities of less developed countries are different from those in more developed countries.

A study conducted by MIDS (1992) concluded that the urban environment had been deteriorating due to a number of reasons. The major among them are the gap between the demand and supply of infrastructure services, the accumulated backlog in urban housing with increased population of urban poor and the resulted proliferation of slums and squatter settlements. The weak financial and organizational base of urban administrative bodies also led to inequitable supply of urban services.

The Down to Earth Report (1988) regarded urbanization and industrialization linkages. The report revealed that along with industrialization and urbanization, there is a steady destruction of the nature. Cities and industries had polluted the clean air, and water, industries produce a lot of hazardous wastes and city life produce a lot of garbage. Similar view was expressed by IRC News Letter (1992). The explosive urban growth led to a downward trend in the coverage of basic urban services, such as water supply, sewage and drainage. The capacity of existing system is often stretched to the limits. Their function is deteriorated due to management problems and maintenance procedure. This leads to production of large and increasing amount of human, and other organic, liquid and solid waste pollution.

Trivedi and Raj (1996) traced out the reason behind urban environmental problems as the industrial revolution. This led to concentration of people in urban areas and added new sources of waste by shops, institutions and factories.

Madhiwalla (2007) has examined that the growth of cities has always been accompanied by the growth of slums. The industrial revolution in Western Europe led to the migration of people to slums in cities which created new conditions to ill health due to overcrowding, poor housing &unsanitary environment, coupled with poverty. In earlier times the institution of family and church were primarily responsible for care and relief for health crisis.

Prasad and Kochher (2009) have attempted to explore Global Warming an important aspect of climate change is primarily a consequence of accumulation of green house gases in the atmosphere. The study identifies the impact of climate change in the global as well as Indian context. The paper also highlights major international developments related to climate change including the UN Framework Convention on Climate Change (UNFCCC), 1992 and Kyoto Protocol are described along with significant meetings like those at Bali and Bangkok and outcomes at these international exchanges. The authors also suggested that it is important for us to stick to the principle of common but differentiated responsibility in our negotiations and to take forward the concept of equalizing per capita emissions of countries proposed by the Prime Minister of India.

Mrinal, et al., (2005) have studied about the public health implications of vehicular emissions. The particulate matter, particularly that is less than 10m in size, can causes allergic disorders. Based on the data of air monitoring stations, SPM, RPM, NOx, SO2, CO and PM indicate very high level which is dangerous to human health. The study proposed strategic air pollution management in cities, to reduce air pollution levels and advocated measures to maintain environmental balance.

Nagdeve (2006) has examined the relationship between population, the environment and growing population. The study reveals the fact that the country's population growth is imposing an increasing burden on the country's limited and continually degrading natural resource base. The increasing population and growing affluence have already resulted in rapid growth of energy production and consumption in India. The environmental effects like ground water and surface water contamination, air pollution and global warming are of growing concern owing to increasing consumption levels.

Raghupathi (1993) has classified the urban environmental problems and their consequences into different levels;

(i) Micro level environmental problems related to the residence and immediate surrounding

(ii) Macro level problems related to countries and the globe as a whole. She argued that the problem of solid waste is severe in urban centers as the ground water or even the surface water is polluted by the discharge of solid wastes into open dumps.

Vyas and Reddy (1998) have pointed out that urban centers face environmental problems at two levels as, one is the impact of high growth oriented development on environment and the other is the direct impact of the improved standard of living through different life styles.

Agarwal (2011) observed that India has the world's second largest urban population (after China). The study expresses the large disparities within urban population in health related indicators. He observed the large disparities in eight cities between the poorest population (the population in the city that is within the poorest quartile for India's urban areas), the population living in settlements classified as "slums and the non-slum" population. He also highlights the poor performance in some health related indicators for the population that is not part of the poorest quartile in several states; for instance in under-

five mortality rates, in the proportion of stunted children and in the proportion of households with no piped water supply to their home.

Sinha (1998) described municipal solid waste as all solid wastes generated in a community except the industrial and agricultural waste. He divided solid wastes into three categories as household, hospital and industrial wastes. The term municipal solid waste is also described as those waste materials that are collected by the municipality itself or by authorized organizations or by persons and it included sewage sludge, combustion ash and other organic and inorganic wastes.

According to Clain (1995) the trend in consumption habits and changes in life styles resulted in generation of more waste. At the same time, existing landfills neared the capacity and new landfill become difficult to site, moreover the secondary markets had contributed much to the rising popularity of recycling to reduce the volume of wastes.

Khambe and Bamane (2003) studied about the garbage treatment problems of hospitality industries of urban India. In each and every urban centers of the country there are many big and small hotels which contributes large quantum of solid wastes. These wastes are either dry wastes or wet wastes. For attaining pollution free environment in cities, these wastes are needed to be treated through proper waste treatment methods. Hence, the study suggested the reuse or recycling method for dry wastes and vermi- composting method for wet biodegradable wastes.

Madhuban(1992) recommended waste management in the sense that the waste if allowed unused led to severe and potential environmental hazards by spreading diseases and leaching of unwanted chemicals into life support system. He also pointed out the resource conservation advantage of waste management.

Leach (1998) has suggested three alternatives to protect and conserve environment. They are;

(i) Reduce the use of resource;

(ii) Reuse of resource; and

(iii) Recycle the waste material.

Mehta (1995) explained the results of the study conducted in the city of Delhi and found that the city generated 4,000 tonnes of waste everyday and the municipal authority did not have the resources and technical capacity to deal with this problem. This led to severe detrimental effects on environment and sustainable development.

Bhagat (1997) has examined the conceptual issues regarding the relationship between population and environment. The result shows that the preponderance of economic variables viz-a-viz population variables in explaining the level of greenhouse gases at a cross-country level. The transportation and constructive requirement of increasing urbanization are also reflected in the positive relationship between percent urban populations with per capita CO_2 emissions. Similarly Bhaduri (2008) attempted to study the growth and impact of vehicular population with particular reference to personalized transport in the mega cities of India. The study concluded that urban transport systems in Indian cities can become sustainable and provide mobility with minimal adverse effects in the environment only if safe and affordable transport for all sections of people is made available.

Ramachandran (1992) has analyzed the process of urbanization and urban systems in India. His study is classified into two aspects. Firstly, he wrote about the Indian point of view in order to correct imbalances which arise from the western dominated literature. He introduced Indian statistics and application of urban geographical principles to India's history of urban development. Secondly, the study addressed the current urban problems in India, including proliferation of slums, the inadequacy of city transport, deficiencies in infrastructure, inflated land values and the unequal spatial distribution of urban services. The author deals with the policy of urbanization. He viewed that India has an unequally long and varied 5000 year history of invasions and successions of cultures and peoples with their contrasting expression of urban development.

Bhan and Jana (2015) have attempted to study urban inequality with the help of two indices. The first is a proxy wealth index (PWI), which creates a distribution of households by the assets they own as a proxy to measure relative levels of wealth or impoverishment. The second is a quality of housing index (QHI), which measures the material adequacy of housing conditions as well as access to basic environmental services such as water and sanitation. On the basis of these indices the study argued that the slum is not a proxy for urban poverty and inadequate housing patterns, it underscores the need for newer methods to spatially trace multidimensional urban poverty and vulnerability.

According to the report of the Central Statistical Organization (1999), the growth of motor vehicles in metropolitan cities of India is at a high level which is not affordable to the existing road networks in India. The major share of vehicular population is two wheelers (70%), followed by jeeps and taxis. The increased number of vehicles in metropolitan cities are found to be responsible for traffic congestion and air pollution.

Greenstone, et al., (2015) have studied about India's air pollution in the context of growing urbanization. Air pollution in India is severe. The paper attempts to estimate the life expectancy loss from fine particulate air pollution in India, and in doing so highlights air pollution as an urgent public health problem that deserves policy attention. The study reveals the fact that 660 million people, over half of India's population, live in areas that exceed the Indian National Ambient Air Quality Standard for fine particulate population. By reducing population in these areas, it is possible to increase the life expectancy for these Indians by 3.2 years on average for a total of 2.1 billion life years. Hence, to fulfill this objective efficient environmental policy is required.

De and Soni (2009) highlighted that vehicular emission is the single most important source of air pollution in India since the last few decades. It is estimated that around 70% pollutants in air are

contributed by motor vehicles. The growth of motor vehicles since 1960, is faster than that of population growth. The data revealed that the total number of cars in 1950 all over the world were 50 million, which have risen to 600 million in 2002 and will be touching to 1 billion in 2020. Similarly, vehicular population in India is increasing at the rate of around 20 percent in every year.

Cropper, et al., (1997) have studied about the health impacts of air pollution due to increased levels of particulate matter in Delhi in between 1991 and 1994. Delhi is one of the most populated cities of the world and hence, the impact of particulate matter on trauma deaths in the city is found to be higher in the age group of fifteen to forty four years. On the basis of contingent valuation method and cost of illness estimates the study revealed that, deaths in the city associated with air pollution causes lost of more life- years compared to many cities of the developed countries.

Nagdeve (2004) has made an attempt to study the impact of rapid and unplanned urbanization on air pollution. Growth of motor vehicles and associated air pollution is adversely affecting environment and health conditions of people. Based on the available data, the study revealed the detrimental impacts of air pollution in major Indian cities due to automobile emission and its concomitant health hazards. Similarly, Trivedy and Goel (1986) admitted that the number of vehicles in Indian cities including metropolitan cities is still insignificant as compared to that of developed countries like USA, Europe and Japan. But, it is shocking to note that the air pollution levels in these countries are low compared to that of India. The study reveals that, this issue is due to inferior maintenance of vehicles in combination with lower combustion efficiency and resulted vehicular exhausts. This is found to be the reason behind growing number of acid rain in Indian cities.

The Central Air Pollution Board (2013) in its annual report has reported that, high levels of NO2 were observed in the majority of urban centers in India. The air quality monitoring data revealed that, the gases pollutants (SO2 and NOx) showed lower concentrations and SPM and RPM showed higher concentrations in ambient air which

resulted in higher rate of respiratory diseases among the residents of selected cities. Hence, the study concluded that under long term exposure, there is high correlation between particulate concentrations and mortality from lung diseases in Indian cities.

Maiti and Agrawal (2005) have analyzed the magnitude of environmental degradation in the context of growing urbanization. The study examined some of the important environmental problems caused by over population growth and rapid urbanization process in the metropolitan cities of India. There was about three fold increase in the percentage of total urban population in Class-I city followed by almost a fifty fold increase in the total population in the Million plus cities in India from 1901 to 2001. Despite several Government housing policies, 41 percent of the total slum population of India is residing in Million plus city alone. In all the four metro cities the problem of solid wastes is found the highest. The noise pollution was noticed more than the prescribed standard in all the four metro cities. Along with these there is an acute shortage of piped drinking water in these cities. Hence, there is an urgent need to tackle the urban environmental problems in rational manner giving attention to the need for improving urban strategies.

Mukhopadhyay and Revi (2009) have studied about India's urbanization and economic growth and related impacts on climate change. They argued that the existing urbanization models are unsustainable. The paper explores a limited set of emergent issues that will have to be considered as India develops its domestic approach to urbanization, while negotiating its international position of climate change. Further this paper is structured into three broad sections; (a) the feedback loops from urbanization to climate change and vice versa, (b) actions needed at multiple levels to influence these processes, and (c) the implications of these for India's negotiating position on climate change.

Dutta (2006) concentrated on urbanization in India with special attention to urban policy issues. The study advocated policies which relate to proper urban planning

where City Planning will consist of operational, developmental and restorative planning. The study also suggested development of strong economic base for urban economy and urban planning should concentrate on housing for slum people with human face for a better living of urban people.

Ghosh (2005) has analyzed that India's environmental problems are gaining global significance because of the rapid and aggressive speed of urbanization and lack of infrastructure. India is the first country, which has provided for the protection and improvement for the environment in its constitution. Therefore the author made an attempt to throw light on the trends in India's planning for the reduction of environmental degradation. For that purpose she used data from the Planning Commission Report of Government of India, from first five year plan up to tenth five year plan. Report shows that there is an increasing importance in planning and policies throughout the plan periods to reduce environmental degradation.

Kundu (1997) argued that Class I cities of India such as Kolkata, Bombay, Delhi, Madras etc. have reached to a point of saturation in case of employment generating capacity. These cities are suffering from urban poverty, unemployment, transport, water supply& sanitation, water pollution& air pollution, inadequate provision for social infrastructure etc. Because of these problems these large cities cannot absorb rural migrants from distant areas.

Naik and Purohit (2003) had attempted to study the noise levels of ten residential locations at Bondamunda city during day and night. The results revealed that during day and night, the noise level exceeded the CPCB recommended limit. The sources of noise are many in the area, which are responsible for health problems in the industrial complex. Similarly, Sing and Kaur (2014) revealed that rapid urbanization along with road network expansion are responsible for noise pollution in the city. As per the study, the main agents of noise pollution in India are vehicular population and industrial sector. Similar view is given by Panday and Varma (1997). The study viewed that the increased levels of noise pollution in Indian cities are contributed by rapid urbanization, industrialization, transportation etc. The study also highlighted the idea that, for assessing the noise pollution level in cities a systematic study needed to be introduced with objective measurement and subjective reaction of people who are affected by the noise pollution.

Rajashekariah (2011) has attempted to analyze the impact of urbanization on biodiversity in the two Indian Cities of Coimbatore and Kolkata. It also aimed to discuss the key environmental issues of these cities. This study showed the fact that rapid growth of these cities has led to the destruction of natural eco systems and an increase in the ecological foot print. It is also argued that developing sustainable cities requires creation of new governance structures and changes in the behavior of citizens. What we need is showing solutions that are affordable, easy and replicable, and ultimately we will attain a sustainable solution to the problems of urbanization. So the urban planning should take into account eco system services and long term sustainability of nature- society relations.

Battacharya (1998) revealed that urbanization of Kolkata and its neighbouring areas have had severe impacts on environment, especially on the Sundarbans. Growing infrastructure construction and increasing demand for natural resources from the city had led to large scale deforestation of mangrovers, siltation and pollution. This affected the ecology and sustainable development of this area.

Kaur (2006) has attempted to study the growth and structure of infrastructure section in Punjab and revealed that when a country moves from a low income to middle income category, the relative share of power, telecom, and roads tends to increase, while irrigation, and railways decrease. The study attempted to analyze the growth, direction, structural transformation in the infrastructural developments by using secondary data analysis.

Vaidhya (2009) has analyzed the major issues of urban areas. India has to improve its urban areas to achieve objectives of economic development. This paper has analyzed urban trends, projected population, service delivery, institutional arrangements, municipal finances, innovative financing etc. It has also described the status of government launched urban investment program JNNURM. As per population projection for 2026, level of urbanization would be different in various states. Hence, India's future urban strategy should focus on: (a) inter-government transfers with built-in incentives to improve performance; (b) integrate urban transport with land use

planning; (c) capacity building of ULBs; (d) investment on asset creation and management; (e) integrate various urban development and related programs at local, state, and national levels; (f) strengthen urban institutions and clarify roles of different organizations; (g) different approach of supporting reform linked investments needed for different states based on level of urbanization; (h) second generation of urban reforms should further focus on regulation, innovative financing and PPP, and climate change initiatives. It has recommended constitutional amendments as well as administrative actions to improve India's urban areas.

Salvi(1996) has studied the problems related with solid waste disposal in the city of Mumbai. She argued that the improper decomposition of waste resulted in unsanitary conditions at the dumping site not only affected the people in the vicinity but also the distant areas where the suffocating gases spreads.

Rao and Shantram (1995) revealed the fact that, in a majority of the urban centers of our country, waste is being disposed of by depositing the same in low lying areas. The disposal sites are selected on the basis of their closeness to the collection areas and new disposal sites are normally identified only when the existing areas are completely filled.

The CPCB (2000) in its report specified that India's population will increase to 600 million by 2030 and hence, the greatest challenge before us will be the proper management of municipal solid wastes (MSW). The country has more than 5000 cities and towns, which generate about 40 million tonnes of MSW per year. It is estimated by The Energy Research Institute (TERI) that the generation of MSW will reach to 260 tonnes per year by 2047.

Agarwal and Taneja (2005)have made an attempt to study about the child health conditions among the urban poor. They observed that increasing urbanization has resulted in a faster growth of slum population. There are mounting disparities among slums in developing

countries. This has led to varying degrees of health burden on the slum children. Child health conditions in slums with inadequate services are worse in comparison to relatively better served slums. Hence, identification, mapping and assessment of all slums are important for locating the hitherto missed out slums and focusing on the neediest slums. In order to improve children's health in slums, an urban child health programme and community-need-responsive approaches are necessary.

Agarwal, et al., (2007) have analyzed about urban poverty and health of urban poor and revealed that nearly 48 percent of the world's population lives in urban areas and the prime locus of this spurt in city dwellers are the developing countries such as India. This paper analyses the association between urban poverty and health of the urban poor in India. The health situation among urban poor is described on the basis of analysis of the NFHS-2 data by economic status. The paper also outlines some of the challenges in improving health outcomes of the urban poor and the potential operational solutions to address such challenges.

Sacratees and Raihan (2014) have studied about the environmental impact of waste water discharge from shrimp farms of Thoothukudy District. The study emphasized the fact that the waste water discharged from the shrimp farms is supposed to be the most significant factor that contributes to the degradation of the environment and to cause self pollution within the culture system. Aquaculture is increasingly confronted with issues of environmental protection. However there is no systematic investigation on the total organic load released by the shrimp farms into the land. Hence, stronger commitment to responsible aquaculture is needed. Currently, the knowledge of potential ecological impacts as well as of negative social and economic side effects of a given aquaculture development is getting mass attention from every sectors.

Mariappan et al., (2000) have pointed out the problem of inadequate provision of water and sanitation facilities in urban areas with the

special implications of its impact on children's health and general development. The child mortality and morbidity rates in poor urban settlements of India were found to be higher than those in rural areas. This may be due to the water contamination problem of the cities. The ground water and its chemical composition are changed a lot due to external pollution agents and this has resulted in worsening the quality of water.

Tyagi(1998) has studied about the problem of water contamination in cities of India and viewed that, the organic material that is discharged with municipal wastes through sewages into the water sources results in biological degradation and ecological imbalance of rivers and lakes. Normally, natural ground water is bacterial free. But it gets contaminated with sewage or industrial seepage and hence, there is higher possibility of water contamination which is the main source of spread of diseases in cities.

Economic Review (2014) report expressed the fact that considering the special features of urbanization and geographical peculiarities of Kerala, the process of urbanization in the state requires special attention while moulding various urban infrastructure development programmes. The scattered pattern of urbanization and high density of population of the state together make a big challenge for the creation of urban infrastructure cities.

The Government of Kerala Status Report (1988) pointed out that the wastes discharged to marine water influenced the coastal fisheries and resulted to mass mortality of benthic organisms of commercial importance like Claus, Mussels and Oysters. Pollution also affected the growth and reproduction of marine plants.

Elangovan (2011) has highlighted that in the fast growing city like Kochi, an ideal mode of public transport must make efficient use of road space and reduce air and noise pollution. This will lead to environment friendly road transport system. Singh (2001) pointed out that the sluggishness of Cochin Corporation in cleaning the waste had resulted

in water logging in several places. This attitude shown by Cochin Corporation had invited flack from various quarters.

A study conducted by Jishi (2000) in the area of solid waste management, recommended the decentralized collection and disposal of waste as the most suitable and efficient system of waste management for Thiruvananthapuram city. She suggested the composting method not only due to its eco-friendliness but also its promotional role in agriculture.

Similarly Pillai (2000) conducted a study of Palakkad Municipality which revealed the fact that the daily collection of waste in Palakkad Municipality was around 30 tonnes and half of the daily produced wastes remain uncollected and this proved the inefficiency of waste collection.

Unni(1993) conducted a study of Calicut Corporation and expressed the idea that Calicut Corporation produced nearly 72 tonnes of municipal solid waste daily. He also proved that the waste generated had a direct connection with the widespread use of plastic covers and objects in a day to day life which is harmful to environment.

Soni(2014) has examined the significance of environment friendly housing development initiatives. The term 'Green Homes' is largely recognized as an extension of the broader concept of 'Green Buildings', often used interchangeably with the terms 'Sustainable Buildings', 'High Performance Buildings', and 'Environmentally Responsible Buildings'. It is a process that creates buildings and infrastructure that minimizes the use of resources, reduce harmful effects on environment and provide healthier environments for people. The concept of 'Green Affordable Homes' combines the two vital ingredients of eco-friendliness and affordability. The study made an empirical study of the attitude of the urban people towards the concept of 'Green Affordable Homes' with reference to Thrissur city in Kerala. The study suggested mass awareness programs to educate the stake holders regarding the urgency of 'Going Green' in all developmental

initiatives, particularly construction of buildings both residential and commercial.

Ullas and Mahvish (2012) conducted a study in Kerala which aimed to find out the magnitude to which, rapid population growth and industrial development is associated with the deterioration of environment. The result shows that large scale environmental degradation has resulted from population pressure, industrialization and indiscriminate use of forest areas for fuel, power generation and irrigation purposes. The relation between population and development is dynamic. They also suggested implementation of strict laws on Kerala Land Utilization to control land filling (ponds, farmlands, wetlands and other water bodies).

Basiago (1999) has attempted to make a comparative analysis of alternative models of cultural development in Curitiba of Brazil, Kerala of India, and Nayarit of Mexico which emphasizes the integration and inter linkage of economic, social, and environmental sustainability. The study reveals that, Curitiba's urban development suggests that economic sustainability requires, planning for people, making the city more 'green', and, hence, more livable, for people. Nayarit's development suggests that environmental sustainability requires planning that provides for ecological conservation in the formative stage of the development plan. Kerala has attained social harmony by emphasizing equitable resource distribution rather than consumption, by restraining reproduction and by attacking divisions of race, caste, religion, and gender. Kerala's development suggests that social sustainability requires planning that encourages people's cooperative rather than their competitive impulses.

Alberini and Krupnik (2000) in their article entitled "Cost of Illness and WTP Estimates of the Benefits of improved Air Quality: Evidence from Taiwan" have applied the willingness to pay and cost-of-illness estimates to analyze the respiratory symptoms associated with air pollution in Taiwan. The Contingent Valuation Method with the use of WTP is aimed to avoid minor respiratory illnesses and health diaries are analyzed to predict the likelihood. The result of the analysis revealed that the WTP is exceeding on COI depending on the pollution levels of the country.

The review of major works mentioned above on urbanization and environment shows that most of the studies are either region specific or deals with only particular problems of environment; studies which consider aspects of environment with

specification of its impact on health conditions of household are very limited. Therefore a meaningful study of the impact of urbanization on sustainable environment in Kerala with special reference to cities of Thrissur district would be highly useful for policy purposes. As far as Thrissur district is considered, it expresses the trend of fastest growing urbanization in Kerala. Though a vast literature on various aspects of urbanization and environment is available, no comprehensive work has done to examine the impact of urbanization on the life of people as well as on the ecology in a detailed manner. The present study also includes the problems of pollution & waste management in the urban study area and will try to suggest suitable policy measures for protecting environment.

CHAPTER- 3

TRENDS AND PATTERN OF URBANIZATION AND ITS IMPACT ON ENVIRONMENTAL QUALITY

CHAPTER- 3

TRENDS AND PATTERN OF URBANIZATION AND ITS IMPACT ON ENVIRONMENTAL QUALITY

3.1 Introduction

Urbanization is the progressive concentration of population in urban units (Davis, 1965). It is the process of population moving towards towns and cities from rural areas, and taking up the culture and work prevailing in the urban areas. The country's population is spread over villages and also towards their nativity with formal occupation, mostly agricultural or its allied ones, making their living with or without ancestral property like lands or houses. An analysis of distribution of population between rural and urban areas of country will reveal the extent of urbanization. Deteriorating quality of urban and suburban environment is to a great extent the result of injudicious land use and is a threat to the whole socio-economic system. Thus planned cities are as necessary as planned farms (Tyler Miller, 1992).

According to the Encyclopedia of social sciences (1971), urbanization is characterized by movement of people from small communities concerned chiefly or solely with agriculture to other communities generally larger, whose activities are primarily centered in Government, trade manufacture or allied interests. Thus Urbanization can be said to be characterized by such self evident factor as;

i. Mobility of population from agricultural to non - agricultural areas ;
ii. Concentration of populace in a new place of habitation or a place characterized by a new way of life.
iii. Variety of professions other than agriculture and continued mobility in these occupations, mobility both - vertical and horizontal.
iv. A particular mode of habitation and non - agricultural (i.e., industrial, commercial etc.) pattern of economy.

In simple words, urbanization usually refers to the process of concentration of people in the densely populated settlements where majority of the people derive their

livelihood from non-primary occupations (Chaudari 2001). It is treated as an index of modernization and one of the chief ingredients which reflects growth.

3.2Pattern of urbanization in the world

Rapid urbanization has been a worldwide phenomenon in the 21st century. According to the United Nations (2011), the world population is estimated to be 9.2 billion by 2050 from7 billion in 2011. Between 2011 and 2050, the world population is expected to increase by 2.3 billion, passing from 7.0 billion to 9.3 billion (UN, 2011). At the same, the population living inurban areas is projected to gain 2.6 billion, passing from 3.6 billion in 2011 to 6.3 billion in 2050.

Some striking differences existed between the More Developed (MD) and Less Developed (LD) countries with respect to their pattern of urbanization. The developed countries achieved the higher degree of urbanization to a great extent with the industrial revolution of the 19th century. Urbanization is emerged around the time of industrial revolution in the case of developing countries and keeps fastest growing compared to the developed nations. This is shown in table 3.1.

The table gives a clear picture regarding the rate of urbanization of the world. Here the entire nations are divided into two categories-the more developed regions (MDR) and the less developed regions (LDR). In the year 1950 proportion of urban population in total population was 29.8 percent, and in the case of MDR it was 54.9 percent. In the case of LDR it was 17.8 percent. Since then, this trend shows an increasing rate. During 2015 urban population in percentage was 53.7 that clearly depicts that half of the total world population is urban. In the case of MDR the percentage of urban population was 78.6 and that of LDR it was 48.6. Similarly, the rate of urbanization in the world was marked as 1.22 percent, and that for MDR and LDR were 1.12 and 1.91 respectively in 1950-1955. The rate shows a fluctuating trend since 1965 were there is diminishing trend for W and MDR. But LDR shows increasing trend upto 2015-2020. This shows that the rate of urbanization is higher in case of less developed regions as compared to that of more developed regions.

Table 3.1

Proportion of Urban Population and Rate of Urbanization of the World-The More Developed Regions and the Less Developed Regions 1950 - 2050.

Proportion of Urban(In Percentage)				Urbanization Rate(%)			
Year	W	MDR	LDR	Period	W	MDR	LDR
1950	29.8	54.9	17.8	1950-955	1.22	1.12	1.91
1955	31.7	58.0	19.6	1955-1960	1.23	1.14	1.91
1960	33.7	61.4	21.6	1960-1965	1.07	1.02	1.80
1965	35.5	64.6	23.6	1965-1970	0.68	0.92	1.23
1970	36.8	67.7	25.1	1970-1975	0.64	0.68	1.29
1975	37.9	70.1	26.8	1975-1980	0.88	0.42	1.82
1980	39.6	71.5	29.3	1980-1985	0.90	0.33	1.79
1985	41.5	72.7	32.1	1985-1990	0.95	0.29	1.76
1990	43.5	73.7	35.0	1990-1995	0.82	0.23	1.44
1995	45.3	74.6	37.7	1995-2000	0.84	0.21	1.39
2000	47.2	75.4	40.4	2000-2005	0.86	0.25	1.33
2005	49.3	76.3	43.1	2005-2010	0.86	0.29	1.24
2010	51.5	76.8	45.9	2010-2015	0.84	0.32	1.16
2015	53.7	78.6	48.6	2015-2020	0.81	0.33	1.07
2020	55.9	79.9	51.3	2020-2025	0.77	0.34	0.98
2025	58.1	81.3	53.9	2025-2030	0.72	0.32	0.90
2030	60.2	82.6	56.4	-	-	-	-

Source: United Nations, World Urbanization Prospects (2011).
Note: W- World, MDR - More Developed Regions, LDR - Less Developed Regions

Population growth is becoming largely an urban phenomenon concentrated in the Developing world (David Satterthwaite, 2007), Asia in particular is projected to see its urban population increased by 1.4 billion, Africa by 0.9 billion, and Latin America and the Caribbean by 0.2 billion. The rate of urbanization by major areas of the world is shown in table 3.2.

Table 3.2

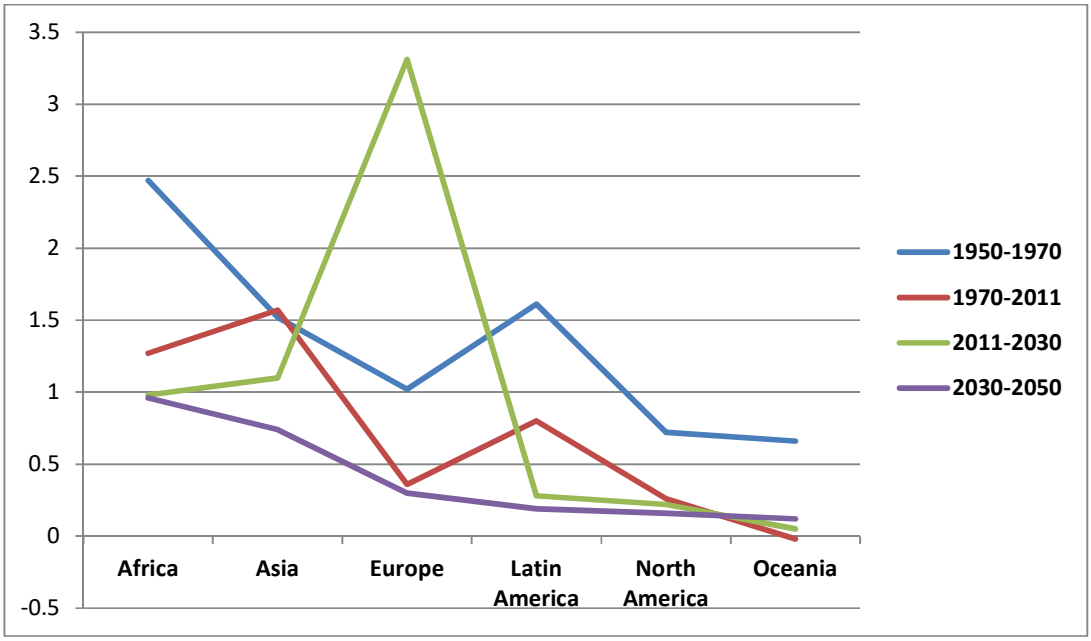
Rate of Urbanization by Major Areas

Major Areas	Rate Of Urbanization (%)			
	1950-1970	1970-2011	2011-2030	2030-2050
Africa	2.47	1.27	0.98	0.96
Asia	1.52	1.57	1.10	0.74
Europe	1.02	0.36	3.31	0.30
Latin America	1.61	0.80	0.28	0.19
North America	0.72	0.26	0.22	0.16
Oceania	0.66	-0.02	0.05	0.12

Source: UN, World Urbanization Prospects, 2011.

Figure 3.1

Rate of Urbanization by Major Areas



The table and figure shows that in the period 1950-1970 highest rate of urbanization was found in Africa and lowest in Oceania. Asia region marked 1.52 percent of urbanization which is higher than that of Europe. During the period 2011-2030 the

urbanization rate shows highest in Europe which is 3.31 percent and in the case of Asia it is 1.10 percent which show that Asian region shows a trend that is not so much fluctuating compared to the other regions of the world.

Table 3.3

Total Urban and Rural Population 1950-2050

Development Group	Population (billion)					Average annual rate of change (%)			
	1950	1970	2011	2030	2050	1950-70	1970-2011	2011-30	2030-50
Total Population									
World	2.53	3.70	6.97	8.32	9.31	1.89	1.55	0.93	0.56
MDR	0.81	1.01	1.24	1.30	1.31	1.08	0.51	0.23	0.06
LDR	1.72	2.69	5.73	7.03	7.99	2.23	1.85	1.07	0.65
Urban Population									
World	0.75	1.35	3.63	4.98	6.25	2.98	2.41	1.66	1.13
MDR	0.44	0.67	0.96	1.06	1.13	2.09	0.89	0.52	0.29
LDR	0.30	0.68	2.67	3.92	5.12	4.04	3.33	2.02	1.34
Rural Population									
World	1.79	2.34	3.34	3.34	3.05	1.36	0.87	-0.01	-0.44
MDR	0.37	0.34	0.28	0.23	1.18	-0.48	-0.48	-0.92	-1.14
LDR	1.42	2.01	3.07	3.11	2.87	1.74	1.03	0.07	-0.40

Source: UN, World Urbanization Prospects, 2011.

Note: MDR-More developed Regions, LDR-Less Developed Regions

The Table 3.3 gives us the clear idea about urban-rural share of total population in more developed and less developed regions. In 1950 total world population was 2.54 billion in which 0.81 billion are from more developed regions and 1.72 billion from less developed regions. Since then, up to the projected estimate of 2050, population shows a drastic change to 9.31 billion in which major share is from less developed regions (7.99 billion). Similarly, the share of urban population is higher in the case of less developed regions which is marked as 2.67 billion in 2011 than 0.96 billion of more developed regions. In 2050 it will be 5.12 billion for LDR and only 1.13 billion for MDR. In case or rural population, more developed regions contributed 0.37 billion and less developed regions 1.42 billion to total rural population of the world. In 2011,

the major share of rural population to total population is from less developed region which is marked as 3.07 billion.

Similarly, the average annual rate of change of urban population in 1950-70 is marked as 2.98 percent. MDR marked 2.09 percent growth, while LDR marked 4.04 percent. The interesting fact is that the average annual rate of change of rural population for the world, MDR and LDR shows negative rate that gives the idea of increasing trend of urbanization. In 2011-30, the rate is -0.01 percent for the world and – 0.92 percent for more developed regions. LDR marked 0.07 percentage change during that period.

3.3Pattern of Urbanization in India

The Asian Region has been very dynamic as revealed by the diversified level of urbanization. Among the Asian Regions, India's urban population is second highest in the world after China and higher than the total population of all countries (HDR, 2000).

In India the definition of urban is substantially dynamic in nature. The major changes in the definition of urban in India took place between 1951 and 1961. As a result, about 810 towns of 1951 were reclassified as rural in 1961 and after that the definition of urban place in the Indian Census has remained more or less stable. Since 1971, Urban Agglomeration (UA); a concept is used by census of India to explain urbanization. Urban agglomeration is a continuous urban spread constituting a town and its adjoining urban outgrowths (OGS) or two or more physical contiguous towns together and any adjoining urban outgrowth of such towns. Examples of OGS are Railway colonies, University Campuses, Port areas that may come up near a city or statutory towns, outside revenue limit of a village or villages contiguous to the town or city.

The definition of 'Urban' given by Census of India includes two classifications. The First category is known as Statutory Tows. These towns are notified under low by the concerned State/Union Territory Government and have local bodies like Municipal Corporation, Municipalities, Municipal committees etc. The second category is Census Town.

According to the 2011 census, an urban area is,

a) All the statutory places with a municipality, corporation, cantonment board or noticed areas exist (Statutory towns).
b) All other places which satisfy the following conditions (Census Towns).
    1. Having a minimum population of 5000
    2. At least 75 percent or more male working population engaged in non agricultural activities.
    3. Having a population density of at least 400 persons per sq.km

The urbanization in India is taking place at a faster rate than the rest of the world. This is because India is in a phase of rapid economic and demographic transition. Urban areas account for about 60% of the GNP of the country. The table 3.4 gives the trends in urbanization in India.

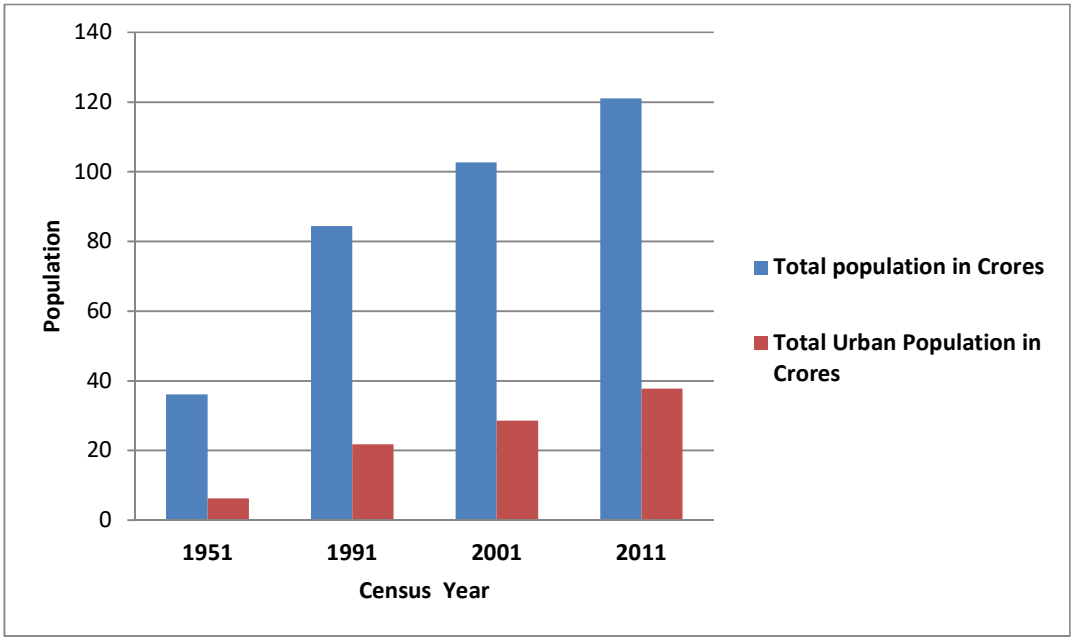
Table 3.4

Trends in Urbanization in India

Year	Total population in Crores	Total Urban Population in Crores	% of Urban population	% of Rural Population	Urban – Rural Ratio (%)
1901	23.84	2.58	10.84	89.15	12.16
1911	25.21	2.59	10.29	89.71	11.47
1921	25.13	2.81	11.17	88.82	12.58
1931	27.89	3.35	12.00	88.01	13.63
1941	31.87	4.41	13.86	86.14	16.08
1951	36.10	6.24	17.29	85.71	20.91
1961	43.92	7.89	17.97	82.03	21.91
1971	59.81	10.91	19.91	81.76	22.31
1981	68.33	15.95	23.34	76.66	30.44
1991	84.43	21.72	25.72	74.28	34.63
2001	102.70	28.61	27.86	72.22	38.47
2011	121.01	37.71	31.16	68.84	45.26

Source: Census of India Various Years, Office of the Registrar General & Census Commissioner, India.

Figure 3.2Trends in Urbanization in India



The above table shows that in the year 1951, total population of the country was 36.10 crores out of which 17.29 percent was urban population. The share of urban population to total population has grown from 10.84 percent in 1901 to 31.16 percent in 2011, whereas percent rural has shown gradual decrease from 89.15% to 68.84%. The urban rural ratio increased significantly from 12.16 percent in 1901 to 45.26 percent in 2011. This implies that for every 100 rural population there are 45 urban people in India. These data show the acceleration trend of urbanization in India since 1950.

Table 3.5

Urban Rural Population Growth Differentials

Decade	Rural (%)	Urban (%)	Urban – Rural Differential (Annual exponential growth rate %)
1971-1981	1.76	3.79	2.03
1981-1991	1.80	3.09	1.29
1991-2001	1.69	2.75	1.06
2001-2011	1.15	2.76	1.61

Source: Census of India various years, Office of the Registrar General & Census Commissioner, India.

The table 3.5 exhibits that urban – rural differential in annual exponential growth rate show a decreasing trend from 2.03 in 1971-1981to 1.61 percent in 2001-2011. This

shows that there is an increasing trend of urbanization in subsequent decades. Similarly, the total urban rural population, male, female population and sex ratio (number of females per 1000 males) is expressed in table 3.6.

Table 3.6

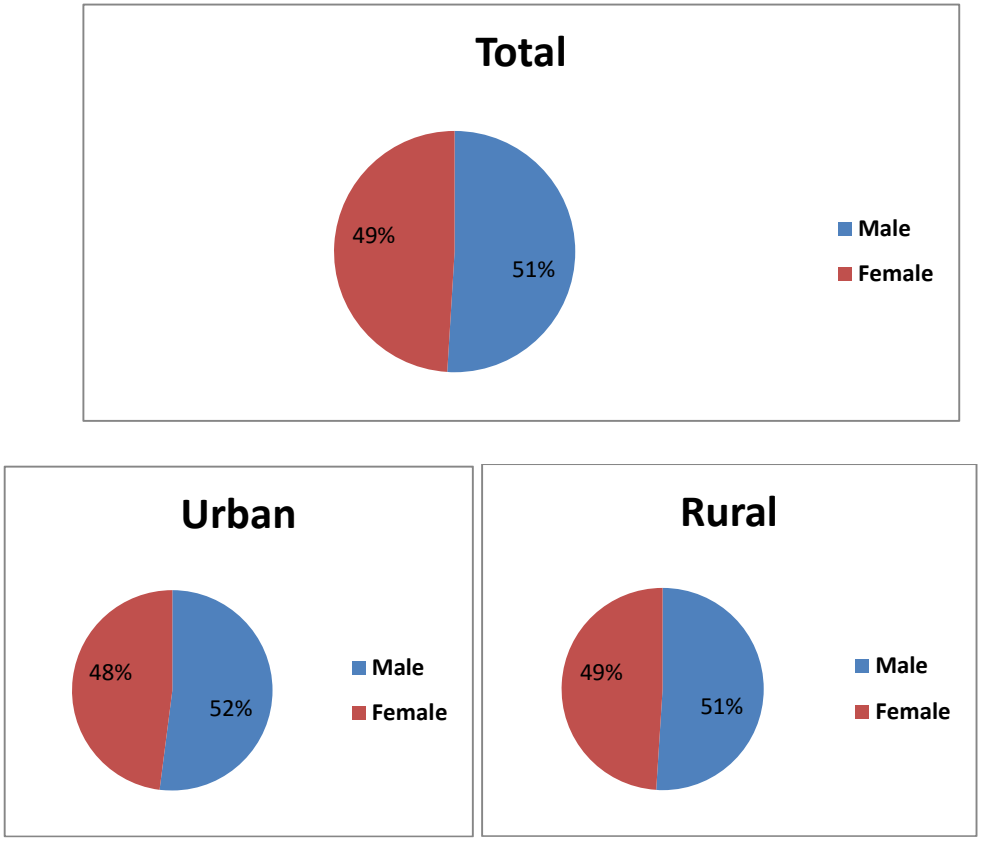
Population of India by Sex and Residence: 2011

India	Male(%)	Female(%)	Total(%)	Sex ratio
Urban	52	48	100	926
Rural	51	49	100	947
Total	51	49	100	940

Source: Census 2011, Office of the Registrar General & Census Commissioner, India.

Figure 3.3

Population of India by Sex and Residence: 2011



The Census report of 2011 shows that, the percentage of urban male was 52 and rural male was 51. Similarly female population was 51. Similarly female population percentage in total population is 48 in urban areas and 49 in rural areas. The total sex ratio is 940 females for males and it is 926 females in urban areas and 947 in rural areas.

Table 3.7 exhibits the total number of UAs/ towns in India since 1901. Total number of towns was 1827 in 1901 and it slightly declined to 1825 in 1911. Later during all the census years the number showed an increasing trend. During 2001, total number of towns was 5161 and it reached to 7935 in 2011 census. Hence, the table gives a clear picture regarding the growth of number of towns in the country.

Table 3.7

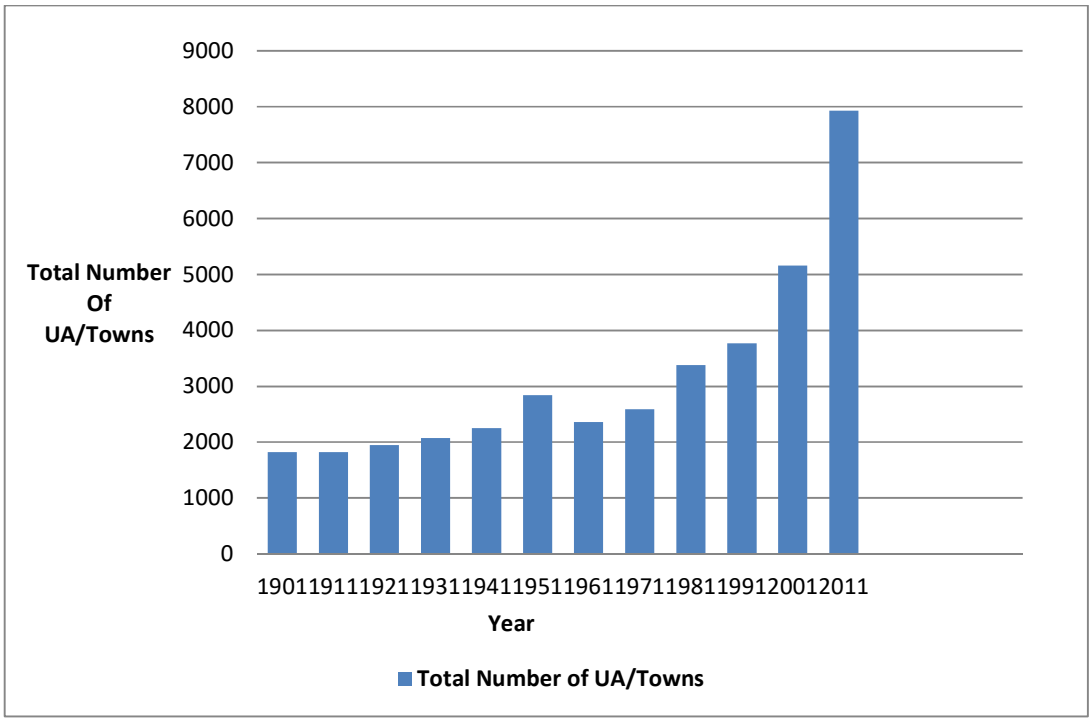
Total Number of UAs/Towns in India

Year	Total Number of UA/Towns
1901	1827
1911	1825
1921	1949
1931	2072
1941	2250
1951	2843
1961	2363
1971	2590
1981	3378
1991	3768
2001	5161
2011	7935

Source: Census of India various years, Office of the Registrar General & Census Commissioner.

Figure 3.4

Total Number of UAs/Towns in India



The percentage of total urban population of India residing in million plus cities has increased drastically from 1901. The growth of population according to the 2011 census in million plus cities is furnished in table 3.8.

The number of million plus cities that is the cities having the population of one million and more, in India had shown considerable growth in 2011. According to the census report of 2011, there are 55 million plus cities in India. It is estimated that the Thrissur city recorded the highest growth rate which accounts for 894.1 percent during 2001-2011. This data shows the importance of studying this phenomenon of Thrissur city. Similarly, the second highest urban growth among the million plus cities is accounted for Kozhikode (463.6 percent) whereas the Kannur recorded urban growth at 243.7 percent in 2011. It is interesting to note that except all the metropolitan cities all other cities have significantly increased the urban population in this period. This may be due to the rural-urban migration which results in the expansion of urban cities. As a result of the increasing urbanization, most of the cities face severe environmental issues and related health aspects.

Table 3.8

Growth of Population of Million Plus Cities

S.N	Cities	2001	2011	Growth Rate(%)
1	Mumbai	16.46	18.39	11.7
2	Delhi	13.85	16.34	18.0
3	Kolkata	13.20	14.05	6.4
4	Chennai	6.56	8.65	31.9
5	Bangalore	5.70	8.52	49.5
6	Hyderabad	5.74	7.67	33.6
7	Ahmedabad	4.52	6.35	40.5
8	Pune	3.76	5.05	34.3
9	Surat	2.81	4.59	63.3
10	Jaipur	2.32	3.04	31.0
11	Kanpur	2.71	2.92	7.7
12	Lucknow	2.24	2.90	29.5
13	Nagpur	2.12	2.49	17.5
14	Ghaziabad	0.96	2.37	146.9
15	Indore	1.50	2.17	44.7
16	Coimbatore	1.46	2.13	45.9
17	Thriruvananthapuram	1.35	2.11	56.3
18	Patna	1.69	2.04	20.7
19	Kochi	1.65	2.02	22.4
20.	Bhopal	1.45	1.88	29.7
21	Kozhikode	0.33	1.86	463.6
22	Vadodara	1.49	1.82	22.1
23	Agra	1.33	1.76	32.3
24	Visakapatnam	1.34	1.72	28.4
25	Thrissur	0.17	1.69	894.1
26	Malappuram	0.88	1.67	89.8
27	Kannur	0.49	1.64	234.7
28	Ludhiana	1.39	1.61	15.8
29	Nasik	1.15	1.56	35.7
30.	Vijayawada	1.03	1.47	42.7
31	Madurai	1.20	1.46	21.7
32	Varanasi	1.20	1.43	19.2
33	Meerut	1.16	1.42	22.4
34	Faridabad	1.05	1.41	34.3
35	Rajkot	1.00	1.39	39.0
36	Jamshedpur	1.10	1.33	20.9
37	Srinagar	0.98	1.26	28.6
38	Jabalpur	1.09	1.26	15.6
39	Asansol	1.06	1.24	17.0
40	Bhiwandi	0.71	1.12	57.7
41	Vasasi-Virar	0.69	1.22	76.8
42	Allahabad	1.04	1.21	16.3
43	Dhanbad	1.06	1.19	12.3

S.N	Cities	2001	2011	Growth Rate(%)
44	Aurangabad	0.89	1.18	32.6
45	Amritsar	1.00	1.18	18.0
46	Jodhpur	0.86	1.13	31.4
47	Ranchi	0.86	1.12	30.2
48	Kollam	0.38	1.11	192.1
49	Gwalior	1.05	1.10	4.8
50	Bhilainagar	0.92	1.06	15.2
51	Chandigarh	0.80	1.02	27.5
52	Trichi	0.86	1.02	18.6
53	Kota	0.70	1.00	42.9
54	Raipur	0.70	1.01	44.3
55	Guntur	0.78	1.05	34.6

Source: Census of India, 2011 Office of the Registrar General & Census Commissioner, India**.**

Table 3.9 shows the number and percentage of population in million plus cities in India.

Table 3.9

Million Plus Cities in India Since 1951

Census year	No. of City	Population (in millions)	Population Per Million Plus City (in millions)	Percent to Urban Population
1951	5	11.75	2.35	18.81
1961	7	18.10	2.58	22.93
1971	9	27.83	3.09	25.51
1981	12	42.12	3.51	26.41
1991	23	70.66	3.07	32.54
2001	35	107.80	3.08	38.60
2011	55	162.40	2.95	50.53

Source: Census of India 2011, Office of the Registrar General & Census Commissioner, India.

Figure 3.5

Million Plus Cities in India Since 1951

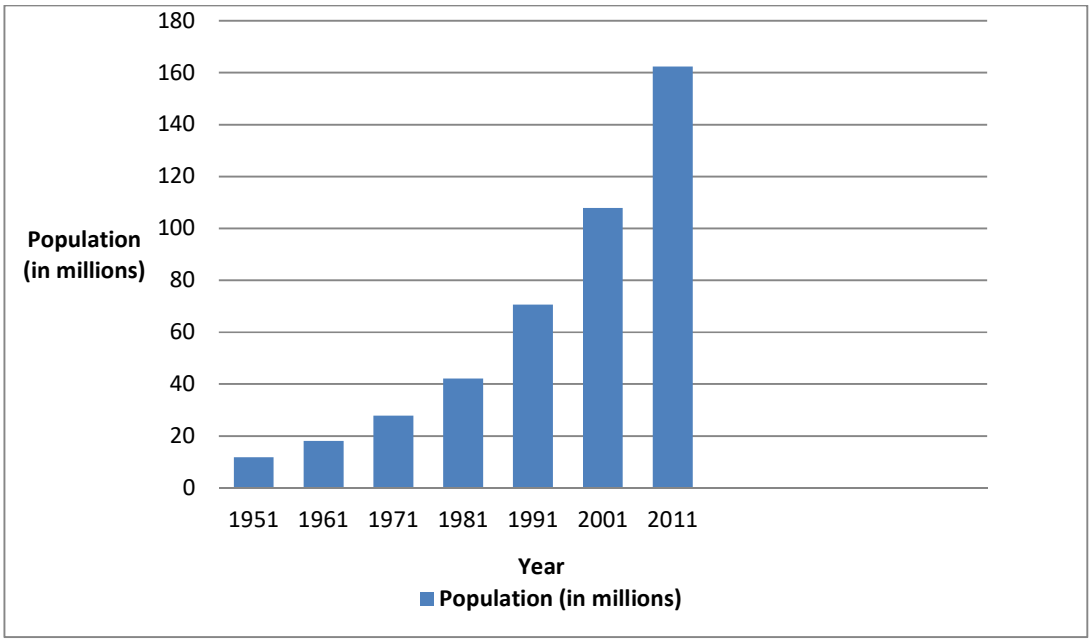


Table 3.9 and the figure indicate the number and percentage of population in million plus cities in India. During 1951, there were 5 million plus cities in India and it increased tremendously to 55 in 2011. It shows the significant expansion of the rate of growth of urban areas and urban population as more people are moving towards cities in search of high standard of living. The urban population is recorded 50.5 percent growth in 2011 compared to 18.81 percent growth of 1951. The data pinpoints the positive association between growth of urban cities and growth of urban population in the country.

The pattern of urban growth across states and union territories of India is showing different trends compared to the levels of urbanization. The level of urbanization at the State and Union Territory level and the share of urban population in each of these is clear from table 3.10. During 2011, Goa occupies the first position with 62.17 percentage of urban population followed by Mizoram (51.51), Tamil Nadu (48.45) and Kerala (47.72). Goa's percentage share in India's urban population is only 0.24 and that of Kerala is 4.22. The state Himachal Pradesh has the lowest proportion of urbanization among the other states. It has only 10.04 percentage of urban population to total population.

Table 3.10

Position of India's States and Union Territories based on Percentage of Urban Population 2011

Sl. No	State/UT	Percentage of Urban Population to Total Population	Percentage Share in India's Urban Population
1	Goa	62.17	0.24
2	Mizoram	51.51	0.15
3	Tamil Nadu	48.45	9.27
4	Kerala	47.72	4.22
5	Maharashtra	45.23	13.48
6	Gujarat	45.58	6.82
7	Telangana	38.66	4.21
8	Karnataka	38.57	6.25
9	Punjab	37.49	2.75
10	Haryana	34.79	2.34
11	Andhra Pradesh	33.49	3.31
12	West Bengal	31.89	7.73
13	Uttaranjal	30.55	0.82
14	Manipur	30.21	0.22
15	Nagaland	28.97	0.15
16	Madhya Pradesh	27.63	5.32
17	Jammu & Kashmir	27.21	0.91
18	Tripura	26.18	0.25
19	Sikkim	24.97	0.04
20	Rajasthan	24.89	4.53
21	Jharkhand	24.05	2.10
22	Chhattisgarh	23.24	1.57
23	Arunachal Pradesh	22.67	0.08
24	Uttar Pradesh	22.28	11.79
25	Meghalaya	20.08	0.16
26	Orissa	16.68	1.86
27	Assam	14.08	1.16
28	Bihar	11.30	3.11
29	Himachal Pradesh	10.04	0.18
Union Territories			
1	Delhi	97.50	4.33
2	Chandigarh	97.25	0.27
3	Lakshadweep	78.08	0.01
4	Daman & Diu	75.16	0.05
5	Pondicherry	68.31	0.23
6	Dadra & Nagar Haveli	46.62	0.04
7	Andaman & Nicobar Islands	35.67	0.04

Source: Census of India, 2011 Office of the Registrar General & Census Commissioner, India.

Among the union territories, Delhi tops the list with 97.50 percentage of urban population followed by Chandigarh (97.25) and Lakshadweep (78.08). Among the states, Uttar Pradesh is having the highest percentage share in India's urban population with 11.79 percent.

The urban scenario in the post independence period was characterized by dualism. The developed states attracted more population in urban areas due to industrialization and infrastructural investment. This phenomenon was largely in and around large cities and upcoming industrial centers. Hence, the backward states too experienced rapid urban growth, due to higher urbanization in their backward districts and small and medium towns. All these show the acceleration trend of urbanization in India.

3.4 Urbanization in Kerala

As per the 2011 Census report, the population of Kerala is 3,33,87,677 of which 1,74,55,506 belong to rural areas and 1,59,32,171 people belong to urban areas. In other words the rural population constitutes 52.26 percent and urban 47.74 percent of the total population. It is interesting to note that Kerala is considered to be a model for other states in development aspects. Kerala has the lowest population growth rate compared to other states; its share in the total population of India is 2.76 percent as per the census report of 2011. The density of population of Kerala as a whole was 859 persons per km square. But the urban population of Kerala is higher than the national average of 31.16 percent.

Urbanization process in Kerala is mainly due to increase in urban population growth, which is positively linked with the development of service sector. Sector wise annual growth of GSDP (at 2004-05) for the subsequent periods from 2008 to 2011 is shown in table 3.11.

The table reveals the fact that among the three sectors tertiary sector shows significant contributions to GSDP of 11.57 percent in 2010-2011. The contribution of primary sector is marginal, which is only 0.64 percent of GSDP during the same year. Hence the growth of service sector is positively associated with urbanization in Kerala.

Table 3.11

Sector wise Annual Growth of GSDP (at 2004-05)

Period	Primary (%)	Secondary (%)	Tertiary (%)
2008-09	2.18	0.30	8.07
2009-10	0.01	7.51	11.17
2010-11	0.64	6.12	11.57

Source: Government of Kerala (2011), Economic Review, State Planning Commission.

The development indicators of Kerala are considered as a model to other states in India. As per the 2011 census report, the literacy rate of Kerala for male is 96.02 and that for female is 91.98 which are higher than the national level of 82.14 for males and 65.46 for females. Similarly, birth rate is 28.8 in India, and 14.6 in Kerala, which shows lower population growth. Infant mortality rate and life expectancy in Kerala are 12 and 74 respectively. In India they are 50 and 63. These indicators show the development of social indicators in Kerala which is shown in table 3.12.

Table 3.12

Trends in Development Indicators, 2011

Indicators	India	Kerala
Literacy		
Males	82.14	96.02
Females	65.46	91.98
Birth rate (1000)	28.8*	14.6*
Infant Mortality rate(1000)	50*	12*
Life Expectancy (year)	63*	74*

Source: Government of Kerala (2011), Economic Review, State Planning Commission. **Note: *** denotes 2008.

The growth of urbanization in Kerala marked significant since 1980. More than one fourth of the population in Kerala live in urban area, and occupies third among the states in India having the highest share of urban population. The population and its growth from 1901 to 2011 along with urban and rural classification are given in the table 3.13.

Table 3.13

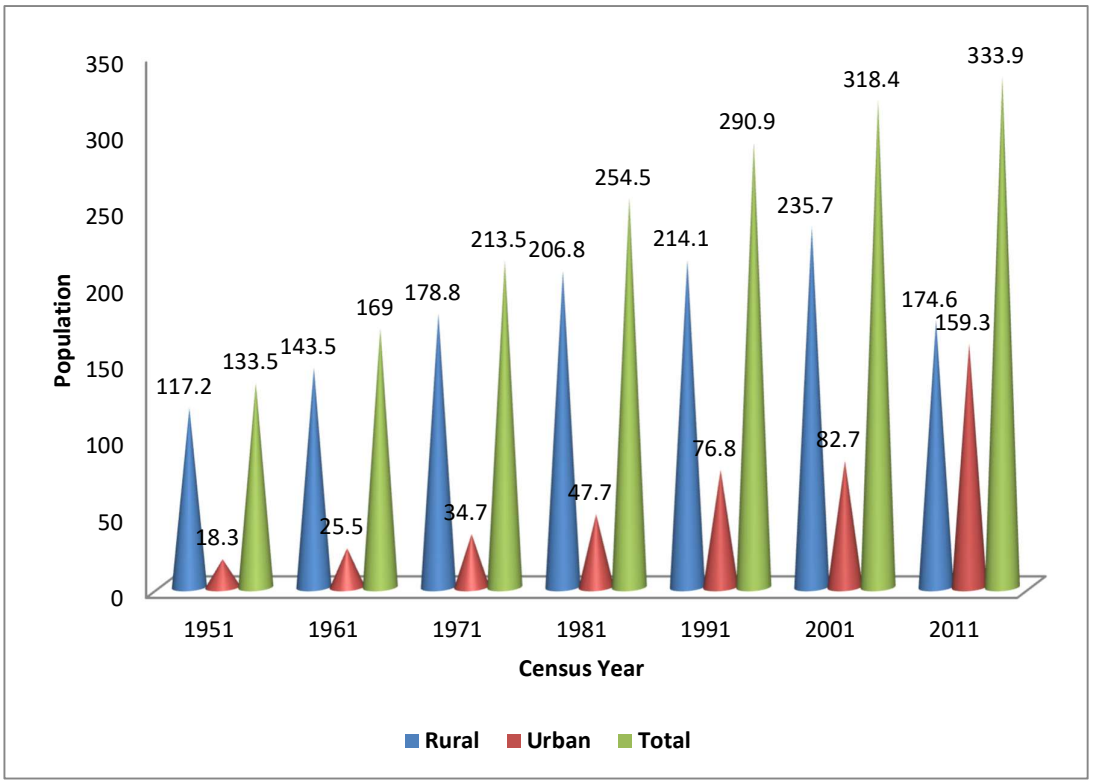
Population and its Growth from 1901-2011 in Kerala

Year	Population in Lakhs				Decadal Growth	
	Rural	Urban	Total	Decadal growth rate	Rural	Urban
1901	59.4	4.5	63.9	-	-	-
1911	66.2	5.3	71.5	11.8	11.5	17.8
1921	71.2	6.8	78.0	9.09	7.6	28.3
1931	85.9	9.2	95.1	21.92	20.6	35.3
1941	98.3	12.0	110.3	15.98	14.4	30.4
1951	117.2	18.3	133.5	22.85	19.2	52.5
1961	143.5	25.5	169.0	24.72	22.4	39.3
1971	178.8	34.7	213.5	26.33	24.6	36.1
1981	206.8	47.7	254.5	19.20	15.7	37.5
1991	214.1	76.8	290.9	14.30	3.5	61.0
2001	235.7	82.7	318.4	9.45	10.7	7.64
2011	174.6	159.3	333.9	4.86	-25.86	92.72

Source: Census of India, 2011 Office of the Registrar General & Census Commissioner, India.

Figure 3.6

Population and its Growth from 1951-2011 in Kerala



The table and the figure above exhibited the population growth of Kerala from 1901 to 2011. During 1911 total population of the state was 71.5 lakhs and it increased to 333.9 lakhs in 2011. The decadal growth rate of population marked an increasing trend since 1921, with a growth rate of 9.09, and increased till 1971. Since 1981, there is a declining trend of decadal growth rate of population and it reached to 4.86 percent in 2011. Similarly, the rural urban share in population is 174.6 lakhs and 159.3 lakhs respectively in 2011. The decadal growth of rural urban population shows some interesting facts that, the growth of rural share shows a declining trend since 1981and it reached to -25.96 percent in 2011 and this influenced the growth rate of urban population to an increasing trend for all the census years. It reached to 92.72 percent in 2011.

The table 3.14 reveals the fact that there is significant increase in the growth of urban population in Kerala. Urbanization trends in Kerala show that, during all the census years from 1951 to 2011, there is considerable increase in total number of urban towns from 94(25) to 520(59). Similarly, total urban population is increased from 0.18 crores in 1951 to 1.59 crores in 2011. Hence, the percentage of urban population increased considerably and reached to 47.74 percent in 2011.

Table 3.14

Trends in Urbanization in Kerala 1951-2011

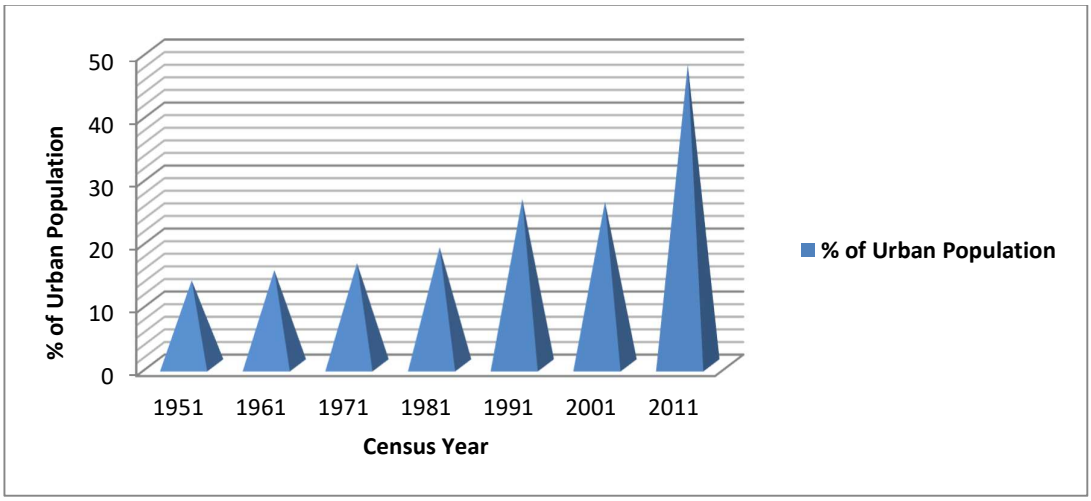
Census Year	Total No. of Urban Town	Total population in crores	Total Urban Population in crores	% of Urban Population
1951	94(25)	1.35	0.18	13.48
1961	92(30)	1.69	0.25	15.11
1971	88(32)	2.13	0.35	16.24
1981	106(48)	2.55	0.48	18.74
1991	197(65)	2.91	0.77	26.39
2001	159(60)	3.18	0.83	25.96
2011	520(59)	3.33	1.59	47.74

Source: Census of India various years, Office of the Registrar General & Census Commissioner India.

Note: Figures in bracket represent the number of statutory towns.

Figure 3.7

Trends in Urbanization in Kerala 1951-2011



Classification of towns in Kerala and India according to their status is depicted in table 3.15. It helps to get a clear picture of the trend in urbanization in Kerala. Total number of towns of Kerala increased from 197 to 520 in between 1991 to 2011. The number of census towns increased from 132 in 1991 to 461 in 2011. This shift was due to the inclusion of villages as towns but they are outside of the statutory jurisdiction of the concerned towns. At the same time during this period statutory towns witnessed a declining trend, as it declined from 65 in 1991 to 59 in 2011. Similarly, the rate of growth of total towns in Kerala from 2001 to 2011 is 227.04 percent than growth of towns in India (53.75).

Table 3.15 Classification and Growth of Towns in Kerala and India According to their Status

Census Year	Kerala				India			
	Statutory	Census	Total	Growth of Total Towns in %	Statutory	Census	Total	Growth of Total Towns in %
1991	65	132	197	-	2987	1702	4689	-
2001	59	99	158	-19.29	3799	1362	5161	10.07
2011	59	461	520	227.04	4041	3894	7935	53.75

Source: Census of India various years, Office of the Registrar General & Census Commissioner India.

3.4. (i) District Wise Pattern of Urbanization in Kerala

Kerala is known as a unique state among the other Indian states as it has shown many developmental aspects which are different from that of other states. Almost all districts of the state reveal significant growth in urbanization and related growth of cities. As per the census of 2011, in the district wise urban population in Kerala, Ernakulam district has the highest urban population with 22.32 lakhs population, followed by Thrissur (20.90 lakhs), Kozhikode (20.75 lakhs) and Kannur (16.43 lakhs). Similarly, the percentage of urbanization is lowest in Wayanad with 3.81 percent and it is highest in Ernakulam with 68.09 percent followed by Thrissur (67.18%). Wayanad and Idukki districts record relatively small urban population compared to other districts. This is shown in table 3.16.

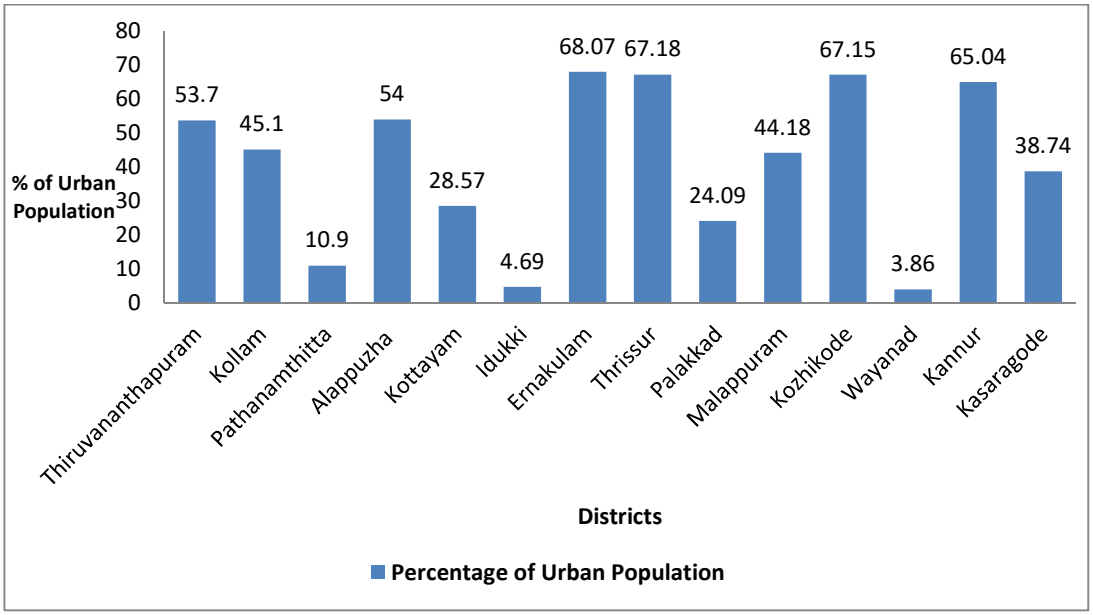
Table 3.16

Trend and Pattern of Urbanization across Districts in Kerala (2011)

Districts	Urban Population (in lakhs)	Percentage of Urban Population
Thiruvananthapuram	17.79	53.7
Kollam	11.86	45.1
Pathanamthitta	1.31	10.9
Alappuzha	11.47	54.0
Kottayam	5.65	28.57
Idukki	0.52	4.69
Ernakulam	22.32	68.07
Thrissur	20.90	67.18
Palakkad	6.77	24.09
Malappuram	18.16	44.18
Kozhikode	20.75	67.15
Wayanad	0.31	3.86
Kannur	16.43	65.04
Kasaragode	5.05	38.74

Source: Census of India various years, Office of the Registrar General & Census Commissioner India.

Figure3.8 Trends and Pattern of Urbanization across Districts in Kerala (2011)



Ranking of districts in Kerala on the basis of percentage of urban population in census years of 2001 and 2011 is expressed in table 3.17.

Table 3.17 Ranking of Districts by Percentage of Urban Population in Kerala 2001-2011

Districts	Degrees of Population		Ranks	
	2001	2011	2001	2011
Thiruvananthapuram	33.78	53.7	4	6
Kollam	18.02	45.1	8	7
Pathanamthitta	10.03	10.09	11	12
Alappuzha	29.36	54.0	5	5
Kottayam	15.35	25.57	9	10
Idukki	5.10	4.69	13	13
Ernakulam	47.65	68.07	1	1
Thrissur	28.21	67.18	6	2
Palakkad	13.68	24.09	10	11
Malappuram	9.82	44.18	12	8
Kozhikode	38.25	67.15	3	3
Wayanad	3.79	3.86	14	14
Kannur	50.46	65.04	2	4
Kasaragode	19.41	38.07	7	9

Source: Census of India 2001& 2011, Office of the Registrar General & Census Commissioner, India.

The table shows that Ernakulam is the most urbanized district in Kerala followed by Thrissur, Kozhikode and Kannur. In 2011, the districts Ernakulam, Thrissur and Kozhikode marked higher degree of urban population. Districts like Ernakulam, Thrissur, Kozhikode and Kannur occupies higher ranks in two census years. A tremendous change is shown in the case of Thrissur district as it came to the second position in 2011 compared to the sixth position in 2001. Wayanad has the lowest degree of urbanization in two periods with fourteenth rank among the districts.

The number of statutory and census towns in Kerala with district wise classification are given in table 3.18. The number of statutory towns shows a declining trend from 2001 to 2011. Hence, the number of census towns in almost all districts marked significant growth in both 2001 and 2011 census years.

Table 3.18 District Wise Classification of Towns in Kerala

State/Districts	2001			2011		
	Statutory towns	Census towns	Total	Statutory towns	Census towns	Total
Thiruvananthapuram	5	-	5	5	26	31
Kollam	3	-	3	3	24	27
Pathanamthitta	3	-	3	3	1	4
Alappuzha	5	6	11	5	33	38
Kottayam	4	2	6	4	13	17
Idukki	1	-	1	1	-	1
Ernakulam	9	16	25	9	47	56
Thrissur	7	21	28	7	128	135
Palakkad	4	1	5	4	17	27
Malappuram	5	-	5	5	39	44
Kozhikode	3	10	13	3	48	52
Wayanad	1	-	1	1	-	1
Kannur	7	38	45	7	60	67
Kasaragode	2	5	7	2	25	27
Kerala	**59**	**99**	**158**	**59**	**461**	**520**

Source: Census of India 2001& 2011, Office of the Registrar General & Census Commissioner, India.

The table 3.18 also highlights that Idukki and Wayanad districts lag behind in case of number of salutatory as well as census towns. Thrissur district has shown tremendous growth in census towns. In Thrissur there are 128 census towns in 2011 than 21 of 2001. Similarly districts like Ernakulam, Kannur and Kozhikode witnessed sharp increase in the number of urban towns during the period between 2001 and 2011.

Thus, the above analysis reveals the fact that, there is rapid urbanization in the world, in the country, in the state and in the district. The urbanization process has become concentrated in developing regions of the world and in our country it is in larger cities and towns. In India, the process of urbanization is mounting very fast in million plus cities. This may be due to the rural – urban migration which results in the expansion of urban cities. As far as Kerala is concerned, about 48% of the total population is categorized as urban, where there is tremendous increase in statutory as well as census towns in the state. Hence, spatial and demographic urban growth is characterized by the deterioration of physical, economic and social living conditions for a large and increasing part of urban population. Urbanization and its allied activities have severe impact on the environmental aspects of the country.

3.5 Impact of Urbanization on the Environment

The process of urbanization has made a profound impact on the environment of the country in the form of deterioration in the quality of available environmental goods. It has been accepted by the United Nations that, it is quite impossible for developing countries to provide in advance, the urban planning and design because it is not possible to project the urban growth accurately. Through the rapid urbanization is taking place, but the town planning and socio infrastructural and institutional facilities are far behind and inefficient to meet the need of growing urban population, there has been acute shortage of housing in urban areas, which results in fast growing slums in all urban centers throughout the nation.

3.5.(i) Growth of Slum Settlements

One of the major impacts of growing urbanization is increasing slums and slum population. The Govt. of India slum areas (improvement and clearance) Act of 1954 defines a slum “as any predominantly residential areas, in which light or sanitary facilities or any combination of these factors are detrimental to the safety, health or

morals". The table 3.19 reflects the growth of urbanization and growth of slums in India. During 1981 total urban population in the country was 15.95 crores and identified slum population was 2.79 crores. This showed an increasing trend with growing urban population during 1991, 2001 and 2011 census years. During 2011, total slum population in India is marked 6.56 crores.

Table 3.19

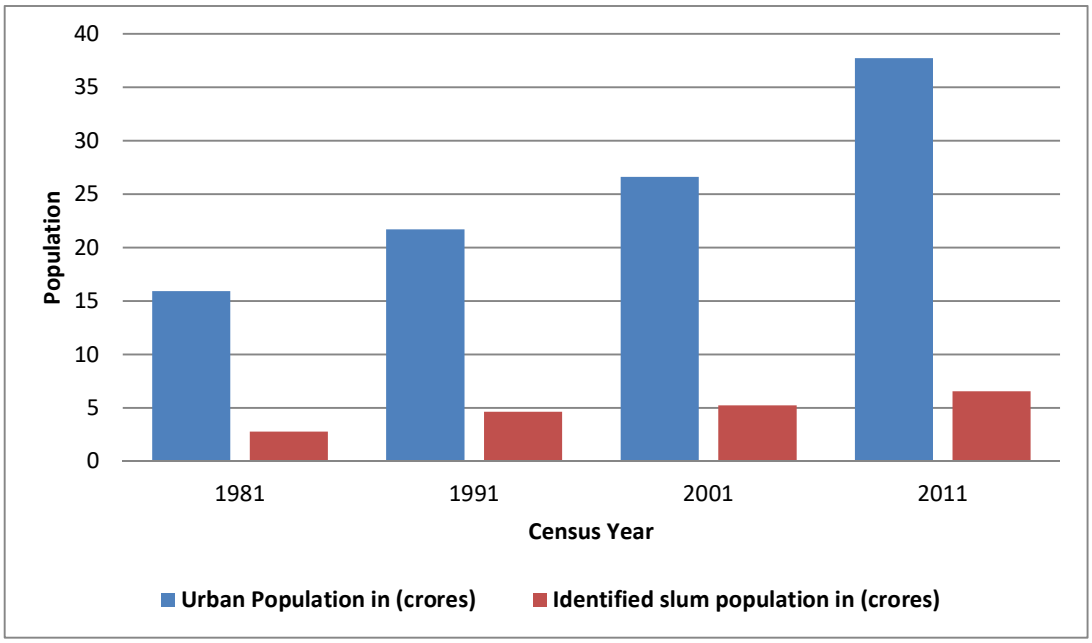
Urbanization and Growth of Slums in India

Year	Urban Population in (crores)	Identified slum population in (crores)
1981	15.95	2.79
1991	21.72	4.62
2001	26.61	5.24
2011	37.71	6.56

Source: Census of India 2011, Office of the Registrar General & Census Commissioner, India.

Figure 3.9

Urbanization and Growth of Slums in India



Kerala is believed as a rural –urban continuum and there are arguments suggesting that there are differences between rural and urban Kerala. Urbanization of Kerala is found to be a little different from other parts of the country. In Kerala, it is not limited

to the designated cities and towns, but except a few panchayaths in the hilly area and some isolated areas the entire state exhibits the picture of urban rural continuum. A large portion of Kerala can be termed as urbanized. The increased density of urban population is mainly due to the overcrowding, migration and the extensive growth of population in urban area.

In India, most of the large slums are located in metropolitan cities. Hence, a fewer amount of slums can be found in Kerala too. A comparison of number of statutory town and slum reported towns with number of slum population in India as well as in Kerala is depicted in table 3.20. In 2011, total number of statutory towns in India was 4,041 and in Kerala it was 59. Slum reported towns were 2,613 and identified slum population were, 2,28,28,135 in India. But in Kerala there were only 19 towns categorized as slum reported towns and identified slum population was 6,998.

Table 3.20

Number of Statutory and Slum Reported Towns in India & Kerala (2011)

Sl. No	Towns/Slum Population	India	Kerala
1	Statutory towns	4,041	59
2	Slum reported towns	2,613	19
3	Total population	6,54,94,604	2,02,048
4	Identified slum population	2,28,28,135	6,998

Source: Primary Census Abstract for Slum 2011, Office of the Registrar General & Census Commissioner, India.

A town- wise analysis of slums in Kerala in 1985 and 1996 is given in table 3.21. The table shows that during 1985, total number of slum in Kerala was 705 and it mounted up to 1169 in 1996. Highest number of slums is reported in Ernakulam with 148 slums in 1985 and it increased to 339 during 1996. Palakkad, Thiruvananthapuram, Alappuzha, Kozhikode and Malappuram districts marked higher number of slums in 1996, whereas Kasargode and Idukki districts had fewer slums in Kerala. Hence, the table shows the existence of slums in Kerala with increasing trend of urbanization.

Table 3.21

Slums in Kerala (1985, 1996)

Sl.No	Towns Reporting Slums	No. of Slums	
		1985	1996
1	Kannur	15	24
2	Kozhikode	79	89
3	Malappuram	57	83
4	Palakkad	34	124
5	Trichur	57	57
6	Ernakulam	148	339
7	Idukki	25	17
8	Kottayam	62	66
9	Alappuzha	97	92
10	Kollam	36	71
11	Thiruvananthapuram	95	122
12	Kasargode	-	6
13	Wayanad	-	28
14	Pathanamthitta	-	51
15	**Kerala**	**705**	**1169**

Source: Statistics Division, Town planning Department, Kerala**.**

Table 3.22 shows the census report of 2011, which emphasizes slum populations in towns of Kerala. In 2011, total number of slum households in 19 towns is 45417 with total slum population of 202048. There are 97429 males and 104619 females in total slum population. There is a huge amount of slum population in Thrissur and Kozhikode Municipal Corporations with 79801 and 50343 slum populations respectively. In Thrissur district, Kunnamkulam and Chavakkad Municipalities also recorded the presence of slum population. This data throws light on the impact of unplanned urbanization pushed by the unabated migration which created an imbalance situation in environment in the cities.

Table 3.22

Slum Population in Kerala – 2011

Name of Towns Reporting Slums	Total Number of Slum Households	Total Slum Population	Male Population	Female Population
Kerala	**45417**	**202048**	**97429**	**104619**
Kasargode (M)	1101	6321	3048	3273
Kannur (M)	278	1501	718	783
Vadakara (M)	472	3105	1455	1650
Kozhikode (M. Corp + OG)	9039	50343	24075	26268
Palakkad (M)	3404	15238	7419	7819
Kunnamkulam (M)	362	1381	653	728
Chavakkad (M)	175	900	390	510
Thrissur (M. Corp)	19629	79801	38545	41256
Kochi (M. Corp + OG) (part)	1594	5184	2648	2536
Thrippunithura (M)	738	2936	1462	1474
Kayamkulam (M)	1974	8410	4004	4406
Chengannur (M)	222	931	426	505
Mavelikkara (M)	184	763	384	379
Kollam (M.Cop+OG)(part)	2761	11659	5688	5971
Paravoor (M)	230	981	461	520
Attingal (M)	579	2306	1082	1224
Nedumangad (M)	962	3593	1713	1880
Thiruvananthapuram(M.Corp+ OG) (Part)	834	3320	1634	1686
Neyyatinkara (M)	879	3375	1624	1751

Source: Census of India, 2011 Office of the Registrar & Census Commissioner, India.

3.5.(ii) Water Pollution

Water is a free gift of nature and is one of the most important natural resources essential for the survival of living organisms. Water as a commodity generates concern for being an exhaustible resource and also because of the environmental issues related to its degradation. Pollution of water may take place due to natural causes such as organic wastes of plants and animals, minerals leaching through soils, thermal pollution etc. It may also be due to the discharge of domestic and industrial waste waters.

The major driving forces of water pollution are urbanization and industrialization. In India water pollution is a serious problem as almost 70 percent of its surface water resources and a growing percentage of its ground water reserves are contaminated by biological, toxic, organic, and inorganic pollutants. This degraded water quality can contribute to water scarcity as it limits its availability for both human use and for the ecosystem.

The level of water pollution in the country can be examined by the status of water quality around India. The water quality monitoring results carried out by Central Pollution Control Board (CPCB) particularly with respect to the indicator of oxygen consuming substances Biochemical Oxygen Demand (BOD) and the indicator of pathogenic bacteria (total coli form and fecal coli form) show that there is gradual degradation in water quality (CPCB, 2009). The study revealed the fact that almost all sampling stations (in 19 states) reflect unacceptable levels of BOD. Thus the water quality monitoring results obtained by CPCB during 1995 to 2009 indicate that organic and bacterial contamination was critical in the water bodies. The main cause for such contamination is discharge of domestic and industrial wastewater in water bodies mostly in an untreated form from urban centers.

In Kerala, water availability and water contamination aspects are a little different from that of all India level. Kerala has been considered as a model to show, how it is possible to achieve both growth and improved income distribution through human development.

The source wise availability of drinking water in Kerala is given in table 3.23. In Kerala 78 percentage of the people availed drinking water from their own premises, 14 percent of the people depending upon near the premises and 8 percent away from the premises. The table and graph also reveal that almost all the districts show similar trend where there is easy availability of drinking water within the premises. The all India average is 47 percent, 36 percent and 18 percent in drinking water availability within the premise, near the premise and away from the premise respectively. While considering the status of the districts Kollam, Thiruvananthapuram, Thrissur, Malappuram, Kannur, Ernakulam and Pathanamthitta exhibited higher percentage of water availability within the premises. In this case the lower percentage is represented by Idukki (41%). The district also represented higher percentage in

availability of water away from the premise (27%) which is higher than the all India rate.

Table 3.23

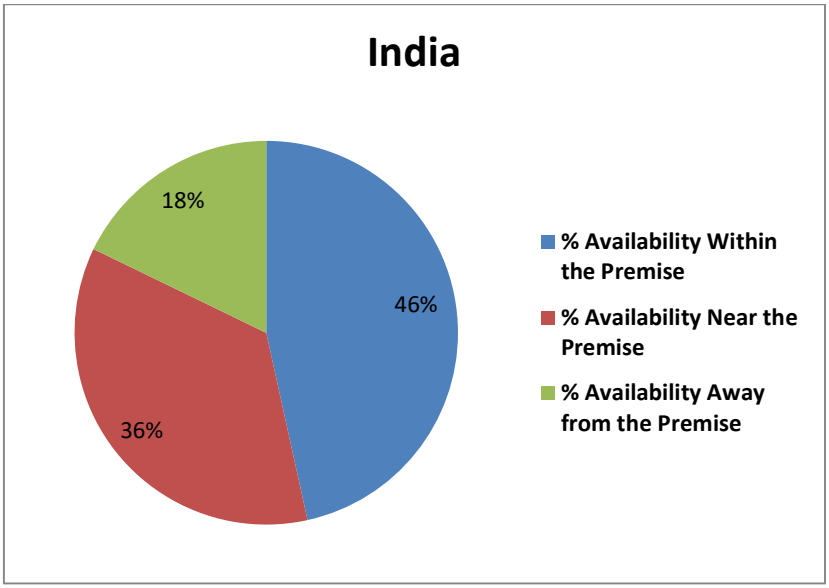
Source Wise Drinking Water Availability in Kerala – 2011

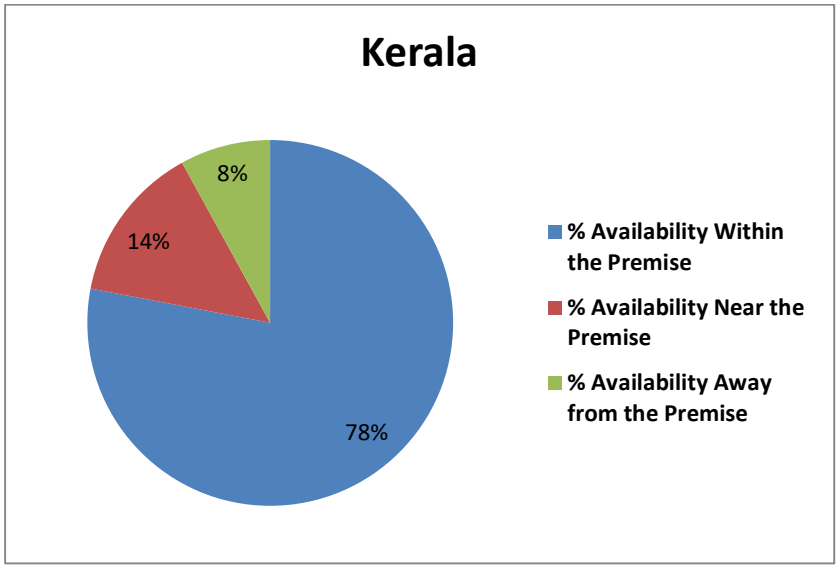
Sl. No	Districts	% Availability Within the Premise	% Availability Near the Premise	% Availability Away from the Premise
	India	**46**	**36**	**18**
	All Kerala	**78**	**14**	**8**
1	Thiruvananthapuram	84	10	6
2	Kollam	86	10	5
3	Pathanamthitta	80	12	9
4	Alappuzha	73	16	11
5	Kottayam	73	15	12
6	Idukki	41	31	27
7	Ernakulam	80	15	5
8	Thrissur	84	12	5
9	Palakkad	72	20	9
10	Malappuram	81	12	7
11	Kozhikode	79	13	8
12	Wayanad	60	24	16
13	Kannur	81	12	7
14	Kasaragode	73	15	12

Source: Housing Census, Census of India, 2011, Office of the Registrar & Census Commissioner, India.

Figure 3.10

Source Wise Drinking Water Availability in Kerala – 2011





In Kerala, the level of contaminated water is increasing in year by year. In 2012, the study conducted by Ministry of Drinking Water and Sanitation highlighted that about 34% of available water is contaminated water in all over Kerala. It increased to 40% within one year period. This shows the serious issue of water pollution. District wise analysis shows that the highest contamination is in Kozhikode as 55% of tested sources indicated bacterial and chemical contamination and Idukki experiences as low level. Except Palakkad, in all the districts the level of drinking water is worsening.

The highest increase in quality affected district in 2012 is Malappuram, where zero level of contamination was reported and in 2013, the indicated contamination was 15 percent. The comparison of the level of water contamination in two subsequent years shows that in Kollam, Kottayam, Thrissur, Malappuram and Kannur the percentage increase of contamination is higher in 2013. This trend is clearly depicted in table 3.24.

Table 3.24

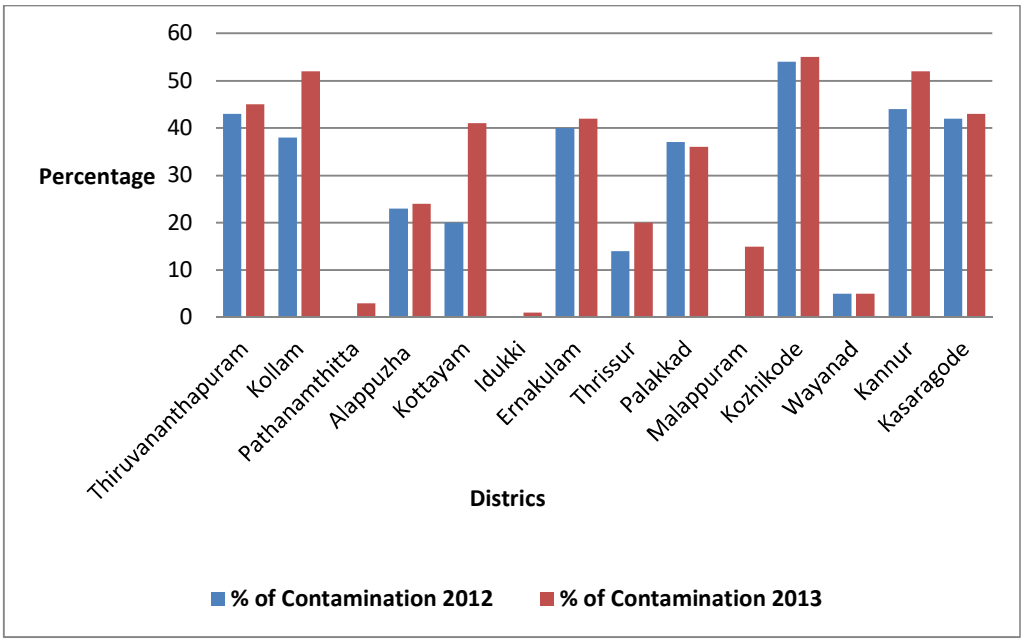
District Wise Indication of Contaminated Water

Sl. No	Districts	% of Contamination 2012	% of Contamination 2013
	Kerala	**34**	**40**
1	Thiruvananthapuram	43	45
2	Kollam	38	52
3	Pathanamthitta	0	3
4	Alappuzha	23	24
5	Kottayam	20	41
6	Idukki	0	1
7	Ernakulam	40	42
8	Thrissur	14	20
9	Palakkad	37	36
10	Malappuram	0	15
11	Kozhikode	54	55
12	Wayanad	5	5
13	Kannur	44	52
14	Kasaragode	42	43

Source: Ministry of Drinking Water and Sanitation, Government of India, 2014 (FTK Test).

Figure 3.11

District Wise Indication of Contaminated Water



Hence, water pollution- one of the major impact of urbanization and industrialization has contributed many issues to living organisms of the environment. Increasing urbanization leads to increased water contamination in all over the world.

3.5.(iii) Solid Wastes and Land Pollution

Rapid urbanization with uncontrolled growth of population and resulting municipal solid waste (MSW) generation is one of the major threats faced by urban areas of India. Unscientific handling of MSW degrades the urban environment as it is mounting up day by day in cities which can causes health hazards. Planning commission report (2014) reveals that 377 million people residing in urban area generate 62 million tons of MSW per annum currently. The report highlighted the fact that by 2031 these urban centers will generate 165 million tonnes of waste annually and by 2050 it could reach 436 million tonnes.

The table 3.25 gives the composition of MSW in overall urban India with special attention to regional variation. In 2012 major contribution of MSW is made by metropolitan cities with 51,402 tonnes per day, followed by east India with 6835 tonnes per day. In MSW major portion is compostable, which accounts for 50 percent,

and moisture is about 45-50 percent. Hence, the major contributor of MSW is the major cities of the country.

Table 3.25 Composition of MSW in India and Regional Variation, 2012

Region /City	MSW(TPD)	Compostable (%)	Recyclables (%)	Inert (%)	Moisture (%)
Metros	51,402	50.89	16.28	32.82	46
Other cities	2,723	51.91	19.23	28.86	49
North India	380	50.41	21.44	28.15	46
East India	6835	52.38	16.78	30.85	49
South India	2343	53.41	17.02	29.51	51
West India	380	50.41	21.44	28.15	46
Overall Urban India	**130000**	**51.3**	**17.48**	**31.21**	**47**

Source: CPCB and Annepu, 2012**.**

Waste generation scenario of Kerala with special attention to per capita waste generation is given in the table 3.26. Total waste generation in 5 Municipal corporations during 2001 is marked as 1096 tons per day. In 53 municipalities, 683 tons of waste is generated and 4126 tonnes of wastes are contributed by 999 panchayats. It is estimated that total waste generation in Kerala is 6506 tonnes / day in 2006, as it was 5878 tonnes / day in 2001.

Table 3.26

Waste Generation Scenario in Kerala – 2006

Region	Population 2001	Per capita waste generation (g)	Total waste generation (TPD)	Projected population 2006	Projected waste generation (g)	Total waste generation 2006 (TPD)
5 Corporations	2456618	435	1096	2543812	465	1183
53 Municipalities	2731093	250	683	2828030	268	758
999 Panchayaths	23574449	175	4126	24411200	187	4565
Total Waste Generation in Kerala			**5878**			**6506**

Source: After KSUDP, 2006.

Table 3.27

Solid Waste Generation in Kerala

Sl. No	Source	% to Total
1	Household Waste	49
2	Hostels, Marriage Halls, Institutions	17
3	Shops and Markets	16
4	Street Sweepings	9
5	Construction	6
6	Slaughter House, Hospitals	3

Source: Malinya Mukta Keralam Action Plan (2007), Government of Kerala**.**

The major sources of solid waste and their contribution in percentage to total solid waste in Kerala are given in table 3.27. Major share of SW is contributed by household sector (49 percent), followed by wastes from hostels, marriage halls, and institutions (17%). Similarly shops & markets, street sweepings, construction and waste from hospitals and slaughter houses had their own contributions to solid waste generation in the state which makes harmful environmental issues.

Table 3.28 Physical Composition of Solid Waste in Kerala

Sl. No	Component	% to Total
1	Biodegradable	71-83
2	Paper	3.5-5
3	Plastic, rubber, glass, metal	5-9
4	Inerts, earth, domestic hazardous	4.9-11.5

Source: Malinya Mukta Keralam Action plan (2007), Government of Kerala.

The major component of solid waste in Kerala is biodegradables (71-83percent). Inert, earth and domestic hazardous wastes marked 4.9-11.5 percent to total waste. Likewise, plastic and other wastes also contribute 5-9 percent to total solid waste which is highlighted in the table 3.28.

In short, with growing urbanization, generation of solid wastes and related environmental problems are mounting up day by day. Hence, proper methods of waste disposal have to be undertaken to ensure that it does not affect the environment

around the living area or cause health hazards to the people living there. At the household – level proper segregation of waste has to be done and it should be ensured that all organic matter is kept aside for compositing which is undoubtedly the best method for the correct disposal of this segment of waste.

3.5. (iv) Growth in Motor Vehicles and Air Pollutions

Air pollution is recognized as a major threat to human health. We can survive without food for several weeks. We can also live without water for a few days. But, we cannot live without breathing air even for a few moments. The air we breathe directly gets into our blood stream. Hence, it is necessary for us to ensure that the air quality is not polluted beyond the threshold limits.

In Indian cities air pollution is one of the serious environmental concerns. Most of the Indian cities are experiencing rapid urbanization and the majority of the country's population is expected to be living in cities within a span of next two decades. It has resulted in a tremendous increase in the number of motor vehicles. Emissions from various sources contribute air pollution in cities. In India the major source of deteriorating the air quality is growth of motor vehicles and related emission.

Table 3.29

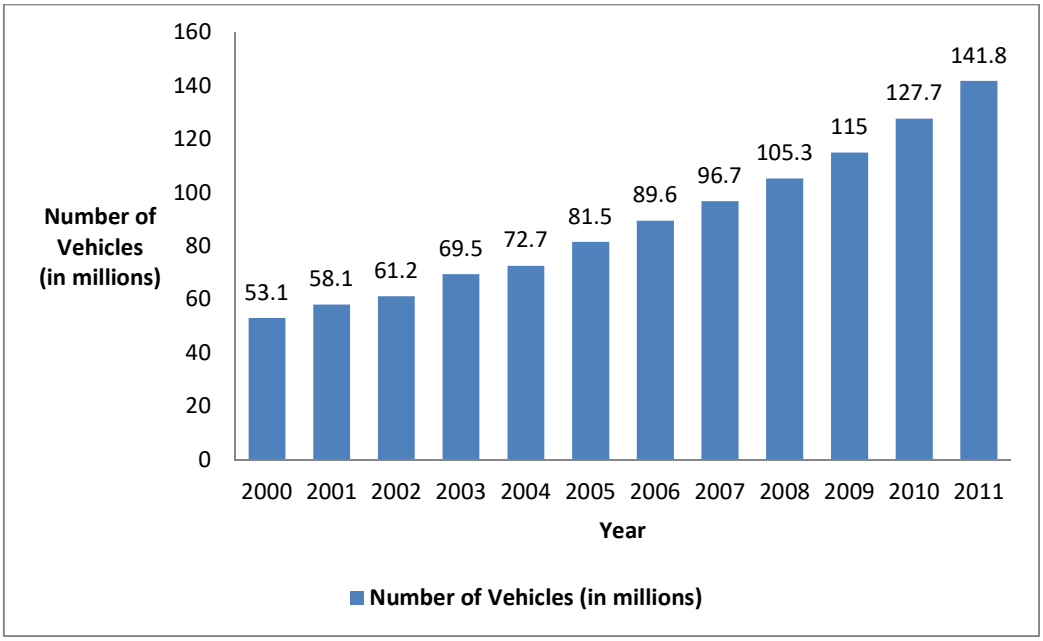
Growth of Motor Vehicles in India, 2000-2011

Year	Number of Vehicles (in millions)	% Increases
2000	53.1	-
2001	58.1	9.4
2002	61.2	5.3
2003	69.5	13.6
2004	72.7	4.6
2005	81.5	12.1
2006	89.6	9.9
2007	96.7	7.9
2008	105.3	8.9
2009	115.0	9.2
2010	127.7	11.0
2011	141.8	11.0

Source: Centre for Pollution Control Board, Ministry of Environment and Forests, Government of India, New Delhi, 2011.

Figure 3.12

Growth of Motor Vehicles in India, 2000-2011



The details of the growth of vehicles in India are furnished in table 3.29. Motor vehicles, which are the main source of vehicular pollution, are constantly increasing since 1990. Since the year 2000, there has been almost three fold increase in the number of motor vehicles in India. On an average 10 percent increase in motor vehicles has been found during a period of 2000-2011, which is a serious reason for air pollution. During 2011, the number of motor vehicles in India has increased to 141.8 million from 53.1 million of the year 2000.

Rapidly increasing industrialization, urbanization, population growth and demand for transportation along with metrological conditions influence air pollution in many India cities. In general, combustion is the chief contributor to outdoor air pollution. In most cities the major source of combustion is fuel use, which tends to increase along with the population size and economic activity.

The air we breathe can become contaminated with pollutants like Sulphur dioxide (SO_2), Oxides of Nitrogen (NO_2), Carbon monoxide (CO), Ozone (O_3) and particulate matter from various natural and manmade sources. In recent years, the focus of ambient air quality largely includes not only criteria air pollutants, but also other toxic air pollutants. The particulate matter (PM) is a complex mixture of suspended solid

and liquid particle in semi equilibrium. The outdoor (ambient) PM size, rages from approximately 0.001 -100 μm in aerodynamic diameter.

The growth of motor vehicles in Kerala from 2008-09 to 2012-13 is given in table 3.30. Total number of motor vehicles increased to 8048673 in 2012-13 from 4853360 in 2008-09. This shows that total number of vehicles in Kerala marked an increase which is almost double. This growth is associated with high vehicular emission which ultimately contributes to air pollution in the state.

Table 3.30

Growth of Motor Vehicles in Kerala 2008-09 to 2012-13

Year	Total Number
2008-2009	4853360
2009-2010	5370955
2010-2011	6045322
2011-2012	6865539
2012-2013	8048673

Source: Transport Commission, Government of Kerala, 2013.

Table 3.31

Air Quality in Important Cities in Kerala 2012-2013(Annual Average mg/m^3)

Sl. No	Districts	SO_2	Air quality	NO_2	Air quality	PM10	Air quality
1	Kochi	3	L	13	L	38	M
2	Kozhikode	2	L	8	L	46	M
3	Thrissur	2	L	14	L	33	M
4	Malappuram	2	L	5	L	30	L
5	Thiruvananthapuram	10	L	23	M	58	M
6	Kollam	4	L	20	L	53	M
SO_2 – Sulphur Dioxide, NO_2 – Nitrogen dioxide, PM10 – Particulate Matter having aerodynamic diameter.							

Source: State Pollution Control Board, Government of Kerala, 2013.

The air quality in major cities of the sate which is shown in table 3.31 gives the fact that in all the cities the air quality is L (low) where there is high presence of sulphur dioxide. Similar is the case in NO_2 level which marked high presence and hence there is low air quality. In case of particulate matter (PM) all other cities; except Malappuram shows medium air quality.

Major air pollutants, their sources, and their impacts of human health are summarized in table 3.32.

Table 3.32

Summary of Health Effects of Basic Air Pollutants

Pollutant	Source	Effect on Human Health
Carbon Monoxide	Incomplete fuel combustion (e.g. two stroke engine)	Heart disorders, head ache, breathing disorders, poor reflexes etc….
Lead (Pb)	Emission from motor vehicles	Kidney damage, reproductive system damage, nervous system damage.
Sulphur Dioxide	Burning of sulfur containing fuel like coal in power plants and oil by vehicles	Heart and lung diseases, respiratory illness like asthma
Nitrogen Oxides	Fuel combustion in motor vehicles, power stations and furnaces.	Lung irritation, head ache, eye burning, chest lightness and discomfort
Ozon	Emission from motor vehicles, photochemical reactions of nitrogen oxides and reactive hydrocarbons.	Respiratory system damage, reduces mental activity, chest discomfort, eye irritation, breathing difficulties, chronic lung diseases etc.
Suspended Particulate Matter	Smoke from domestic, industrial and vehicular sources	Respiratory illness, heart diseases, asthma etc…

Source: Kerala State Pollution Control Board, State Environment Report, 2013, Department of Economics and Statistics.

3.5. (v) Noise Pollution

There are different qualities of sounds. The sounds which are not pleasant to hear are called ‘Noises’ so an excess of noise in the outdoors leads to noise pollution. This can be experienced by too many vehicles honking at the roads, heavy machinery being operated in the open space, trains, clubs, over populated crowds and many more.

The Central Pollution Control Board has prescribed the level of noise which should be accepted in urban areas. In cities the density of population is much higher and this is the main reason behind the growth of transport sector and other activities. Almost all

the cities in the country exhibit the noise levels above the accepted decibel levels. In fact the noise pollution along with the air pollution has made life of the people miserable. The ambient air quality standards, in respect of noise are given in table 3.33.

Table 3.33

Ambient Air Quality Standard in Respect of Noise

Sl. No	Category Area	Limit in dB(A) leq	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Source: CPCB, 2000

Note:

1. Day time is reckoned from 6 AM to 10 PM.
2. Night time is reckoned from 10PM to 6 AM
3. Silence zone is referred as areas within 100 meters around premises such as hospitals, educational institutions and courts. The silence zones are: to be declared by the competent authority.
4. Use of vehicles, loudspeakers and bursting of crackers shall be banned in these zones.

On the basic of this prescribed standard the average noise levels in various metropolitan cities of India is shown in the table 3.34.

Table 3.34

Average Noise Levels in the Metropolitan Cities

Metropolitan cities	Day /Night	Industrial Area	Commercial Area	Residential Area	Silence Area
Mumbai	Day	76	75	70	66
	Night	65	66	62	52
Kolkata	Day	78	82	79	79
	Night	67	75	65	65
Chennai	Day	71	78	66	63
	Night	66	71	48	49
Delhi	Day	71	72	68	63
	Night	67	68	60	45

Source: CPCB, 1997

In all the metro cities the noise pollution was noticed as much above than the prescribed standard. The highest noise pollution level is exhibited by Kolkata in all

the areas like residential, commercial and industrial in both day and night. Mumbai, Delhi and Chennai also experience similar pollution level in noise. The major threat of this trend is that in silence zones too the situation is worst.

In India, noise pollution seemed to be at an increasing trend year by year due to growing vehicular transport, industrial noise, domestic electric equipments, loud speakers used for party etc… The total effects of noise pollution in human health are summarized in table 3.35.

Table 3.35

Effects of Noise Pollution in Human Health

A. Noise Hazards		B. Noise Nuisance	
Stage I	**Stage II**	**Stage III**	**Stage IV**
Threat to survival	Causing injury	Curbing efficient performance	Diluting comfort and enjoyment
(a) Communication interference	(a) Neural – humeral stress response	(a) Mental Stress	(a) invasion of privacy
(b) Permanent hearing loss	(b)Temporary hearing loss	(b) Task interference	(b) Disruption of social interaction
	(c) Permanent hearing loss	(c) Sleep interference	(c) Hearing loss

Source: Kerala State Pollution Control Board, Department of Economics and Statistics, Government of Kerala, 2013.

It is evident from the various data on urbanization that since last fifty years, there is a tremendous growth in the pattern and trends of urbanization in India. Along with the metropolitan cities, all other cities and towns of every state have shown growth in urban population due to rural- urban migration. Kerala too witnessed surprising growth in urbanization as about half of the total state population belongs to the category of urban population. Thrissur city among all cities of India achieved the top most position in growth of urban population, where there is 894.1 percent growth in 2001-2011. With growing urbanization, the environmental issues are growing at a faster rate. Increase in slums, soil pollution, water pollution, air pollution and noise pollution are the main issues coming from this unplanned urban growth. These pollutions have affected the entire people adversely in the form of various health hazards.

CHAPTER – 4

PROFILE OF THE SAMPLE CITY

CHAPTER – 4

PROFILE OF THE SAMPLE CITY

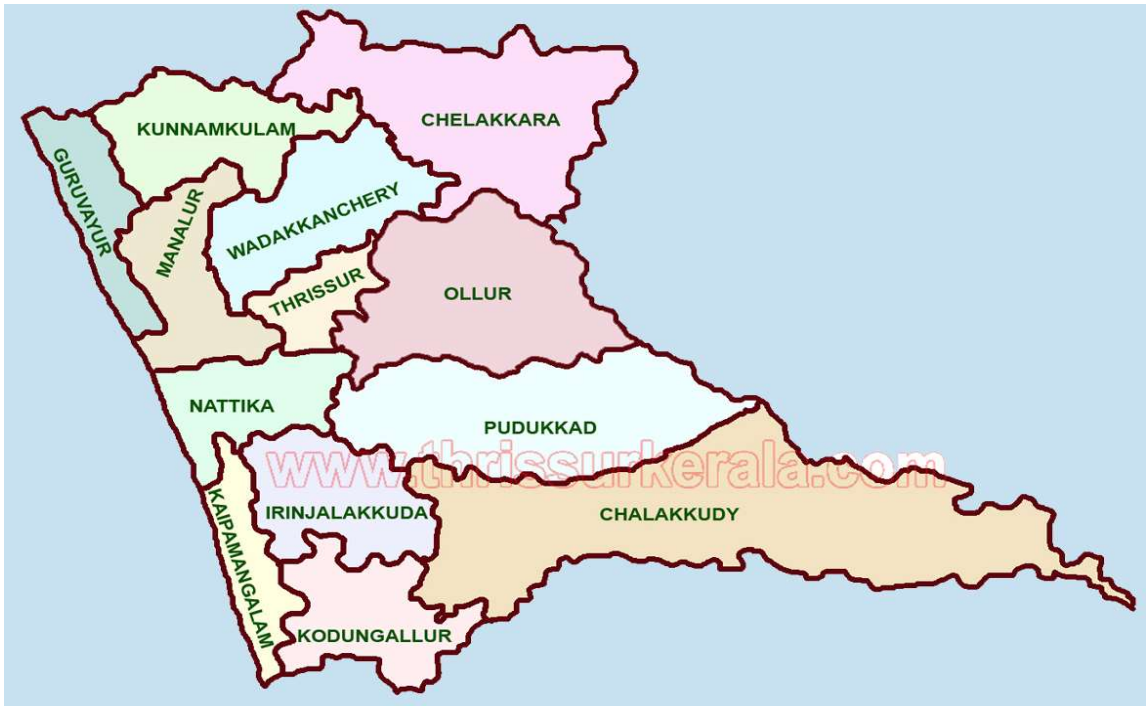
4.1 Thrissur District

Thrissur is one of the important historical cities of Kerala, which is known as the cultural capital of Kerala. Thrissur district came into existence on 1st July 1949. The district has an area of 3027 sq.km and is located in the central part of the state. The district ranks the fifth in area among the districts.

4.1.(i)Topography

The district lies between North latitudes 100 10' 22" and 100 46' 54"; and East longitudes 750 57'20" and 760 54' 23", in the survey of India Toposheet No. 58B and 49N. It is bounded on the north by Malappuram district and south by Ernakulam and Idukki districts, touching Western part of Tamil Nadu on the east and Lakshadweep Sea on the west. Thrissur district accounts for 7.8% of the area of the state (Economic Review, 2016).

Figure 4.1 Map of Thrissur District



4.1. (ii) Rainfall and Climate

The Thrissur district is characterized by wet type of climate and four types of seasons are identified. The hot summer season from March to May the southwest monsoon season from June to September, the northeast monsoon from October to December and a general cool and salubrious climate period during January and February. The average annual rainfall ranges between 2310.1 and 3955.3 mm in the district with mean annual rainfall of 3198.133mm (CGWB, Government of India,2013).

The month of July experience abundant rainfall and is the wettest month. The months of June, August, September and October also receive heavy rainfall. The year to year variability of annual rainfall is around 22%. In general it varies from 18.6 to 24.0%. The annual rainfall received in Thrissur district during the last 6 years is presented in table 4.1.

Table 4.1

Annual Rainfall (mm) Received in Thrissur District

Year	2006	2007	2008	2009	2010	2011
Rainfall (mm)	3576.7	3955.3	2310.1	3090.3	314.4	3142

Source: Central Ground Water Board, Ministry of Water Resources, Kerala State, Government of India, 2013.

The maximum temperature ranges from 29.3 to 36.20 C, whereas the minimum from 22.1 to 24.90 C in the district. The average annual maximum temperature is 32.300 C and minimum temperature 23.30 C. The humidity is higher during monsoon months from the June to October and is around 93% during morning hours and 76% during evening hours (Kerala State Environment Report, 2013).

4.1. (iii) Geomorphology and Soil Types

The three geomorphologic units of the Thrissur district are coastal plain, mid lands and high lands. Similarly, the soils in the district have been classified in the following types, based on the morphological features and physiochemical properties. They are the late rite soil, brown hydro orphic saline soil, coastal alluvium, reverie alluvium and forest loamy soil. These soil types vary according to different locations and climate conditions (Kerala State Environment Report, 2013).

4.1. (iv) Administration

Thrissur district has five taluks viz. Chavakkad, Thalappilli, Thrissur, Kodungallur, and Mukundapuram which comprises 17 blocks spread over a total of 97 panchayaths and 7 municipalities. Chavakkad, Gurvayoor, Kunnamkulam, Chalakkudy, Kodungallur, Irinjalakkuda are the 6 municipalities and Thrissur city is the municipal corporation.

Table 4.2

Distribution of Towns in Thrissur District as on 31-12-2009

Name of District / Taluks	No. of Towns	
	Statutory towns	Census towns
Talappilly Taluk	1	29
Chavakkad Taluk	2	20
Thrissur Taluk	1	45
Kodungallur Taluk	1	12
Mukundapuram Taluk	2	22
Thrissur District	**7**	**128**

Source: Census of India 2011.

The table 4.2 shows the number of statutory and census towns in five taluks of the district. The entire district comprises 7 statutory towns and 128 census towns. The district comprises of a single revenue division – Thrissur consisting of 5 taluks and 98 villages.

Table 4.3

Total Number of Villages and Towns – 2011

Villages/Towns		Kerala	Thrissur
Number of villages	**Total**	**1,018**	**98**
	Inhabited	1,017	98
	Uninhabited	1	-
Number of towns	**Total**	**520**	**135**
	Statutory	59	7
	Census	461	128

Source: Census of India, 2011.

Table 4.3 shows a comparison between Kerala and Thrissur in total number of villages and towns. According to the census report of 2011, in Kerala there are 1,018 villages and Thrissur the number is 98. Similarly the total number of towns in Kerala

is 520 and in Thrissur it is 135. This shows that the number of villages and its proportion is comparatively lower in Thrissur compared to towns.

Table 4.4

Population Statistics of Kerala and Thrissur – 2011

Population	State/District	
	Kerala	**Thrissur**
Total population		
Total	33406061	3121200
Males	16027412	1480763
Females	17378649	1640437
Rural Population		
Total	17471135	1024749
Males	8408054	488303
Females	9063081	536491
Urban Population		
Total	15934926	2096406
Males	7619358	992460
Females	8315568	1103946
% Urban Population	**47.7**	**67.17**

Source: Census of India, 2011.

The table 4.4 shows the distribution of villages & towns in Kerala as well as Thrissur with classification of villages and towns along with population statistics. It gives total population, total male & female population and rural & urban population. The data shows that percentage of urban population in Kerala is 47.7 and in Thrissur district it is 67.7 percent which shows that Thrissur district is far ahead than the state in urbanization.

Table 4.5

Area and Density of Population in Kerala and Thrissur – 2011

State / District	Area (in sq.Km)	Density of population (persons per sq.km)
Kerala	38852	860
Thrissur	3027	1031

Source: Census of India, 2011.

Table 4.6

Sex Ratio of Kerala and Thrissur – 2011

Sex ratio (number of females per 1000 males)	Kerala	Thrissur
Total	1,084	1,108
Rural	1,078	1,099
Urban	1,091	1,112

Source: Census of India.

Table 4.5 shows that the state has an area of 38852 sq. kms, with 860 density of population in 2011. Thrissur district has the area of 3027 sq.kms with 1031 density of population which is much higher than the state density. Similarly, table 4.6 represents that the sex ratio of the district is 1108 in total, 1099 in rural areas and 1112 in urban areas which are higher than the state.

There are 7 cities in the district which comes under the district administration. Those are – Thrissur Municipal Corporation, Kodungallur, Kunnamkulam, Chalakkudy, Chavakkad, Irinjalakuda, and Guruvayoor. The share of population of these cities is given in table 4.7. According to the census report of 2011, the major share of urban population is from Thrissur city (3,15,957) followed by Kodungallur (60,190) and Kunnamkulam (54,071). Thrissur Municipal Corporation occupies the top position in urban population of the district.

Table 4.7

Cities and Urban Population in Thrissur District

Cities	Population	Area (km^2)
Thrissur	3,15,957	101.4
Kodungallur	60,190	26.8
Kunnamkulam	54,071	34.2
Chalakkudy	49,525	25.2
Chavakkad	39,098	7.5
Irinjalakkuda	28,741	11.2
Guruvayoor	20,510	12.4

Source: Census of India 2011, Thrissur District Data**.**

4.2 Thrissur City

Thrissur Municipality came into existence on 1st July 1942 and later in the year 2000 it was upgraded to the level of the municipal corporation, by merging the adjoining Ayyanthole, Ollukkara, Koorkanchery, Ollur and Vilvattom Panchayaths and parts of Nadathara Panachayath with the erstwhile municipal area. Thrissur Municipal Corporation came into being on 2nd October 2000.

The city has been scientifically planned and built around a hillock on which the famous Vadakkunnathan Temple is situated. The city is built around the vast open space called "ThekkinkaduMaidanam" surrounding the centrally located Vadakkumnnathan temple.

Thrissur city is located 75km North of Kochi, 133 km West of Coimbatore and 144 Km South of Kozhikode. The city is well connected by road and rail network due to which it acts as a connecting place to all local bodies in the surrounding areas. The total population of the city accounts for 10.61 percentage of the total population of the district (Thrissur City Development Plan, 2016).

Figure 4.2 Map of Thrissur City

The Thrissur Municipal Corporation (TMC) is the civic body that governs the Thrissur city in Kerala. It is the second largest corporation in Kerala by area and fourth by population. The Kerala Municipality Act 1994 (KM act) governs all functions in TMC. The TMC is responsible for civic infrastructure and administration; the distribution of electricity and water for Thrissur city. The corporation manages a total area of 101.42 sq.km of Thrissur city, which limits through 55 wards. These wards are classified under six zones namely Ayyanthole, Vilvattom, Ollukkara, Ollur, Koorkanchery and the Central Zone or Old Municipal Area (CSP, 2016).

Thrissur has a tropical humid climate. The south west monsoon is from June to September and North east monsoon from October to November. The remaining months are generally dry. The hottest period in the city ranges from March to May. The average annual rain fall of the city is 3000 mm (City Sanitation Plan, 2016).

Table 4.8

Socio- economic Profile of Thrissur City – 2011

Sl. No	Indictors	Total number
1	Total Population	3,15,957
2	Population Density	3,112
3	No. of households	86,604
4	Average household size	4.5
5	Below poverty line population (2009 survey)	21,809
6	Number of notified slums	133
7	% of slum population	10
8	Sex ratio	1076
9	Literacy rate	97.24%
10	Total workers (Socio economic survey, 2010)	1,03,234
11	City sanitation rank (Hand book of urban statistics, 2016)	67 out of 476 class I cities in India

Source: Census 2011, City Sanitation Plan, 2016.

With a total area of 101.42sq.kms, Thrissur MC accounts for 3.3% of the geographical area of the district. The table 4.8 reveals that the population of the city is 3,15,957 which constitute 10% of the district population. The male population is around 48% of the total indicating a higher sex ratio. The population density of Thrissur city is 3112 persons /sq.km as per 2011 census which is much higher than the district density of 1125 persons/sq.km. The literacy rate is 97.24 percent. For men the literacy rate is 98.12 % and for females it is 96.09% as per census report of 2011.

Table 4.9

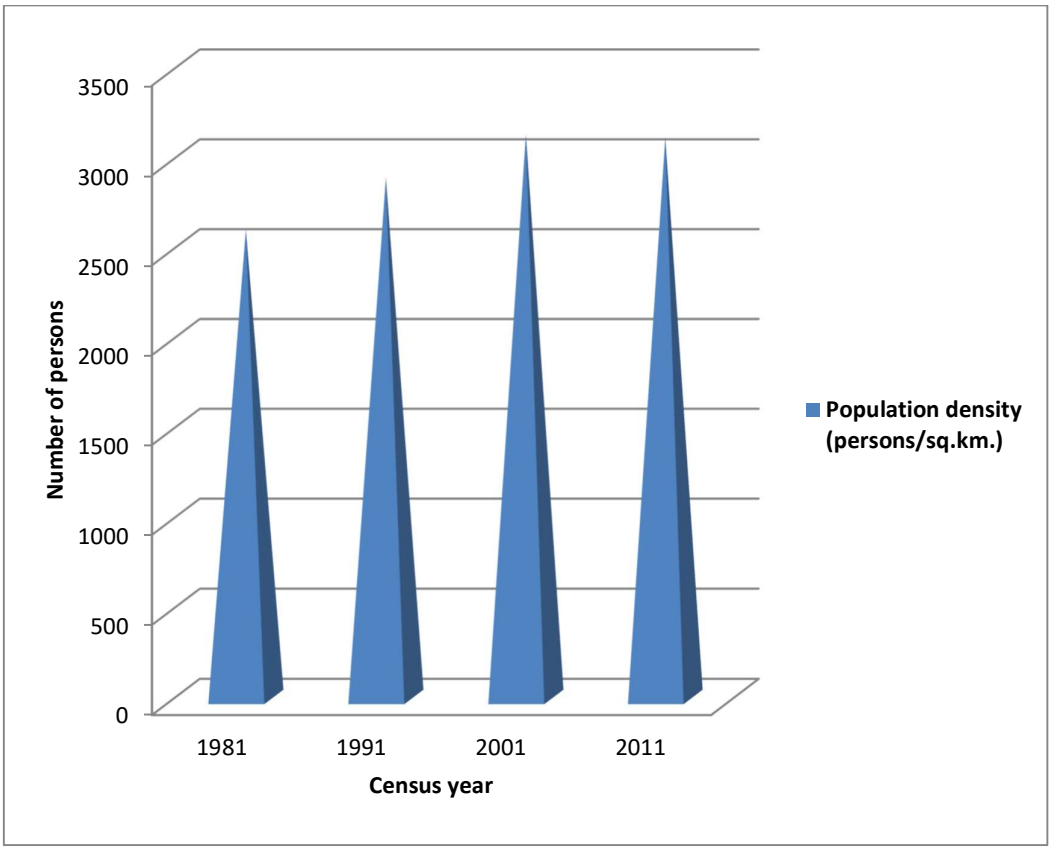
Growth of Population of Thrissur City

Census year	Population	Decadal growth rate (%)	Population density (persons/sq.km.)
1981	263,584	4.71	2599
1991	292,963	11.15	2889
2001	317,526	8.38	3130
2011	315,957	-0.49	3112

Source: Census 2011, City Sanitation Plan, 2016.

Figure 4.3

Growth of Population of Thrissur City



Growth of population and its decadal growth rate along with density is illustrated in table and figure above. From 1981 to 1991 the growth rate of population is high which is marked as 11.15% and it slightly declined to 8.38% in 2001. During 2001-2011, the city exhibited negative growth rate of population (-0.49). Similarly, the density of population in Thrissur city was 2599. It increased to 3112 during 2011.

Thrissur city is one of the major cities of Kerala in educational services. There are a total of 112 educational institutions in the city including pre primary, high school, higher secondary and vocational higher secondary. These institutions are under government sector, government aided sector, unaided sector etc. This data is exhibited in table 4.10.

Table 4.10

Educational Facilities in the City

Educational institutions	Government	Aided	Unaided	Total
Pre Primary	10	41	4	55
High School	4	10	12	26
Higher Secondary Schools	6	8	14	28
Vocational Higher Secondary Schools	3	0	0	3
Total	**23**	**59**	**30**	**112**

Source: City Development Plan 2016, Thrissur Municipal Corporation.

Table 4.11

Health Care Facilities in Thrissur City

Type of Hospital	No. of Hospital / Dispensary	No. of Doctors	No. of Beds
Allopathic	32	743	5268
Ayurvedic	10	31	165
Homeopathic	2	3	25
Others	5	6	0
Total	**49**	**783**	**5458**

Source: City Development Plan 2016, Thrissur Municipal Corporation

The table 4.11 shows the level of health care facilities in the city. There are 32 allopathic hospitals in the city with 743 doctors and 5268 beds which is sufficient for a growing city. Similarly there are ayurvedic, homeopathic and other hospitals within the city limits. The total number of hospitals in the city is 783.

The trade and commercial activities of the city are mostly concentrated in Swaraj round, Kizhakkekotta, West fort, High road, Sakthan Market, Chettiyangadi, North bus stand, and Patturaikkal. Thrissur is also known as the gold capital of India. About 70% of manufacturing of gold happens in this city. It is also an important centre of silk garments. The city holds the record for the highest number of financial institutions as they exceed 1000, both government and private. Three predominant

schedule banks in Kerala- South Indian Bank, Catholic Syrian Bank and Dhanalakshmi Bank have their headquarters at Thrissur. Diamond polishing and automobile tire moldings are the remaining industries that play an important role in Thrissur economy.

Table 4.12

Industries in Thrissur City

Type	Number	Labourers
Large	3	520
Small	21	465
Micro	387	2832

Source: District Industry Centre (CSP, 2016), Thrissur Municipal Corporation.

The type, number and total labourers of various industries in the city are exhibited in table 4.12. Mostly small scale and micro industries function in the city. It includes brick and tile manufacturing companies packing case manufacturing units, gold covered ornament manufacturing unit, textile units, edible oil producing units, tailoring units, printing units, handloom weaving units etc. There are industrial estates at Ollur and Anchery Chira which are close to the city. There are 387 micro industries in the city which accommodate 2832 labourers.

Table 4.13

Zone Wise Water Supply Coverage of Households

Zone	Total No. of Households	Households with Water Tap Connection	Households without Water Tap Connection
Old municipal area	25818	23706	2112
Koorkanchery	9624	5763	3861
Vilvattom	8465	3675	4789
Ollukkara	8059	2649	5410
Ayyanthole	10662	7898	2764
Ollur	15708	3687	12021
Total	**78336**	**47378**	**30957**

Source: CSP, 2016, Kerala Water Authority, Thrissur.

The table 4.13 shows that the existing water supply system caters to 60.48 % of the households in the city. Total number of households in 6 zones of Thrissur city is 78336 and number of households with water tap connection is 47387. The number of households without water connection in the city is 30957. The gap in the water supply is reasonably managed by alternative sources like wells, tube wells, public taps and community oriented projects like 'Swasraya'. The water supply system in the city is under the control of ULB (Thrissur Municipal Corporation) and Kerala Water Authority (KWA). The main water sources are Peechi Dam, and Karuvannur river- a downstream of Chimony Dam.

Similarly the status of water supply service levels of Thrissur city indicates that presently 60.48% is the coverage of water supply connections and the gap of 39.52% is found in this. Likewise the quality of water supplied is 80% and the gap is 20%. Hence there is significant gap between the present status and MOUD Benchmark in case of water supply services of the city (SLIP 2016-17).

Table 4.14 Status of Sewerage Network and Service Levels in Thrissur City

Sl. No	Indicators	Existing service levels	MOUD Benchmarks
1	Coverage of latrines (individual/community)	94.87%	100%
2	Coverage of Sewerage network services	-	100%
3	Efficiency of collection of sewerage	-	100%
4	Efficiency in treatment: Adequacy of Sewerage treatment capacity	-	100%

Source: CSP 2016, Thrissur Municipal Corporation.

The table 4.14 shows the status of existing sewerage network in Thrissur city. There is no centralized sewerage system in the city. Similarly, there is no sewerage treatment plant in the city. City's drainages are designed for storm water only and mixing of sewerage in storm water drains is critical. Kerala Water Authority (KWA) is the sole authority responsible for sewerage in the city. The city generates around 34 MLD of sewerage. The table shows the fact that there are no ongoing projects to meet the existing gap in sewerage system. The sewerage system has to be planned 100% from the grass root level to implement a sustainable system to attain MOUD benchmarks.

Table 4.15

Solid Waste Generation and Collection Report of Thrissur City

Waste Generation (MT)		150
Waste Collected by ULB		35
Waste Generation Units	**Number**	**Quantity of Waste Composed (MT)**
Hotels	403	11.00
Lodges	87	1.00
Convention centers & Marriage Halls	79	3.75
Hospitals	33	1.00
Educational Institutions	92	1.28
Flats	304	6.00
Markets	9	17.42
Waste Disposed System Supplied by ULB	**Number**	**Quantity of Waste Composed (MT)**
Bio gas plant	73	18.25
Pipe compost	140	10.50
Others	27	6.75
Household disposal by citizen	133	33.25
OWC plant	2	8.00
Common Biogas plant	8	2.00
Food waste collection centers	3	0.50
Dry waste collection centers	24	6.95
Total		**127.65**

Source: CSP, 2016, Thrissur Municipal Corporation.

Solid waste generation, collection and disposal of Thrissur city is highlighted in table 4.15. In the city 150 MT solid wastes are generated daily through various units; hence a fewer amount is composed. There are a number of waste disposal systems supplied by ULB; hence they are insufficient for proper waste management. The percentage of solid waste disposal at household level and different methods arranged by ULB comes to around 85%.

Table 4.16

Total Number of Power Connections in Thrissur City.

Units	Number
Household	61,220
Commercial	22,604
Industrial	2,611
Agricultural	3,105
Others	67
Total	**89,607**

Source: City Development Plan 2016, Thrissur Municipal Corporation.

The table 4.16 shows that total number of power connections in Thrissur city is 89607 in which the major unit is households. Industrial and agricultural units in the city, in cast of power connections are marginal compared to commercial units.

Table 4.17

Roads and Street Lightings in the City

Length of the Roads Available	
National highway	13km
State highway	22 km
Local	1785 km
Type of Roads	
Kuchha	84 km
Bitumen	1450 km
Concrete	235 km
Red metalled	26 km
% of roads facing vehicular congestion	46%
Street Light Coverage	
Total No. of streetlights	34507
Street light / Km of road length	22
% of tar roads / concrete roads with street lighting	89%

Source: City Development plan, 2016, Thrissur Municipal Corporation

The table 4.17 shows the length of roads, type of roads, street light coverage etc. of the city. On the basis of the data, it is clear that 46% of roads of the city are facing vehicular congestion. Similarly, 89% of the city roads are having street light coverage. Hence, there is gap to full street light coverage in the city.

The availability of Green Space and Parks is almost sufficient in Thrissur city compared to other urban areas of the state. The existing area of park and open space accounts for 4.70 sq.kms, which come to 4.63% of the total area of the corporation. The ULB has adequate recreational facilities like park & open spaces, stadiums, theatres, zoo, museums, etc. The present status accounts for 14.89 sq.ms/ person, which exceed the bench mark of 10-12 sq.ms/ person at the national level (City Development plan, 2016).

4.3 Status of Pollution Levels in Thrissur City

Pollution is an important concern as it is associated with urbanization. Mainly there are land (soil) pollution, water pollution, air pollution and noise pollution. Thrissur city is one of the major cities of Kerala which exhibits growing trends of urbanization. Hence studies made by several environmental agencies and organizations reveals that Thrissur city is facing several environmental problem than other cities of the state. The quality of air & water is deteriorating the city.

In the Indian context most commonly used air pollution index (API) is a four parameter model. It is based on the values of National Air Quality Standards, 2009. The range of air quality index and its interpretations are given in table 4.18.

Table 4.18

Range of Air Quality Index and its Interpretations

Sl. No	API Value	Inference
1	0-25	Clean air
2	20-50	Light air pollution
3	50-75	Moderate air pollution
4	75-100	Heavy air pollution
5	>100	Severe air pollution

Source: CPCB, 2009

Air quality is measured based on the number of small particles in every cubic meter of air, specifically those smaller than 2.5 micrograms (PM2.5) or 10 micrograms

(PM10). These particles are capable of entering the human blood stream directly through lungs and increase the risk of heart attacks strokes and lung cancer (CPCB, 2009).

Studies made by CPCB and Kerala State Pollution Control Board (KSPCB) during 2008 to 2010 shows that two neighbouring and heavily urbanized cities of Kerala (Thrissur & Kochi) are facing air pollution. The average API values including suspended particulate matter in Thrissur is 72.89 and in Kochi it is 66.87. This exhibits that there is moderate air pollution in two cities.

A comparative study made by World Health Organization (WHO) during 2016 to 2018 period among two major cities of Kerala (Kochi and Thrissur) reveals aspects of environmental pollution. The results of the study are exhibited in the table 4.19.

Table 4.19

Environmental Pollution Aspects in Two Cities

Sl. No	Indicators	Kochi	Thrissur
1	Air Pollution (PM10)	70 **(High)**	73 **(High)**
2	Water Pollution	69.55 **(High)**	75.00 **(High)**
3	Water Quality	30.45 **(Low)**	25.00 **(Low)**
4	Noise and Light Pollution	52.73 **(Moderate)**	59.62 **(Moderate)**

Source: WHO, 2016, and 2018 (City Level Studies of Kochi & Thrissur)

The table shows that two cities of Kerala are facing high level of air pollution and water pollution. The quality of available water in two cities is low which results in severe health issues. Similarly, noise and light pollution is at a moderate level which may aggravate to high level in coming years. The study also shows that, drinking water pollution and inaccessibility of Thrissur is at a moderate level (50.00) which has deep impact as human health. This study also emphasizes that overall pollution index of Thrissur city is 66.55 in 2016 to 2018 period, and the expected scale of pollution in 2019 is 115.92. Hence, the pollution indicators of the city are reflecting the environmental situation along with problems of pollution on living things as a whole.

Thus the chapter exhibits a clear picture regarding the profile of the sample city with emphasis on its geographical, cultural and other aspects which are considered as the prerequisite for better environmental and living conditions. The study also highlights

the infrastructural deficiencies of the city which needed to be solved for sustainable urban development. Based on the available information regarding the infrastructural and other aspects of the district of Thrissur and its urban area the ecological, social and economic conditions for sustainable urban development can be examined.

CHAPTER- 5

SOCIO – ECONOMIC PROFILES AND HOUSING CHARACTERISTICS OF SAMPLE HOUSEHOLDS

CHAPTER- 5

SOCIO – ECONOMIC PROFILES AND HOUSING CHARACTERISTICS OF SAMPLE HOUSEHOLDS

5.1 Introduction

Urbanization process has been associated with other important aspects such as economic, social and environment. Based on the report of UN (2014) urban living is often associated with higher level of literacy and education, better health condition, greater access to social and economic services, and enhanced opportunities for cultural and political participation. But unplanned or inadequately managed urban expansion leads to rapid sprawl, pollution and environmental degradation, together with unsustainable production and consumption patterns. The rapid urban growth, high population density and high consumption rate of residents of cities has led to a wide range of socio-economic and environmental impact on living conditions.

The present chapter is concerned with the socio-cultural profiles of the sample households in the Central Zone (Old Municipal Area), Ayyanthole zone and Koorkancheri zone of Thrissur Municipal Corporation inclusive of their housing characteristics. The study includes the demographic particulars and general characteristics of the sample households and economic and housing conditions which includes basic and common facilities, education and cultural interests. To be more specific, the entire chapter has been divided into several sections, each dealing with one aspect of the particular study area. The household is the sampling unit of the survey and stands for the family. It is the basic social unit. Some social economic conditions are common to a household however some others are different for different households.

5.2 Selection of Sample Respondents

In Thrissur city, almost all zones among the six zones face water contamination, solid waste and air pollution problems every day. Hence the selection of sampling zones

had been significant, as they had to include both slum and non – slum areas. The details of the selection of zones are provided in table 5.1.

Table 5.1

Name and Frequency of Sample Zones

Zones	Frequency	Percent
The Central zone	83	36.9
Ayyanthole zone	72	32.0
Koorkancheri zone	70	31.1
Total	**225**	**100**

Source: Survey Data

There are 78,336 households in Thrissur city. The Central zone includes 25,818 households, Ayyanthole 10,662 households and Koorkancheri 9,624 households. Among the total of 55 divisions of the Municipal Corporation 15 are under the Central zone, 10 are under Ayyanthole and 8 are under Koorkancheri zones. The study estimates that among the 225 sample respondents 36.9 percent of respondents (83) have been selected from the Central zone according to the proportion of size of the total population. Similarly, 32.0 percent respondents (72) have been selected from Ayyanthole zone and the remaining 31.1 percent respondents (70) have been from Koorkancheri zone.

5.3 Sex Wise Classification of Respondents

Among the socio economic characters, the sex wise distribution of respondents have significantly influenced the living conditions in the sample areas. The sex wise distribution of heads of the households is presented in table 5.2. The heads of the family occupies the most important position in maintaining a proper living condition of the members of the family. Hence, both male and female heads are represented in the study area. Among the 225 respondents 186 or 82.7 percent are male and 39 or 17.3 percent are female heads. This shows that male heads are dominating in the sampling area.

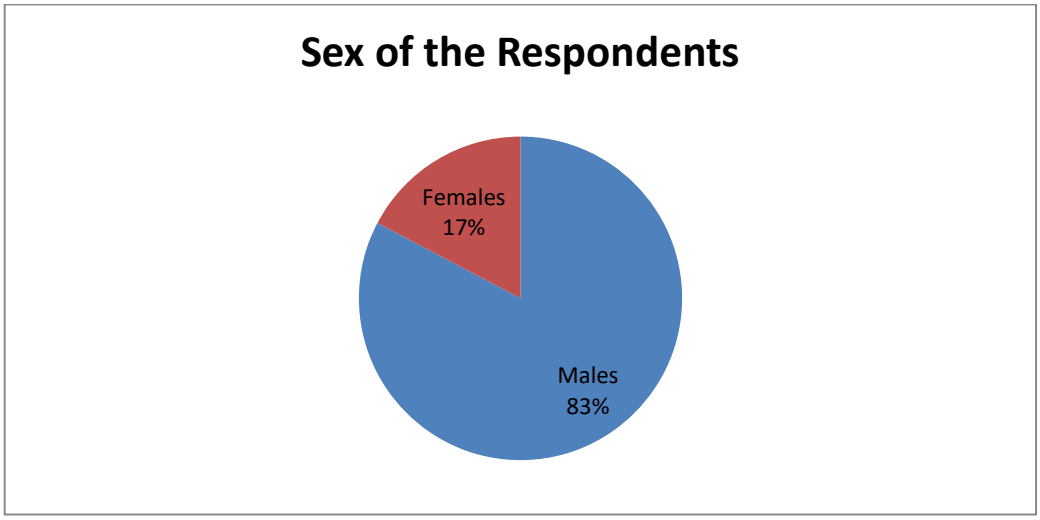
Table 5.2 Sex Wise Distribution of the Respondents `

Zones	Sex of the Respondent		**Total**
	Male	Female	
The Central zone	71 (85.5) [38.1]	12 (14.5) [30.8]	**83** (100.0) [36.9]
Ayyanthole zone	62 (86.1) [33.3]	10 (13.9) [25.6]	**72** (100.0) [32.0]
Koorkancheri zone	53 (75.7) [28.6]	17 (24.3) [43.6]	**70** (100.0) [31.1]
Total	**186** (82.7) [100.0]	**39** (17.3) [100.0]	**225** (100.0) [100.0]

Source: Survey Data

Note: Figure in the parenthesis indicates row percentage. Figure in square brackets indicates column percentage.

Figure 5.1 Sex Wise Distribution of the Respondents



From the table it is clear that, out of 186 male respondents 38.1 percent are from the Central zone, 33.3 percent are from Ayyanthole and 28.6 percent are from Koorkancheri zone. Similarly out of 39 female respondents 43.6 percent are from Koorkancheri zone, 30.8 percent are from the Central zone and remaining 25.6 are from Ayyanthole zone. In the Central zone, 85.5 percent are male respondents and remaining 14.5 percent are female respondents. Similarly in Ayyanthole zone, 86.1 percent respondents are male and 13.9 are females. In Koorkancheri zone, 75.7

respondents are males and 24.3 percent are females. This shows the sex wise distribution of respondents which ultimately influence the socio- economic characteristics of family.

5.4 Age Wise Classification of the Respondents

Many studies have emphasized the close relationship between the age and location of sample respondents because the average life expectancy is greater in urban areas than the rural areas. The details of age wise distribution of respondents is given in table 5.3 with zone wise classification.

Table 5.3 Age Distribution of the Respondents

Age	Zones			**Total**
	Central zone	Ayyanthole zone	Koorkancheri zone	
>30	8 (38.1) [9.6]	6 (28.6) [8.3]	7 (33.3) [10.0]	**21** (100.0) [9.3]
30-35	7 (25.9) [8.4]	11 (40.7) [15.3]	9 (33.4) [12.8]	**27** (100.0) [12.0]
35-40	14 (38.9) [16.9]	9 (25.0) [12.5]	13 (36.1) [18.6]	**36** (100.0) [16.0]
40-45	20 (34.5) [24.1]	14 (24.1) [19.4]	24 (41.4) [34.3]	**58** (100.0) [25.8]
45-50	19 (38.0) [22.9]	20 (40.0) [27.8]	11 (22.0) [15.7]	**50** (100.0) [22.2]
>50	15 (45.4) [18.1]	12 (36.4) [16.7]	6 (18.2) [8.6]	**33** (100.0) [14.7]
Total	**83** (36.9) [100.0]	**72** (32.0) [100.0]	**70** (31.1) [100.0]	**225** (100.0) [100.0]

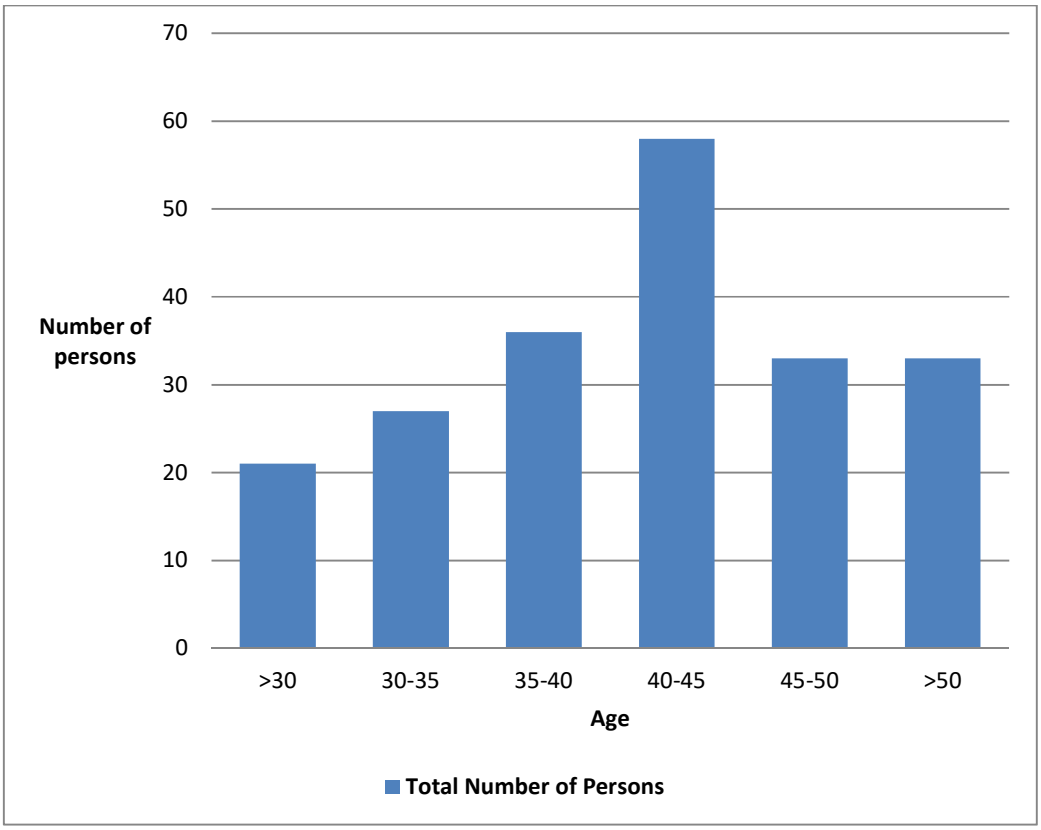
Source: Survey Data

Note: Figure in the parenthesis indicates row percentage.

Figure in square brackets indicates column percentage.

Figure 5.2

Age Distribution of the Respondents



The total number of respondent below 30 years of age is 21 which accounts for 9.3 percent of total respondents. Major portion of the respondents belong to the age group of 40-45 which accounts for 25.8 percent. Similarly, 14.7 percent of the respondents belong to the age category of more than 50 years. Total 24 respondents of 40-45 age group are from Koorkancheri zone which accounts for 41.4 percent out of 58 respondents. In the Central zone, 39.6 respondents belong to the age group of less than 30 years and18.1percent belongs to the age group of greater than 50 years. Likewise, in Ayyanthole zone 27.8 percent of the respondents belong to the age group of 45 to 50, and 8.3 percent belong to less than 30years of age. In Koorkancheri zone, 10 percent respondents belong to less than 30 years of age and 34.3 percent belong to 40 to 45 age group.

5.5 Educational Status

Educational status or literacy level is generally perceived as the ability of a person to read and write a given language. Education has significant role in human development of a nation. Better education leads to healthy living conditions and better standard of living. Education has significant influence on knowledge about food habit, nutrient contents and hygiene consciousness of people. Thus, Educational attainment of parents provides better living conditions of children. The educational status of respondents of the three zones is explained in table 5.4.

The table shows the attainment of literacy of the respondents. The number of illiterate is only 5 which accounts for 2.2 percent of the total respondents. There are 97.8 percent literate respondents in the study area. In Ayyanthole zone, all the respondents are literate which means there are 100 percent literate respondents. Among the illiterate respondents, 80 percent belong to the Central zone and 20 percent belong to Koorkancheri zone. This is due to the existence of slum area in these zones.

Table 5.4

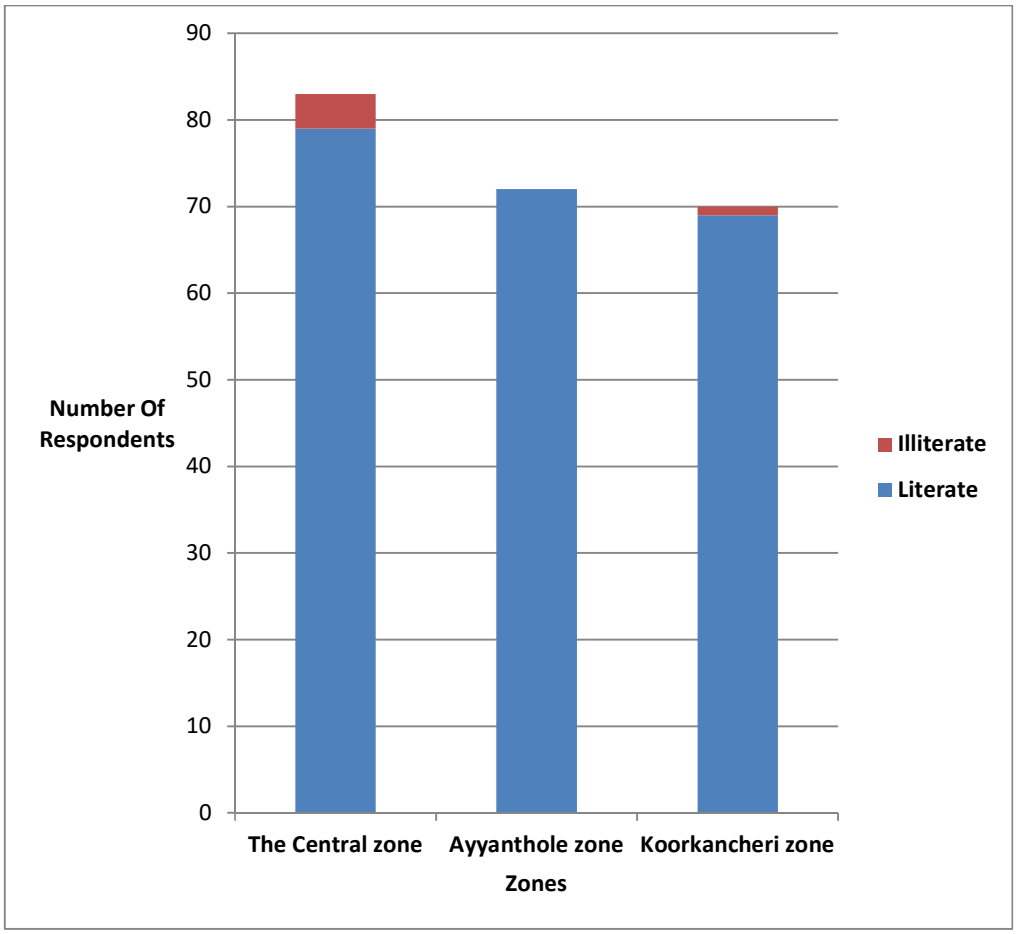
Literacy Status of the Respondents

Zones	Literacy		**Total**
	Literate	Illiterate	
The Central zone	79 (95.2) [35.9]	4 (4.8) [80.0]	**83** (100.0) [36.9]
Ayyanthole zone	72 (100.0) [32.7]	0 (0.0) [0.0]	**72** (100.0) [32.0]
Koorkancheri zone	69 (98.6) [31.4]	1 (1.4) [20.0]	**70** (100.0) [31.1]
Total	**220** (97.8) [100.0]	**5** (2.2) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figure in Parenthesis indicates row percentage.
Figure in square brackets indicates column percentage.

Figure 5.3

Literacy Status of the Respondents



The levels of education of the respondents are represented in table 5.5. The respondents who have lower level of education are seemed to be settled in slum areas whereas who have higher educational levels are settled in comfortable areas of the city. It is clear that 21.7 percent of the respondents have higher levels of education, 27.3 percent have graduation level education, 22.3 percent respondents have higher secondary level education, 17.3 percent have secondary level education and remaining 11.4 percent have primary educational level. The number of primary educational holders is higher in Koorkancheri zone (18.8 percent) whereas, the number of higher education holders is more in Ayyanthole zone (37.5 percent). Out of 220 literate respondents, 108 are having educational level of graduation and higher.

Table 5.5

Classification of Educational Levels of the Respondents

Education Levels	Name of Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Primary	8 (32.0) [10.1]	4 (16.0) [5.6]	13 (52.0) [8.8]	**25** (100.0) [11.4]
Secondary	14 (36.8) [17.8]	6 (15.8) [8.3]	18 (47.4) [26.2]	**38** (100.0) [17.3]
Higher Secondary	26 (53.1) [32.9]	12 (24.5) [16.7]	11 (22.4) [15.9]	**49** (100.0) [22.3]
Graduation	20 (33.3) [25.3]	23 (38.3) [31.9]	17 (28.4) [24.6]	**60** (100.0) [27.3]
Higher	11 (22.9) [13.9]	27 (56.2) [37.5]	10 (20.9) [14.5]	**48** (100.0) [21.7]
Total	**79** (35.9) [100.0]	**72** (32.7) [100.0]	**69** (31.4) [100.0]	**220** (100.0) [100.0]

Source: Survey Data
Note: Figure in Parenthesis indicates row percentage.
Figure in square brackets indicates column percentage.

5.6 Religion Wise Distribution of the Respondents

Similar to all other aspects religion also plays an important role in determining the socio- economic conditions of the respondents. Each religion plays a pivotal role to influence, educational, health and settlement aspects of households. The distribution of household respondents under different religion is furnished in table 5.6.

Mainly there are 3 main religions in the city- Hindu, Christian and Muslim. Among the total respondents 121 are Hindus (53.8 percent), 94 are Christians(41.8 percent) and 10 are Muslims (4.4 percent).The number of Hindu respondents are higher in the Central zone as well as the Ayyanthole zone. The Muslim respondents are higher in Koorkancheri zone. Out of 10 Muslim respondents 5 are from Koorkancheri zone. Hence, there is prominence of Hindu and Christian religion in the city.

Table 5.6

Religion Wise Distribution of the Respondents

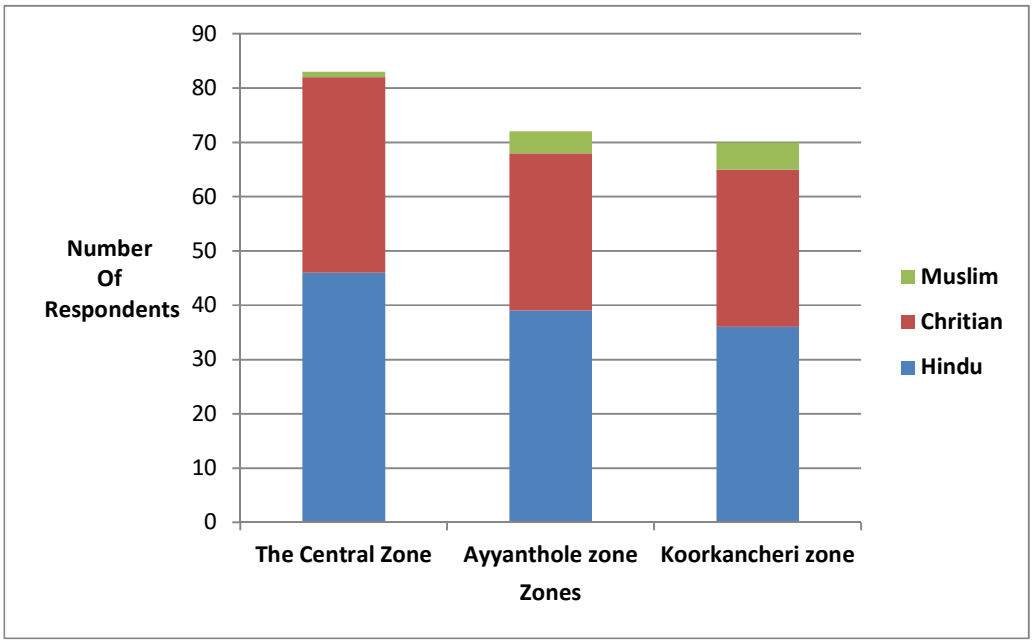
Zones	Religion			**Total**
	Hindu	Christian	Muslim	
The Central zone	46 (55.4) [38.0]	36 (43.4) [38.4]	1 (1.2) [10.0]	**83** (100.0) [36.9]
Ayyanthole zone	39 (54.2) [32.2]	29 (40.3) [30.8]	4 (5.5) [40.0]	**72** (100.0) [32.0]
Koorkancheri zone	36 (51.4) [29.8]	29 (41.4) [30.8]	5 (7.2) [50.0]	**70** (100.0) [31.1]
Total	**121** (53.8) [100.0]	**94** (41.8) [100.0]	**10** (4.4) [100.0]	**225** (100.0) [100.0]

Source: Survey Data

Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percent.

Figure 5.4

Religion Wise Distribution of the Respondents



5.7 Marital Status of the Respondents

The concept of marital status leads to family life of the respondents. It also influences the educational, social and cultural aspects of society. The details of marital status of the respondents are given in table 5.7.

It is observed that there is close relationship between marital status and living conditions of the respondents. The survey data reveals that 82.2 percent of the total respondents are married respondents. The number of unmarried respondents is 24 (10.7 percent) and widowed respondents are 16 (7.1 percent). In the Central zone 85.5 percent respondents are married, 4.8 percent are unmarried and 4.8 percent are widowed. In Ayyanthole zone, 75.0 percent respondents are married, 18.1 percent are unmarried and 6.9 percent of the respondents are widowed. Similarly, in Koorkancheri zone 85.7 percent respondents are married, 10 percent are unmarried and 4.3 percent respondents are widowed.

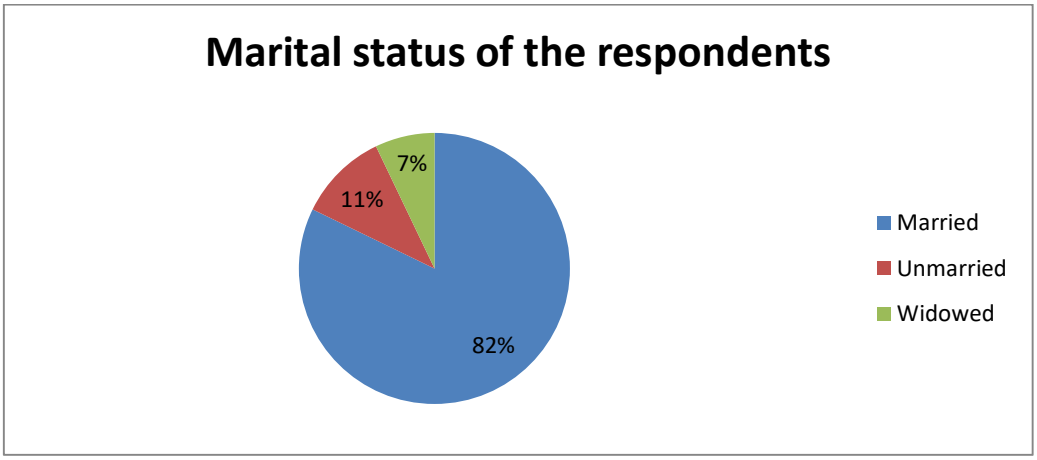
Table 5.7

Marital Status of the Respondents

Zones	Marital Status			**Total**
	Married	Unmarried	Widowed	
The Central zone	71 (85.5) [38.4]	4 (4.8) [16.7]	8 (9.7) [50.0]	**83** (100.0) [36.9]
Ayyanthole zone	54 (75.0) [29.2]	13 (18.1) [54.1]	5 (6.9) [31.3]	**72** (100.0) [32.0]
Koorkancheri zone	60 (85.7) [32.4]	7 (10.0) [29.2]	3 (4.3) [18.7]	**70** (100.0) [31.1]
Total	**185** (82.2) [100.0]	**24** (10.7) [100.0]	**16** (7.1) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 5.5 Marital Status of the Respondents



5.8 Size of the Family of the Respondents

The size of the family has significant influence upon the expenditure and saving decision of households. It also plays pivotal role in determining the educational as well as health aspects of members of a family. Table 5.8 highlights the distribution of family size in 3 different zones.

Table 5.8

Family Size of the Respondents

Zones	Size of the Family				**Total**
	2	3	4	More than 4	
The Central zone	4 (4.8) [20.0]	8 (9.6) [18.6]	24 (28.9) [35.3]	47 (56.7) [50.0]	**83** (100.0) [36.9]
Ayyanthole zone	9 (12.5) [45.0]	10 (13.9) [23.3]	31 (43.1) [45.6]	22 (30.5) [23.4]	**72** (100.0) [32.0]
Koorkancheri Zone	7 (10.0) [35.0]	25 (35.7) [58.1]	13 (18.6) [19.1]	25 (35.7) [26.6]	**70** (100.0) [31.1]
Total	**20** (8.9) [100.0]	**43** (19.1) [100.0]	**68** (30.2) [100.0]	**94** (41.8) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

The table pointed out that about 41.8 percent of the family is having more than 4 members. 30.2 percent have 4 members, 19.1 percent have 3 members and 8.9 percent have 2 members in family. In the Central zone 56.7 percent respondents are having a family size of more than 4 members 28.9 percent are having a family size of 4 members, 9.6 percent are having a family size of 3 members and only 4.8 percent are having a family size of two members. In Ayyanthole zone major portion (43.1percent) respondents are from 4 member family. In Koorkancheri zone too most of the respondents have a family size of more than 4 members. Hence, the size of the family has significant influence on environmental conditions.

5.9 Occupation of the Respondents

Occupation is considered as the main reason for urban migration. People prefer to settle in cities where they can find better job opportunities for themselves. This will ultimately lead to the improvement of their living conditions. Many studies of urbanization exhibit that there is a close relationship between the nature of occupation and nature of locations in urban areas. In fact, the nature of occupation determines the living areas of the respondents. This makes the settlements in slum as well as non-slum areas. People with low level of occupation will be residing at slum areas whereas with higher level of occupation and income will be found in non-slum areas. Hence, it is important to examine the nature of occupation and nature of locations to study about the environmental conditions. The distribution of sampled households according to the nature of occupations in different zones is presented in table 5.9.

It is pointed in the table that out of 225 respondents, 69 (30.7 percent) are self employed or doing their own business, 47 (20.9 percent) are casual or daily wage workers, 41 (18.2 percent) are government employees, 39 (17.3 percent) are private sector employees and 18 (8.0 percent) are engaged in other works. The remaining 11 (4.9 percent) are found to be unemployed.

In the Central zone 45.8 percent respondents are engaged in business or are self employed, 16.8 percent are having private sector jobs, 10.8 percent are engaged in government sectors, 13.3percent respondents are daily wage workers and so on. In Ayyanthole zone 22 respondents (30.5 percent) are in government sector occupations 17 are doing business, 15 are engaged in daily/casual wage works and so on. Similarly in Koorkancheri zone, 30.0 percent respondents (21) are engaged in casual/ daily

wage work, 20.0 percent are self employed or doing their own business, 24.3 percent are private sector employees, 14.3 percent are government employees and so on. It is important to note that out of 11 unemployed respondents, 6 are from Koorkancheri zone.

Table 5.9

Occupational Distribution of the Respondents

Occupation	Name of Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Government Sectors	9 (21.9) [10.8]	22 (53.7) [30.5]	10 (24.4) [14.3]	**41** (100.0) [18.2]
Private Sectors	14 (35.9) [16.8]	8 (20.5) [11.1]	17 (43.6) [24.3]	**39** (100.0) [17.3]
Self employed /Business	38 (55.1) [45.8]	17 (24.6) [23.6]	14 (20.3) [20.0]	**69** (100.0) [30.7]
Daily Wage Works	11 (23.4) [13.3]	15 (31.9) [20.8]	21 (44.7) [30.0]	**47** (100.0) [20.9]
Others	7 (38.9) [8.5]	9 (50.0) [12.5]	2 (11.1) [2.8]	**18** (100.0) [8.0]
Unemployed	4 (36.4) [4.8]	1 (9.1) [1.5]	6 (54.5) [8.6]	**11** (100.0) [4.9]
Total	**83** (36.9) [100.0]	**72** (32.0) [100.0]	**70** (31.1) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

5.10 Wealth Possession of the Respondents

The amount of wealth is an important factor and standard of living of households. Many studies in this area highlight that there is close association between wealth possessions and living conditions of the households. To study the relationship

between urbanization and environmental conditions, wealth aspects also should bring into concern. Table 5.10 reflects the details of wealth possessions of the respondents.

Table 5.10

Wealth Possession of the Respondents

Wealth Composition	Name of the Zones			
	The Central zone	Ayyanthole zone	Koorkancheri zone	**Total**
Less than 5,00,000	7 (30.4) [8.4]	4 (17.4) [5.5]	12 (52.2) [17.1]	**23** (100.0) [10.2]
5,00,000 – 10,00,000	13 (27.1) [15.7]	15 (31.2) [20.8]	20 (41.7) [28.6]	**48** (100.0) [21.3]
10,00,000 – 15,00,000	8 (28.1) [21.7]	27 (42.2) [37.5]	19 (29.7) [27.1]	**64** (100.0) [28.4]
15,00,000 – 20,00,000	28 (46.7) [33.7]	14 (23.3) [19.4]	18 (30.0) [25.7]	**60** (100.0) [26.7]
More than 20,00,000	17 (56.7) [20.5]	12 (40.0) [16.8]	1 (33.3) [1.5]	**30** (100.0) [13.4]
Total	**83** (36.9) [100.0]	**72** (32.0) [100.0]	**70** (31.1) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figures in the parenthesis indicate row percentage.
Figures in the square brackets indicate column percentage.

The economic status of the respondents is influenced by wealth conditions of the respondents. Total wealth of the households is estimated by wealth from all means. Hence, the overall wealth possessions are considered. It is observed that 28.4 percent of the respondents have wealth at worth of Rs. 10,00,000- 15,00,000, 26.7 percent have wealth at worth of Rs. 15,00,000- 20,00,000, 21.3 percent have wealth possession at worth of Rs. 5,00,000-10,00,000 and so on. The zone wise comparison of wealth possession reflects that 52.2 percent respondents of Koorkancheri zone, 30.4 percent of the Central zone and 17.4 percent of the Ayyanthole zone have own wealth at worth of less than rupees 5,00,000. Higher wealth holders (more than 20,00,000 rupees) are found more in the Central zone (56.7 percent). Similarly, in the

Central zone more respondents (33.7 percent) are seemed to have wealth possession at worth of Rs. 15,00,000 – 20,00,000 and lower percentage (8.4) are seemed to have wealth at worth of less than 5 lakhs rupees. In Ayyanthole zone, major portion of the respondents have wealth at worth of Rs. 10,00,000 – 15,00,000 and fewer percentage (5.5) of the respondents have wealth possessions at worth of less than 5 lakhs rupees. In Koorkancheri zone, 28.6 percent of the respondents, have wealth at worth of Rs. 5,00,000- 10,00,000 and 27.1 percent of respondents have wealth at worth of Rs. 10,00,000- 15,00,000. Households with higher wealth possessions are found less in Koorkancheri zone (1.5 percent). On the other hand, households with lower wealth possessions are found more in this zone (17.1 percent). This is because of the existence of slum area in this zone.

Therefore, it is concluded that the possession of wealth highly influences the standard of living and economic conditions of the respondents. It is related with locations too. Hence, there is significant influence of assets/wealth possessions on environmental aspects too.

5.11 Total Income of the Households

Household income is an important element in the measurement of economic well-being, standard of living and economic development. It is a measure of the combined incomes of all people sharing a particular household or place of residence. It includes income from salaries and wages, retirement income, cash benefits from government transfers and investment gains. Household income is the main source of consumption expenditure and it ultimately determines the economic conditions of a nation.

Household income is the total of all types of earnings received by the members of each household in economically gainful activities. This income and wealth are essential components of individual well being. Income allows people to satisfy their basic needs and pursue many other goals that they consider as important to their lives; while wealth makes it possible to sustain these choices overtime. Generally, in a given society at a given time, income is positively related to reported subjective well- being, so that individuals with a higher income tend to report higher subjective well- being than those with a lower income (OECD, 2011).

Table 5.11 represents the annual income of the sample respondents in three zones. The table shows that 40.04 percent of the respondents earn annual income at the range of Rs. 50,000 to 1,00,000. 20 percent of the respondents earn the annual income in between Rs. 100000 – 1,50,000, 18.3 percent earn income more than Rs. 2,00,000 and 7.5 percent have annual income less than 50,000 rupees. In the Central zone 32.5 percent respondents earn an annual income in between Rs. 1,00,000 – 1,50,000, 19.3 percent have income more than 2,00,000 rupees and 8.4 percent earn an annual income less than Rs. 50,000. The lowest income category respondents seemed to be residing at slum areas. Similarly, in the Ayyanthole zone, respondents who earn an annual income less than rupees 50,000 is only 2.8 percent, while 45.8 percent respondents have an annual income in between Rs. 50,000 – 1,00,000. In Koorkancheri zone, 52.8 percent of the respondents comes under the income category of Rs. 50,000-1,00,000 and 11.5 percent earn an annual income less than rupees 50,000. In fact, there are income differences in slum as well as non slum areas and this ultimately lead to worsening environmental issues in the former than the non slum areas.

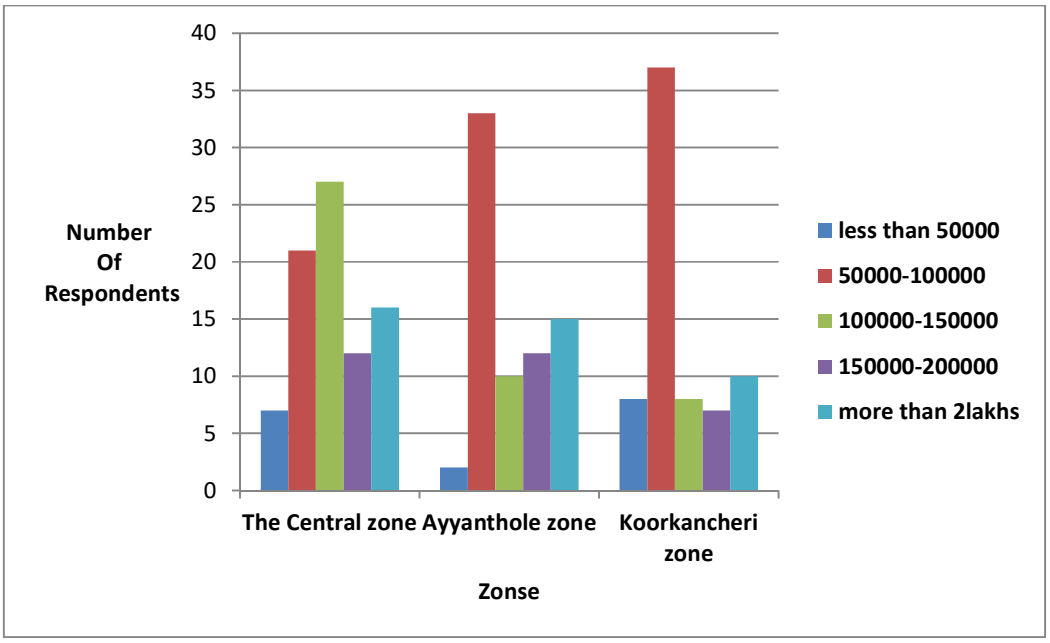
Table 5.11 Annual Household Income of the Respondents

Annual Household Income (In Rupees)	Name of the Zones			
	The Central zone	Ayyanthole zone	Koorkancheri zone	**Total**
Less than 50,000	7 (41.2) [8.4]	2 (11.8) [2.8]	8 (47.0) [11.5]	**17** (100.0) [7.5]
50,000 – 1,00,000	21 (23.1) [25.4]	33 (36.3) [45.8]	37 (40.6) [52.8]	**91** (100.0) [40.4]
1,00,000 – 1,50,000	27 (60.0) [32.5]	10 (22.2) [13.9]	8 (17.8) [11.4]	**45** (100.0) [20.0]
1,50,000 – 2,00,000	12 (38.7) [14.4]	12 (38.7) [16.7]	7 (22.6) [10.0]	**31** (100.0) [13.8]
More than 2,00,000	16 (39.0) [19.3]	15 (36.6) [20.8]	10 (24.4) [14.3]	**41** (100.0) [18.3]
Total	**83** (36.9) [100.0]	**72** (32.0) [100.0]	**70** (31.1) [100.0]	**225** (100.0) [100.0]

Source: Survey Data. **Note:** Figure in the parenthesis indicates row percentage. Figure in the square brackets indicates column percentage.

Figure 5.6

Annual Household Income of the Respondents (In Rupees)



5.12 Expenditure Details of the Respondents

Household consumption expenditure is mainly on two grounds – expenditure on food items and expenditure on non-food items. The annual income earned by each individual is distributed to these expenditures. A major portion of household income is spent on food items, non food items and house rent.

The National Sample Survey Organization (NSSO) provides information on consumption expenditure on food and non-food items. Total consumption expenditure of a household is the expenditure incurred on domestic consumption during the reference period. The household consumer expenditure is calculated by finding the total of the monetary value of consumption of various groups of items namely:

i) Food (which includes cereals, milk & its products, pulses, sugar, vegetables, egg, fish & meat, and oil), pan (betel leaves), tobacco, intoxicants and fuels and light.

ii) Non- food items such as clothing& footwear miscellaneous goods & services and durable articles.

The consumption expenditure is varied in different locations. In slum area, expenditure on food items is relatively less compared to non – slum areas. They can afford cheap food items than expensive protein rich food items. Their consumption of food items is on daily basis. Milk, fish, meat or poultry and egg consumption is on weekly basis in these areas. They prefer to have banana and other cheap fruits instead of expensive seasonal fruits. Similar is the case with non-food items too. With limited annual income slum dwellers cannot afford much expense on durables and semi durables.

The table 5.12 examines the consumption expenditure of the respondents in 3 different zones on food items. Among the 225 respondents 45.8 percent spend Rs. 75,000- 1,00,000 on food items, 26.7 percent spend in between 50,000 – 75,000 rupees annually and only 7.5 percent make an expenditure of more than 100000 rupees on food items. 45 respondents spend an amount of less than 50000 rupees on food items annually.

Table 5.12

Annual Expenditure on Food Items of the Respondents

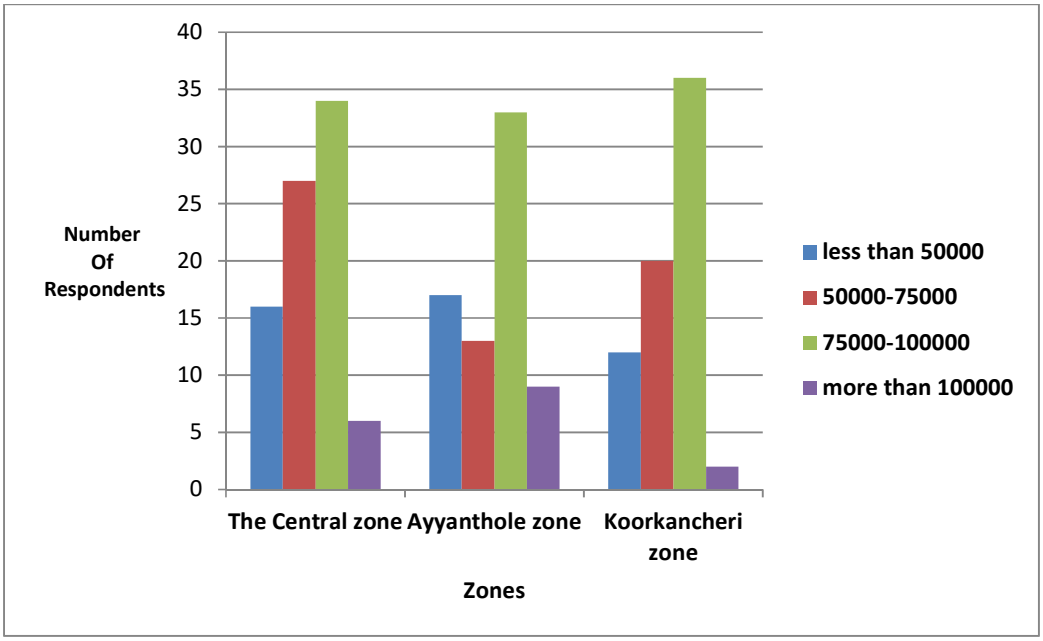
Expenditure (In rupees)	**Name of the Zones**			
	The Central zone	Ayyanthole zone	Koorkancheri zone	**Total**
Less than 50,000	16 (35.5) [19.3]	17 (37.8) [23.6]	12 (26.7) [17.1]	**45** (100.0) [20.0]
50,000 – 75,000	27 (45.0) [32.5]	13 (21.7) [18.0]	20 (33.3) [28.6]	**60** (100.0) [26.7]
75,000 – 1,00,000	34 (33.0) [41.0]	33 (32.0) [45.8]	36 (35.0) [51.4]	**103** (100.0) [45.8]
More than 1,00,000	6 (35.3) [7.2]	9 (52.9) [12.6]	2 (11.8) [2.9]	**17** (100.0) [7.5]
Total	**83** (36.9) [100.0]	**72** (32.0) [100.0]	**70** (31.1) [100.0]	**225** (100.0) [100.0]

Source: Survey Data

Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 5.7

Annual Expenditure on Food Items of the Respondents (In Rupees)



The table also shows that in the zone wise analysis among 83 respondents of the Central zone, 41 percent spent Rs. 75,000 – 1,00,000 annually on food items and only 7.2 percent can afford more than 1,00,000 rupees annually on food items. In the Ayyanthole zone, 45.8 percent make an expenditure of Rs. 75,000- 1,00,000 annually and 23.6 percent of the respondents cannot afford an amount more than 50,000 for food items. In the Koorkancheri zone, only 2.9 percent of the respondents make an expenditure of more than 1,00,000 rupees annually on food items and 51.4 percent belongs to the category of Rs. 75,000-1,00,000 expenditure as food items. Hence, there is significant association between income and expenditure on food items.

The respondent's spending on non food items is depicted in table 5.13.Among the total respondents, 51.1 percent make an expenditure of less than 50,000 rupees annually on non- food items. It is important to note that expenditure on non- food items include rent and medical expenses too. 22.7 percent respondents spend Rs. 50,000 – 75,000 on non- food items and only 6.7 percent of the respondents make an expenditure of more than Rs. 1,00,000 on non food items annually.

Table 5.13

Annual Expenditure on Non – Food Items of the Respondents

Expenditure (In rupees)	Name of the Zones			
	The Central zone	Ayyanthole zone	Koorkancheri zone	**Total**
Less than 50,000	36 (31.3) [43.4]	37 (32.2) [51.4]	42 (36.5) [60.0]	**115** (100.0) [51.1]
50,000 – 75,000	30 (58.8) [36.1]	17 (33.3) [23.6]	4 (7.9) [5.7]	**51** (100.0) [22.7]
75,000 – 1,00,000	9 (20.4) [10.8]	17 (38.6) [23.6]	18 (41.0) [25.7]	**44** (100.0) [19.5]
More than 1,00,000	8 (53.3) [9.7]	1 (6.7) [1.4]	6 (40.0) [18.6]	**15** (100.0) [6.7]
Total	**83** (36.9) [100.0]	**72** (32.0) [100.0]	**70** (31.1) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

In the zone wise distribution, 36.1 percent of the respondents in the Central zone spend Rs. 50,000- 75,000 annually compared to 23.6 percent of the Ayyanthole zone and 5.7 percent of the Koorkancheri zone. Similarly, 60 percent respondents of the Koorkanchery zone spend an amount of less than 50,000 rupees annually compared to 43.4 percent of the Central zone and 51.4 percent of the respondents of the Ayyanthole zone on non- food items. In all the three zones, respondents who can afford an expenditure of more than 1,00,000 rupees on non- food items annually is below 10 percent. In short, there is an association between household income and expenditure on non food items.

5.13 Savings of the Respondents

Savings and investments are considered as the engine of economic growth. The growth of urban areas is one of the outcomes of savings and investments. The urban households spend their major portion of income as consumption expenditure. They also try to save same money in order to meet expenses on health issues because of environmental degradation for some other needs. Social theories argue that when

respondent's savings are higher, they can face environmental issues easily, whereas if the savings of the respondent are lower, it will become difficult to face environmental challenges. The details of savings of the respondents are given in table 5.14.

The table shows that overall 40.4, percent of the respondents save their income at Rs. 1000- 1500 per month; 27.1 percent of them save less than 1000 rupees per month, 21.3 percent of the respondents save rupees 1500- 2000 and 11.2 percent save more than 2000 rupees per month. In zone wise analysis Ayyanthole zone records 51.4 percent respondents in monthly saving of Rs. 1000- 1500 and 48.6 percent of the respondents of Koorkancheri zone save their income at rupees 1000- 1500. In the Central zone, major saving category of amount is Rs. 1500-2000 where there are 32.5 percent respondents. Hence, on the basis of the available data, saving is comparatively low in these areas which results in economic backwardness and issues related with impacts of environmental pollution.

Table 5.14

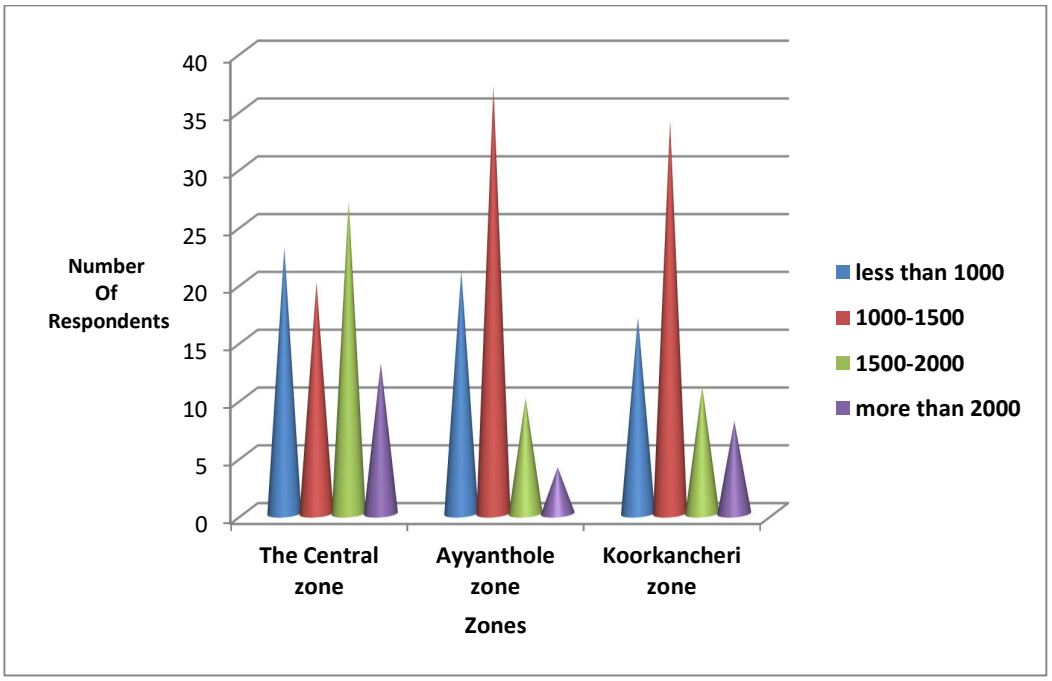
Monthly Savings of the Respondents

Savings (In rupees)	Name of the Zones			
	The Central zone	Ayyanthole zone	Koorkancheri zone	**Total**
Less than 1000	23 (37.7) [27.7]	21 (34.4) [29.2]	17 (27.9) [24.3]	**61** (100.0) [27.1]
1000-1500	20 (22.0) [24.1]	37 (40.6) [51.4]	34 (37.4) [48.6]	**91** (100.0) [40.4]
1500-2000	27 (56.2) [32.5]	10 (20.8) [13.9]	11 (23.0) [15.7]	**48** (100.0) [21.3]
More than 2000	**13** (52.0) [15.7]	**4** (16.0) [5.5]	**8** (32.0) [11.4]	**25** (100.0) [11.2]
Total	**83** (36.9) [100.0]	**72** (32.0) [100.0]	**70** (31.1) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 5.8

Monthly Savings of the Respondents (In Rupees)



5.14 Housing Characteristics of the Respondents

Housing is one of the major medium through which socio-economic status is expressed and health determinants operate. Housing can be conceptualized as an intermediate structural factor that links broader societal process and influences with an individual's immediate social and physical environment (Aidala and Sumartojo, 2007). It provides physical security and protection from the elements, and plays a central role in determining an individual's physical and social risk environment. Housing can also provide a source of identity and belonging (Dunn, 2000).

The housing characteristics of the sample households are not uniform in nature. It depends upon the nature of locations – slum/non slum areas. Similarly, the facilities within the house and allied amenities of the houses vary in degree. The housing conditions of the respondents are analyzed through the concepts like type of the house, nature of the house and essential facilities available etc. These concepts will ensure brief characteristics of the housing and living conditions of urban people.

5.14. (i) Type of the House

In the study area most of the houses are found to be concrete which leads to better living conditions of the households. Similarly, people also live in poor living conditions in slum areas with thatched or Kuchha houses where services are insufficient.

Table 5.15

Type of House of the Respondents

Zones	Name of the Zones				
	Concrete	Tiled	Thatched	Others	**Total**
The Central zone	61 (73.1) [39.6]	17 (20.5) [30.3]	5 (6.0) [35.7]	- - -	**83** (100.0) [36.9]
Ayyanthole zone	53 (73.6) [34.4]	13 (18.0) [23.2]	6 (8.4) [42.8]	- - -	**72** (100.0) [32.0]
Koorkancheri zone	40 (57.1) [26.0]	26 (37.1) [46.5]	3 (4.3) [21.5]	1 (1.5) [100.0]	**70** (100.0) [31.1]
Total	**154** (68.4) [100.0]	**56** (24.9) [100.0]	**14** (6.2) [100.0]	**1** (0.5) [100.0]	**225** (100.0) [100.0]

Source: Survey Data

Note: Figure in the parenthesis indicates row percentage. Figure in the square brackets indicates column percentage.

Figure5.9 Type of House of the Respondents

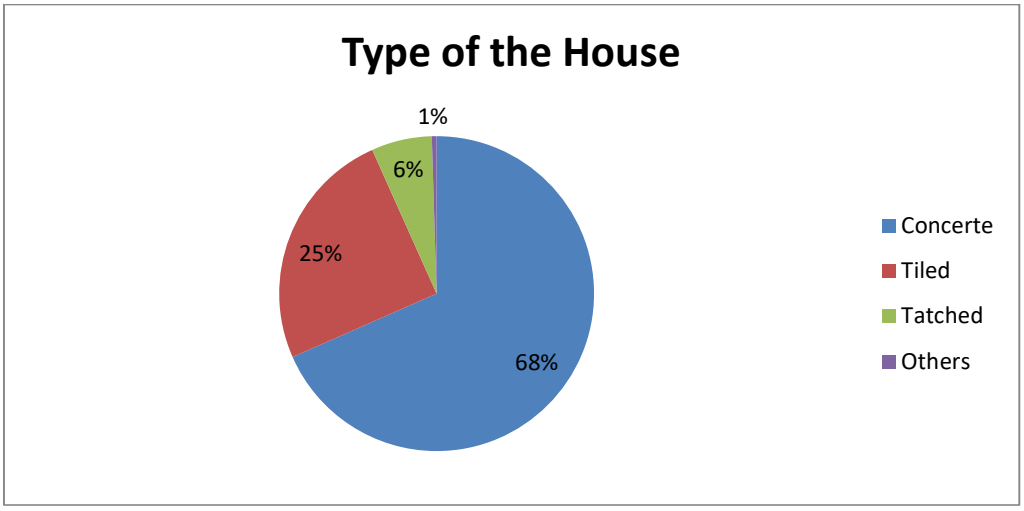


Table 5.15 shows the type of the house of the respondents which shows that 68.4 percent respondents live in concrete houses, followed by 24.4 percent in tiled houses, 6.2 percent in thatched and only 0.5 percent in other types of Kuchha houses. Similarly in all the three zones majority of the respondents live in concrete houses. In Koorkancheri zone one respondent found to be in very poor housing condition.

5.14. (ii)Nature of the House

The nature of house is influenced by location factors. Many respondents in the study area occupy their own houses. Some households stay in rented houses too. Rented houses are mostly found in slum areas where there is minimum rent at one hand, and environmental issues on the other. Problems like water shortages, poor sanitation facilities, poor hygienic conditions and polluted air are some of the environmental problems in these areas. Thus there exist a nexus between the nature of houses and their locations.

Table 5.16 represents the nature of the houses according to the locations. It classifies the houses of the respondents as rented or own houses.

Table 5.16

The Nature of Houses of Respondents

Nature of Houses	Name of the Zones			
	The Central zone	Ayyanthole zone	Koorkancheri zone	**Total**
Own House	73 (39.0) [87.9]	55 (29.5) [76.4]	59 (31.5) [84.3]	**187** (100.0) [83.1]
Rented House	10 (26.3) [12.1]	17 (44.7) [23.6]	11 (29.0) [15.7]	**38** (100.0) [16.9]
Total	**83** (36.9) [100.0]	**72** (32.0) [100.0]	**70** (31.1) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

It is reflected in the table that, 83.1 percent respondents live in their own houses and only 16.9 percent live in rented houses. This is due to economic backwardness or job related reasons. The respondents residing at rented houses are found to be higher in

Ayyanthole zone. The main reason for this is seemed to be job related. All the three zones the higher percentage of respondents with own houses. This shows better economic and living conditions of the households.

5.14. (iii) Availability of Water

Water is a prerequisite for living things. People always prefer to reside in those areas where there is adequate water availability. The sources of water are open well, bore well, public water supply etc. The availability of sufficient water will enhances huge urban settlements in many locations. Hence, the adequacy of quality water is one of the main reasons for household's preference towards some areas of the city. The table 5.17 shows the responses of the respondents towards availability of sufficient water.

Table 5.17

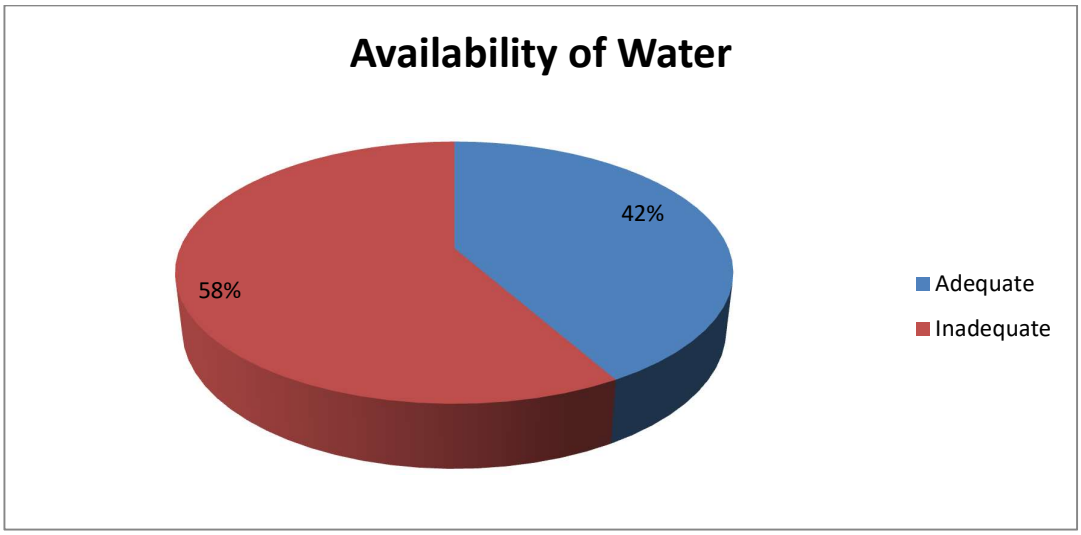
Availability of Water According to the Location

Name of the Zones	Water Availability		**Total**
	Adequate	Inadequate	
The Central zone	36 (43.4) [38.3]	47 (56.6) [35.9]	**83** (100.0) [36.9]
Ayyanthole zone	31 (43.1) [33.0]	41 (56.9) [31.3]	**72** (100.0) [32.0]
Koorkancheri zone	27 (38.6) [28.7]	43 (61.4) [32.8]	**70** (100.0) [31.1]
Total	**94** (41.8) [100.0]	**131** (58.2) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 5.10

Availability of Water According to the Location



Out of the total respondents, 58.2 percent responded that water availability is inadequate in their premises. This may vary in seasons as it worsens in summer and becomes marginal in rainy seasons. 41.8 percent agrees that they are having adequate water availability. Water related problems of the respondents are found to be related with administrative system of the city. Hence proper water management plan will bring solution to this problem.

5.14. (iv) Availability of Electricity

Accessibility of electricity is one of the indicators of better living and economic conditions of households. As per the available data, most of the areas of the city have been electrified including slum areas. But there are few houses without electricity in these areas. This may be due to some organizational or technical problems. The details of the electricity availability of households in the study area are furnished in table 5.18.

The table shows that 86.2 percent of the household respondents have electricity connection. Only 13.8 percent respondents are lacking electricity. This is because of the nature of locations, housing conditions, economic conditions and others. In all the three zones household respondents have electricity availability at their residences. This shows that there is better living and housing conditions in the study area.

Table 5.18

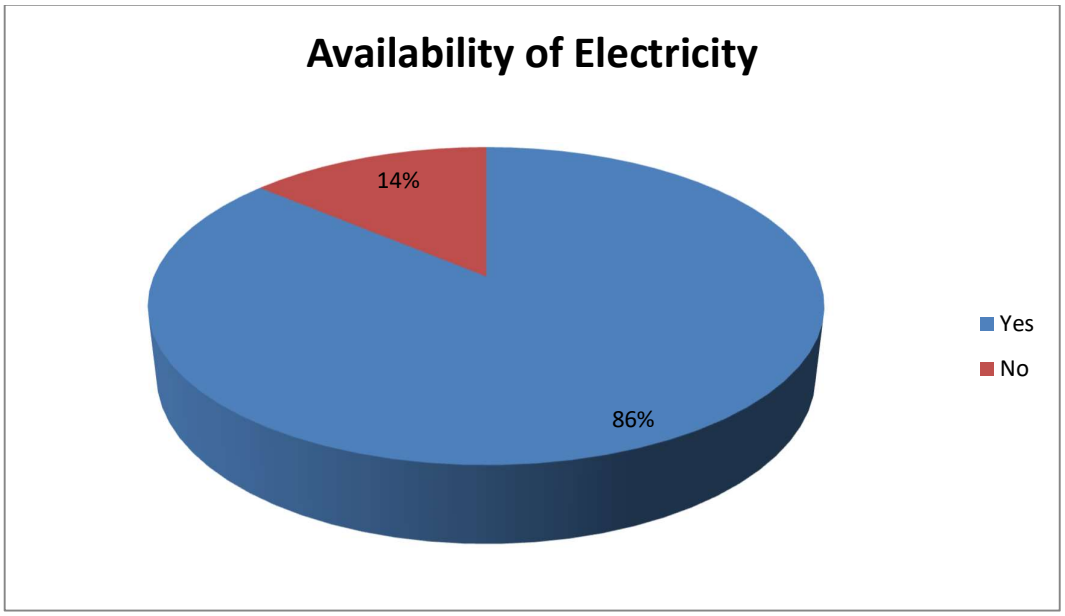
Availability of Electricity According to the Locations

Name of the Zones	Electricity Availability		**Total**
	Yes	No	
The Central zone	73 (87.9) [37.6]	10 (12.1) [32.2]	**83** (100.0) [36.9]
Ayyanthole zone	59 (81.9) [30.5]	13 (18.1) [42.0]	**72** (100.0) [32.0]
Koorkancheri zone	62 (88.6) [31.9]	8 (11.4) [25.8]	**70** (100.0) [31.1]
Total	**194** (86.2) [100.0]	**31** (13.8) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 5.11

Availability of Electricity According to the Locations



Thus, the survey results show that the socio-economic conditions of the respondents are somewhat satisfactory. People from non – slum areas are found to be in better living conditions than people of slum area. In non – slum areas households are having higher literacy, better jobs, higher income and higher savings. Their housing conditions are good, where they enjoy much better services and facilities. But in slum areas there are some economic, social and cultural issues. Slum dwellers are lacking better education, better employment opportunities, cultural aspects and good housing conditions. In these areas, the housing conditions are not satisfactory and hence they are lacking better services and facilities for a decent life. Poor physical environment with insufficient solid waste disposal system is a common phenomenon in slum areas. This ultimately leads to prevalence of water- borne and air borne diseases among the respondents. With low levels of income and savings they could not solve the issues related with environment pollution.

Hence, for creating a healthy environment in the city the government along with the citizens should concentrate on policies which are environment friendly and which incorporates everyone in its implementation. The development of slum areas should give prime importance. There should be stability of income in these areas. For this, better education should be given in these areas and there should be simultaneous and harmonious development in all economic, social and cultural aspects.

CHAPTER – 6

AN ANALYSIS OF THE IMPACT OF URBANIZATION ON ENVIRONMENTAL CONDITIONS OF SAMPLE HOUSEHOLDS

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AN ANALYSIS OF THE IMPACT OF URBANIZATION ON ENVIRONMENTAL CONDITIONS OF SAMPLE HOUSEHOLDS

6.1 Introduction

Urbanization process has been associated with other important aspects such as economic, social and environment. It is commonly thought to be linked to air and water pollution, sprawl and the like. Based on the report of UN (2014), rapid and unplanned urban growth as well as urban expansion threatens sustainable development when the necessary infrastructure is not developed or when polices are not well – implemented. Unplanned or inadequately managed urban expansion leads to rapid sprawl, pollution, and environmental degradation, together with unsustainable production and consumption patterns. Main issues of urbanization emphasized by governments are urban poverty, solid waste disposal, housing for the poor, environmental protection, pollution, the rising crime rate, and so on (Brain, 2000).

In India, the rapid increase in urbanization has led to severe environmental degradation that undermines the environmental resource base upon which sustainable development depends. Urbanization affects the environment in many ways: its relation with discharge, of pollutants and generation of solid/liquid/gaseous wastes, secondly, its relation with the depletion of natural resources and its relation with the social costs of population explosion, pollution, poverty and sustainable development. With urbanization even the simple matter of waste disposal becomes a problem. The 'throw away' societies of cities generate the most trash disposal, which poses a major threat today. Hence, the country is facing serious environmental concerns in terms of air and water pollution, increasing carbon emissions, changing land use pattern solid waste generation and disposal, and poor sanitation amenities.

The environmental degradation in our country could be attributed to rapid growth of population, which adversely affects the natural resources and environment. Similarly,

the increasing population ultimately leads to increasing energy requirements which results in pollution. Thus pollution in the modern cities are caused by the overloading of the environment with noxious substances contained in our daily consumption and production activities, they are the effluents of affluence in one sense. Discarded in the air, land and water, they become the wrong thing in the wrong place at the wrong time. This is posing serious environmental problems and can retard the process of socio – economic development.

Degradation of the environment in Kerala due to urbanization takes many forms such as deterioration of water resources, pollution of air and water, solid waste generation and so on. Increase in population coupled with rapid urbanization, industrialization and consumerism, without due regard to environmental considerations, have led to extensive pollution of air, water and land. The raw materials consumed during these activities have resulted in the dwindling of non –renewable resources and accumulation of wastes. These wastes are indiscriminately disposed of and as a consequence the water, air and land become more polluted. Thus, the major environmental issues related with unplanned urbanization in Kerala are water pollution, air pollution, sound pollution, industrial pollution, vehicular pollution and problems related to deforestation and hospital waste disposal.

Due to excessive human activities vehicle pollution, sound pollution and industrial pollution have been increasing which results in reducing the green cover. Emissions of fluro carbons and carbon monoxide adversely affect the balance of atmosphere and which ultimately results in global warming. Increased level of carbon dioxide and resulting warm atmosphere adversely affects the health conditions of human beings. A study conducted by WHO revealed the fact that in Kerala, the levels of air pollution and water pollution are at a high level which is a clear indicator of environmental degradation of the state. The study concentrates on the fact that in the name of urbanization and development we are ignoring the basic requirement of clean and green environment for the survival of human race. The present study concentrates on the consequences of rapid urbanization in the form of air pollution, water pollution, noise pollution and solid waste pollution.

To examine the impact of urbanization on sustainable environment a study has been carried out in Thrissur city which is one of the most urban populated cities of the

state. About 225 households are selected as sample respondents from three zones such as the Central zone, Ayyanthole and Koorkancheri. In all these three zones, there are some slum dwellers too. The study tries to analyze the environmental living conditions of the household respondents and consequent health impacts with particular emphasis on water, air, noise and solid waste pollution. From the collected reliable information from the respondents with suitable questionnaire the study found that there is close association between the environmental degradation and rapid urbanization.

In order to analyze attitude and perception of the respondents regarding environmental degradation due to urbanization, this chapter has been categorized into several sections.

6.2 Environmental problems due to urbanization

6.2. (i) Water pollution due to urbanization

6.2. (ii) Air pollution due to urbanization

6.2. (iii) Solid waste pollution due to urbanization

6.2. (iv) Noise pollution due to urbanization

6.3 Method of economic valuation of environmental goods

6.4 Implications of the study.

6.2 Environmental Problems Due to Urbanization

The rapid rate of urbanization and development has negative impact on the environment. Urbanization affects the environment in many ways: firstly, its relation with discharge of pollutants, air quality is affected and leading to generation of solid/liquid/gaseous wastes; secondly, its relation with the depletion of natural resources, and its relation with the social costs of population explosion, pollution, poverty and sustainable development. Thus urbanization has resulted in increased pollution of land, water, air and other natural resources. It is not surprising that health risks have also increased.

The details of the environmental problems faced by the sample respondents are furnished in table 6.1.

Among the total sample respondents, 76 respondents admitted to have water pollution, 36 claimed to have air pollution, 48 respondents faced noise pollution and 38 responded to have solid waste pollution. The respondents from all the three zones have different perceptions towards different types of pollutions. Respondents who are affected by air pollution may not have problems of water pollution and other types of pollution and so on. Similar is the case with other types of pollutions and household responses.

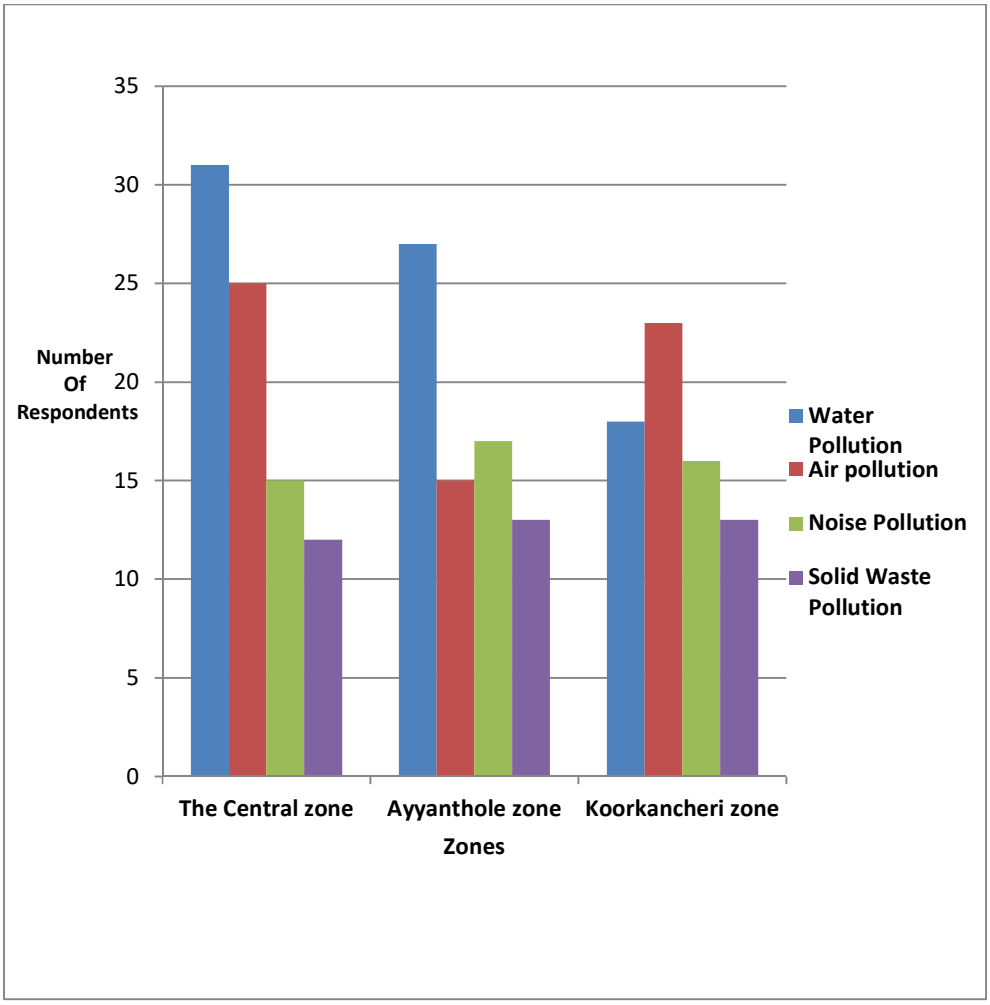
Table 6.1

Environmental Problems Due to Urbanization

Types of Pollution	Name of the Zone			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Water Pollution	31 (40.8) [37.3]	27 (35.5) [37.5]	18 (23.7) [25.8]	**76** (100.0) [33.8]
Air Pollution	25 (39.7) [30.1]	15 (23.8) [20.8]	23 (36.5) [32.8]	**63** (100.0) [28.0]
Noise Pollution	15 (31.2) [18.1]	17 (35.4) [23.6]	16 (33.4) [22.8]	**48** (100.0) [21.3]
Solid Waste Pollution	12 (31.6) [14.5]	13 (34.2) [18.1]	13 (34.2) [18.6]	**38** (100.0) [16.9]
Total	83 (36.9) [100.0]	72 (32.0) [100.0]	70 (31.1) [100.0]	**225** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.1Environmental Problems Due to Urbanization



The table 6.1 also shows that out of 76 respondents, who are affected by polluted water, 40.8 percent are from the Central zone, 35.7 percent respondents are from Ayyanthole zone and 23.7 percent are from Koorkancheri zone. Similarly respondents who are affected by air pollution are 39.7 percent from the Central zone and 36.5 percent from the Koorkancheri zone and remaining 23.8 percent are from Ayyanthole zone. Out of 225 respondents, 48 respondents are facing problems of noise pollution among which 35.4 percent are from Ayyanthole zone, 33.4 percent are from Koorkancheri zone and 31.2 percent are from the Central zone. Similarly, solid waste pollution affected respondents are higher in both Ayyanthole and Koorkancheri zones (34.2 percent) followed by the Central zone (31.6 percent).

In the central zone, 37.3 percent respondents are affected by water pollution, 30.1 percent are affected by air pollution, 18.1 percent are affected by noise pollution and

14.5 percent are having problems due to solid waste pollution. In the Ayyanthole zone, major pollution is water pollution. It is found that 37.5 percent respondents are affected by this. In Koorkancheri zone, higher percentage of pollution is marked in air pollution (32.8) percent respondents. Hence, it can be concluded that, there are severe environmental problems faced by the household respondents due to urbanization. There may be variations in different types of pollutions in different locations. For example, water pollution is higher in the Central zone and Ayyanthole zone, air pollution is higher in the Central zone and Koorkancheri zone, noise pollution is higher in all the zones and solid waste pollution is almost at the same level in all the three zones. Thus due to urbanization, there is environmental problems like water pollution, air pollution, noise and solid waste pollutions which adversely affects the living and health conditions of the households.

A cross-sectional analysis, which attempted to compare income levels of the sample respondents and environmental pollution magnitude are exhibited in table 6.2.

Table 6.2

Environmental Pollution at Different Income Levels of the Households

Types of Pollution	Annual Income (In Rupees)			**Total**
	Less than 1,00,000	1,00,000-2,00,000	More than 2,00,000	
Water Pollution	35 (46.0)	24 (31.6)	17 (22.4)	**76** (100.0)
Air Pollution	27 (42.8)	24 (38.1)	12 (19.1)	**63** (100.0)
Noise Pollution	27 (56.2)	14 (29.2)	7 (14.6)	**48** (100.0)
Solid Waste Pollution	19 (50.0)	14 (36.8)	5 (13.2)	**38** (100.0)
Total	**108** (48.0)	**76** (33.8)	**41** (18.2)	**225** (100)

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.

A combined analysis of environmental pollution at different income levels of the households in the study area is furnished in the table. Households having the income category of less than 1,00,000 rupees per annum are facing higher percentage of different types of pollutions. Among the respondents of this income level 56.2 percent are facing noise pollution, 50.0 percent are admitted to have solid waste pollution and46.0 and 42.8 percent respondents have water and air pollution problems respectively. The respondents with Rs.1,00,000-2,00,000 annual income found to have more of water and air pollution problems. The higher income category respondents (more than 2 lakhs rupees per annum) are comparatively having lower pollution problems than respondents with lower income levels.

6.2. (i) Water Pollution due to Urbanization

Water and air are the most indispensable fundamentals that nature has provided to sustain life on earth. It is a free gift of nature upon which all living things are depended. Water bodies include for example lakes, rivers, oceans, aquifers and ground water. Water has a great self generating capacity that can neutralize the polluting interventions carried out by humans. Due to human activities water bodies are contaminating which is leading to water pollutions. Water pollution results when contaminants are introduced into the natural environment. However, if human activities continue uncontrolled and unscientific exploration of water resources, its self generating capacity will fail which will results in deteriorating the quality of existing water resources.

Mainly the sources of water pollution are agricultural pollution, industrial pollution, domestic pollution, hydrocarbon pollution and sea water pollution. In the state the main source of water pollution is rapid urbanization and population pressure. About 90 percent of water pollution problems usually occur in urban areas. The growth of urban population leads to demand for more water for domestic as well as industrial use and treatment of wastes. Water pollution in urban areas is mainly due to domestic sewage and industrial/hospital/other effluents. The polluted water and its usage is the main cause for water borne diseases in urban areas. There may be seasonal variations in water pollution and availability of water. But commonly the urban areas are suffering from desecration of quality of water.

Figure 6.2 Photographs of Water pollution in Sample City

On the basis of the reference given by Kerala State Pollution Control Board (KSPCB) biological water quality criteria of region can be specified as given in the table 6.3.

Table 6.3

Biological Water Quality Criteria

Indicator Colour	Water Quality Class	Water Quality Characteristic
Blue	A	Clean (**Very good)**
Light Blue	B	Slight Pollution (**Good**)
Green	C	Moderate Pollution (**Bad**)
Orange	D	Heavy Pollution (**Very Bad**)

Source: Kerala State Pollution Control Board, 2013.

The quality of water is classified under 4 classes A, B, C, and D which are representing the characteristics of clean, slight pollution, moderate pollution and heavy pollution. Based on the above criteria the respondent's perception towards quality of water in the urban area is furnished in table 6.4. The responses towards quality of water are marked in 4 categories.

Table 6.4

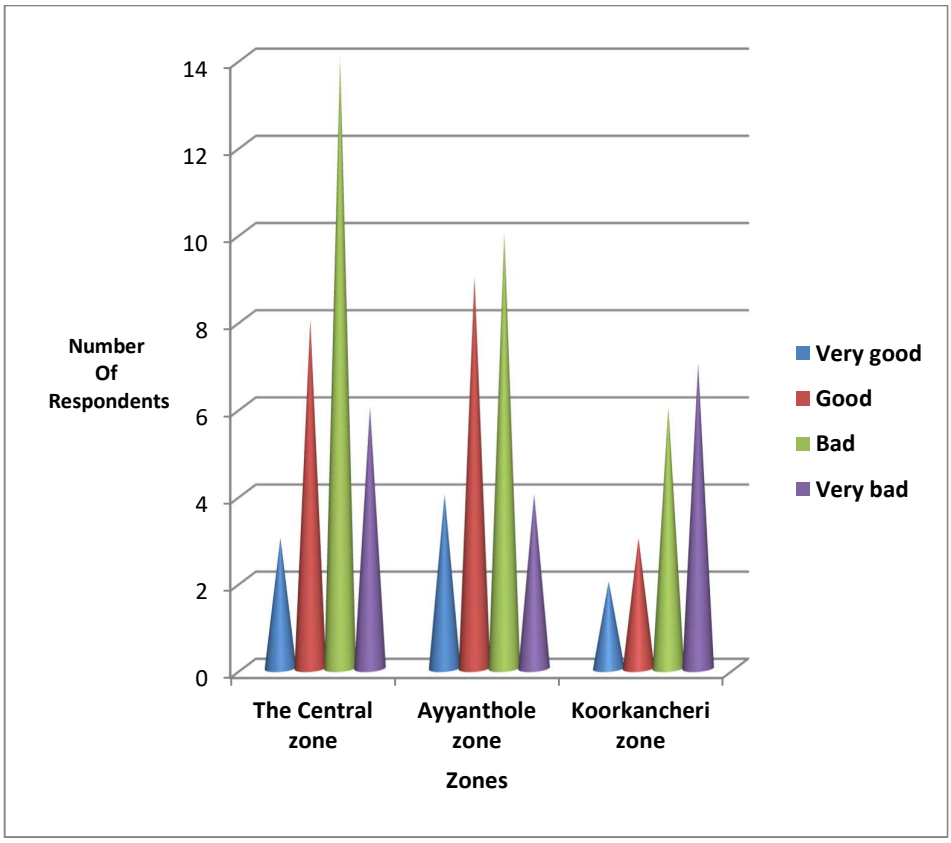
Quality of Water According to the Locations

Zones	Quality of Water				**Total**
	Very good	Good	Bad	Very Bad	
The Central zone	3 (9.7) [33.3]	8 (25.8) [40.0]	14 (45.2) [46.7]	6 (19.3) [35.3]	**31** (100.0) [40.8]
Ayyanthole zone	4 (14.8) [44.4]	9 (33.3) [45.0]	10 (37.1) [33.3]	4 (14.8) [23.5]	**27** (100.0) [35.5]
Koorkancheri zone	2 (11.1) [22.3]	3 (16.7) [15.0]	6 (33.3) [20.0]	7 (38.9) [41.2]	**18** (100.0) [23.7]
Total	**9** (11.8) [100.0]	**20** (26.3) [100.0]	**30** (39.5) [100.0]	**17** (22.4) [100.0]	**76** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicate column percentage.

Figure 6.3

Quality of Water According to the Locations



Out of 76 respondents, 9 respondents admitted water quality as very good, 20 respondents considered the water quality as good, 30 admitted that water quality is bad and 17 respondents admitted water quality as very bad. In other words 39.5 percent respondents are having bad quality water. Only 11.8 percent respondents are accessing very good quality water. Due to the poor maintenance of the drainage system, the waste water frequently get mixed up with the existing water resources. This is the main reason for deteriorating the quality of water in the study area.

In the slum areas of three zones, it is observed that there is severe problem of very bad quality of drinking water. These areas are besides the drainage or sewage system and it ultimately results in pollution of existing water. About 38.9 percent respondents marked the water quality as very bad in Koorkancheri zone. In Ayyanthole zone, 37.1 respondents categorized water quality as bad and in Central zone, 45.2 percent

respondents admitted water quality as bad. In non-slum areas, there is superiority of water quality. Similarly, respondents of high income category are having accessibility of very good quality water. Hence, there is significant relationship between the quality of water and the nature of locations namely slum and non-slum areas.

Lack of proper waste water drainage and sewage system is the main reason for quality deterioration of existing water resources in urban areas. The most important source of water for households is dug wells. But improper drainage system of urban areas results in polluting the wells. Similarly the attitude of people towards waste disposal in water bodies also makes deterioration in the quality of water resources. Industrial wastes, constructions wastes, vehicle lubrication system losses, hospital wastes etc. are the main sources of waste water in urban areas.

Water pollution ultimately results in health problems of the households. Due to water contamination, the respondents are affected by number of diseases. The responses towards water borne diseases are marked in table 6.5.

Table 6.5

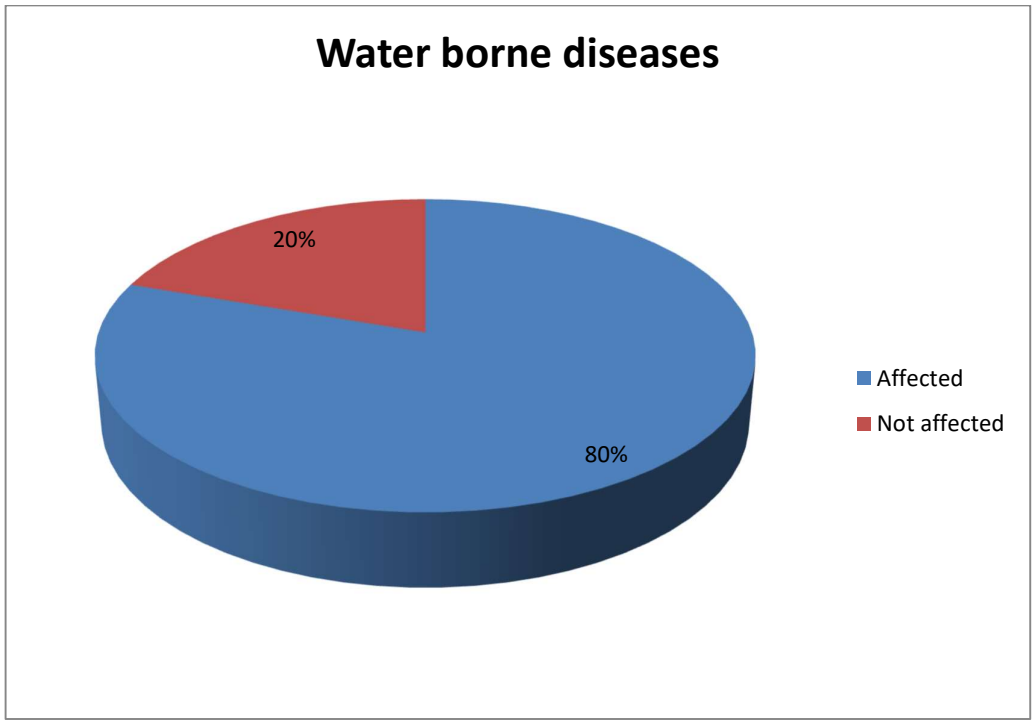
Responses towards Water Borne Diseases

Water Related Diseases	Name of Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Affected	26 (42.6) [83.9]	20 (32.8) [74.1]	15 (24.6) [83.3]	**61** (100.0) [80.3]
Not Affected	5 (33.3) [16.1]	7 (46.7) [25.9]	3 (20.0) [16.7]	**15** (100.0) [19.7]
Total	**31** (40.8) [100.0]	**27** (35.5) [100.0]	**18** (23.7) [100.0]	**76** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.4

Responses towards Water Borne Diseases



The table and the figure show that 80.3 percent respondents related with water pollution are affected by waterborne diseases. Only 19.7 percent respondents are not affected by these kinds of diseases. Among the 3 zones, water borne diseases are higher in the Central zone as well as in Koorkancheri zone compared to the Ayyanthole zone. The incidence of water borne diseases is found to be higher in the slum areas of all the 3 zones. It is interesting to note that 25.9 percent respondents of the Ayyanthole zone are not affected by water borne diseases. The higher percentage of affected respondents is in the Central zone (42.6 percent). Therefore, the data shows that water borne diseases are higher in slum areas compared to non-slum areas. Water contamination leads to water borne diseases among the households. There are health impacts due to water pollution.

Water contamination leads to several diseases in the study area. Some of the prominent water borne diseases affected by the respondents in the study area represented in table 6.6. Drinking contaminated water can lead to waterborne diseases

such as Cholera, Diarrhoea, Typhoid fever, Hepatitis A and E, and other diseases like Malaria, Dysentery, Filariasis, E.coli infection etc. These diseases are mainly found in slum areas rather than non-slum areas. Among the water borne diseases, Diarrhea is found as prominent in household respondents (34.4 percent). Similarly 18.0 percent households are suffered from Hepatitis A and E, 29.5 percent respondents had Typhoid fever and so on. Some of the respondents have other diseases like Malaria, Filariasis, Vibrio illness etc. The zone wise analysis shows that, incidence of Diarrhoea is higher in the Central zone (57.1 percent), Cholera is found higher in Koorkancheri zone (57.1 percent), Typhoid fever is higher in Ayyanthole zone (38.9 percent) and so on. Hence, almost all diseases are reported in sample areas due to water pollution in those areas.

Table 6.6

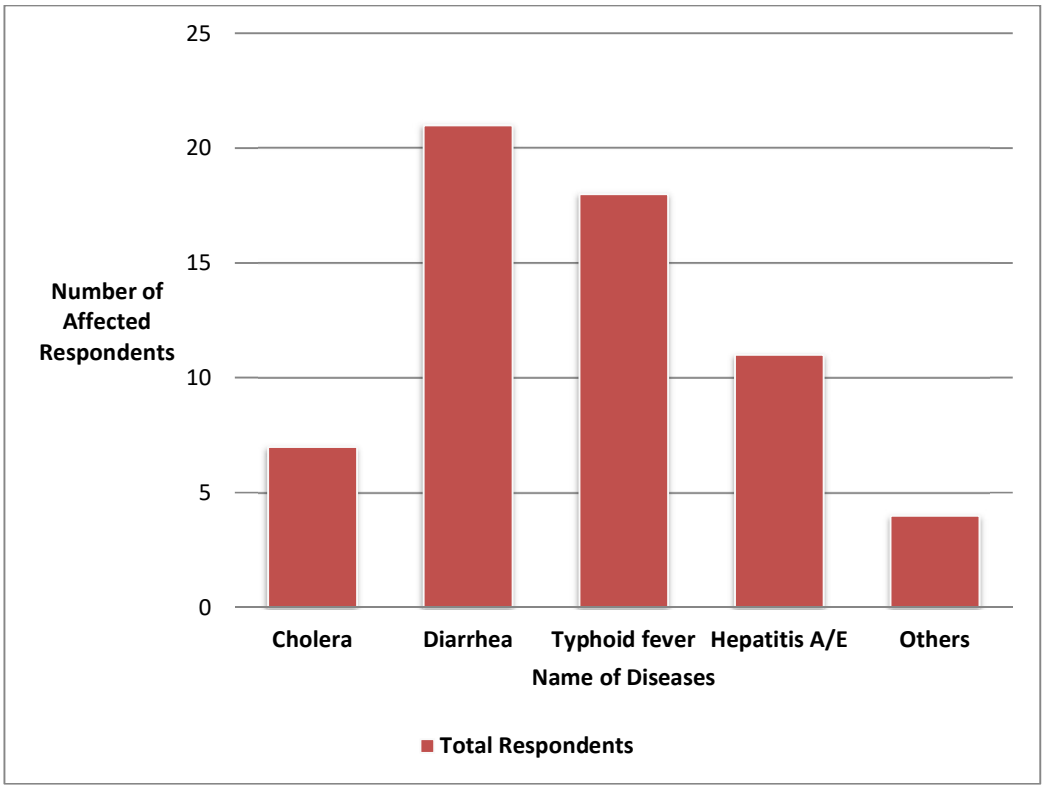
Name of the Water Borne Diseases Affected by the Respondents

Name of Diseases	Name of Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Cholera	2 (28.6) [7.7]	1 (14.3) [5.0]	4 (57.1) [26.7]	**7** (100.0) [11.5]
Diarrhoea	12 (57.1) [46.1]	6 (28.6) [30.0]	3 (14.3) [20.0]	**21** (100.0) [34.4]
Typhoid fever	6 (33.3) [23.1]	7 (38.9) [35.0]	5 (27.8) [33.3]	**18** (100.0) [29.5]
Hepatitis A/E	5 (45.4) [19.2]	4 (36.4) [20.0]	2 (18.2) [13.3]	**11** (100.0) [18.0]
Others	1 (25.0) [3.9]	2 (50.0) [10.0]	1 (25.0) [6.7]	**4** (100.0) [6.6]
Total	**26** (42.6) [100.0]	**20** (32.8) [100.0]	**15** (24.6) [100.0]	**61** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.5

Name of the Water Borne Diseases Affected by the Respondents



The spread of waterborne diseases will lead to higher health cost for the respondents. It is estimated that out of the total earnings of the household respondents a sizable amount has to be spend for medical treatment. This amount may differ in seasonal variations. For example in rainy seasons the incidence of water borne diseases is higher compared to summer season. The estimation of monthly cost incurred by respondents due to water pollution is represented in table 6.7.

About 14.7 percentage respondents incurred a monthly cost of less than 500 rupees for medical treatment of waterborne diseases.Among the respondents 29.5 percent had to spend 500 – 1000 rupees, 40.9 percent respondents incurred 1000 – 1500 rupees, and 14.9 percent respondents spend more than 1500 rupees monthly for medical treatment due to water borne diseases. The cost is found to be higher in the slum areas of Koorkancheri as well as the Central zone. Among the high income group the expenses for medical treatment due to water contamination is marginal. Mainly the

cost is incurred on treatment for fever especially in rainy seasons. In the Ayyanthole zone, 50.0 percent respondents incurred a cost of 1000 – 1500 rupees for health treatment.

Table 6.7

Monthly Cost incurred on Water Borne Diseases

Total Cost in Rupees	Name of the Zones			**Total Respondents**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Less than 500	4 (44.4) [15.4]	1 (11.2) [5.0]	4 (44.4) [26.7]	**9** (100.0) [14.7]
500 - 1000	8 (44.4) [30.8]	7 (38.9) [35.0]	3 (16.7) [20.0]	**18** (100.0) [29.5]
1000 – 1500	10 (40.0) [38.4]	10 (40.0) [50.0]	5 (20.0) [33.3]	**25** (100.0) [40.9]
More than 1500	4 (44.4) [15.4]	2 (22.2) [10.0]	3 (33.4) [20.0]	**9** (100.0) [14.9]
Total	**26** (42.6) [100.0]	**20** (32.8) [100.0]	**15** (24.6) [100.0]	**61** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Hence, the data shows that due to deterioration in quality of available water, the residents of slum areas in the city are affected more in two grounds. Firstly, due to increased health problems; and secondly, due to low income and high health expenses. In order to avoid these problems, the authorities of the urban area should be more responsible to provide good quality water to the residents and ensure the quality regularly through efficient monitoring. This will reduce the recurring expenditure on health and will reduce economic burden of the residents.

To analyze the variances in water borne diseases in three sample zones ANOVA is used. This method is viewed to verify the differences in sample zones in the spread of water borne diseases as it leads to economic issues of the households. The result is exhibited in table 6.8.

Table 6.8

ANOVA (Water- Borne Diseases)

Source of Variation	Sum of Sq. between samples	D.f	Mean Sq. between Samples	F
The Central Zone	31	7	3.7	1.96
Ayyanthole Zone	29	9	3.2	1.74
Koorkancheri Zone	29	8	3.6	1.98

Source: Survey Data

The results of the ANOVA method clearly implied that the F ratio is significantly low in all the cases. This shows that, there are no significant variations in water borne diseases in all the three sample zones. Hence, all the sample zones have similar health impacts due to water pollution.

Hence, the analysis of urbanization and water pollution concludes that there is higher level of water pollution in urban areas where there is high population density. The quality of available water is not satisfactory and because of unscientific sewage and drainage system, water resources are found contaminated. This water contamination influences badly upon the residents in the form of waterborne diseases. For meeting the expenses on waterborne diseases households need to spend sizable amount of money which leads to economic burden for the households. Thus urbanization in an unplanned manner is leading to water pollution and related health and economic issues in the state.

6.2. (ii)Air Pollution Due to Urbanization

The quality of air in Indian cities is a major environmental concern. Recent studies show that India's air pollution is in a critical level compared to other countries of the world. Fuel burning vehicles including trucks, jeeps, cars, trains and airplanes emit harmful gases which causes immense amount of pollution. WHO conducted a study about the air pollution index in cities all over the world and revealed that, 13 of the world's 20 cities with the highest annual levels of air pollution are in India (WHO, 2016). Accelerating growth in the transport sector, booming construction industry, and growing industrial sector are responsible for worsening air pollution in India. Dust & construction, waste burning, transport sector, diesel generator, industries,

domestic cooking are the main contributors of India's air pollution. Among them, dust & construction contribute about 45% to the pollution in India, which is followed by waste burning (WHO, 2016).

Vehicles and industries are mainly responsible for the deterioration of air quality in Kerala. It is found that among the main sources of air pollution, vehicular exhausts have become a major source of air pollution in sample areas of Thrissur city. The consumption of petroleum products in vehicles, industries and burning of plastic wastes by households in the open space results in emission of air pollutants in large quantities. These emissions are of two forms- solid particles (SPM) and gaseous emissions (SO_2, $NO_2$and Co etc.). Health problems such as asthma, chronic bronchitis, heart diseases, TB, Cancer and oxygen deficiency in blood are contributed mainly byhigh levels of air pollution. The attitude of the respondents towards air pollution and related issues are analyzed in this section.

Figure 6.6

Photographs of Air Pollution in Sample City

The household respondents who are affected due to polluted air are having related health issues. Table 6.9 shows the number of air pollution affected respondents in 3 zones of the city.

Table 6.9

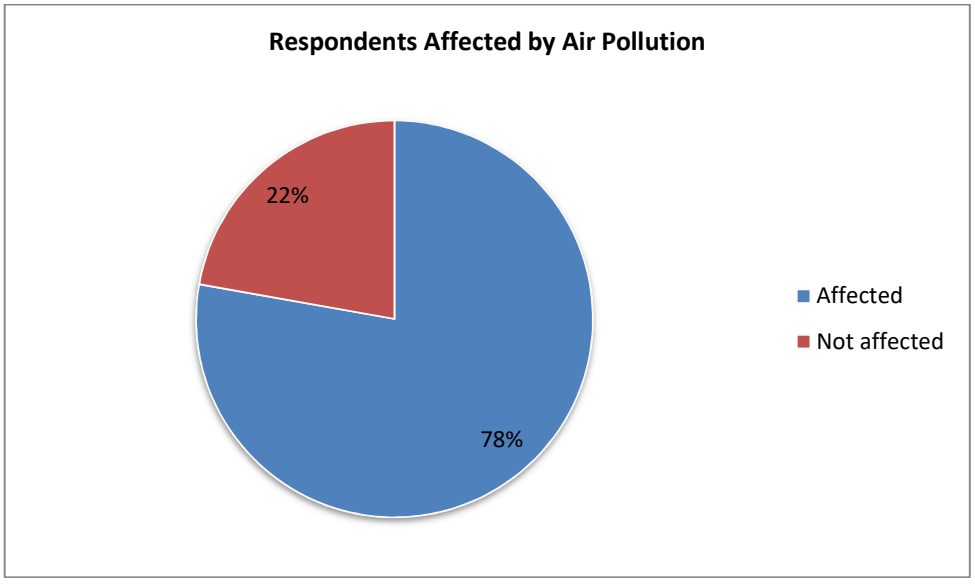
Total Number of Respondent Affected by Air pollution

Air pollution	Name of the Zones			**Total Respondents**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Affected	19 (38.8) [76.0]	12 (24.5) [80.0]	18 (36.7) [78.3]	**49** (100.0) [77.8]
Not affected	6 (42.8) [24.0]	3 (21.4) [20.0]	5 (35.8) [21.7]	**14** (100.0) [22.2]
Total	**25** (39.7) [100.0]	**15** (23.8) [100.0]	**23** (36.5) [100.0]	**63** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.7

Total Number of Respondent Affected by Air pollution



The respondents who are affected by air pollution are 49 (77.8%) and 14 respondents are not affected by polluted air. Out of the 25 respondents of the Central zone who are

responded towards air pollution, 19 (76.0%) are affected by polluted air. Out of the 15 respondents of the Ayyanthole zone, 12 (80.0%) are admitted to have affected due to air pollution. Similarly, out of the 23 respondents of Koorkancheri zone, 18 (78.3%) have problems due to air pollution.

It is worthwhile to mention that out of the 63 respondents 77.8% have admitted to have air pollution problems. Among them 38.8 percent respondents are from the Central zone, 24.5 percent are from the Ayyanthole zone and 36.7 percent are from the Koorkancheri zone. Hence, the study reveals that most of the respondents who are affected by air pollution are residing in the Central zone and Koorkancheri zone. The households in these zones are concerned about air pollution. This is due to the emissions from large number of vehicles in these areas. The discharge of vehicular harmful gases is inhaled by the residents and causes serious health issues.

The main contributors or agents of air pollution in there zone are represented in table 6.10.

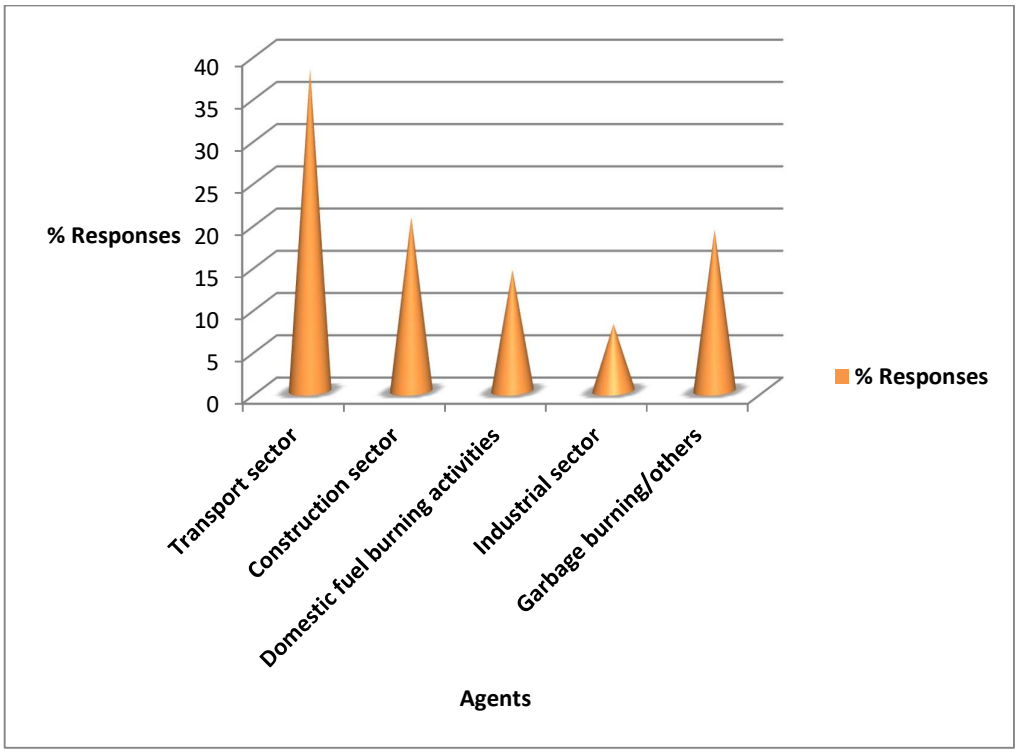
Table 6.10 Main Contributors of Air Pollution

Agents for air pollution	Name of Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Transport sector	10 (41.7) [40.0]	4 (16.6) [26.7]	10 (41.7) [43.5]	**24** (100.0) [38.1]
Construction sector	2 (15.4) [8.0]	4 (30.8) [26.7]	7 (53.8) [30.4]	**13** (100.0) [20.6]
Domestic fuel burning activities	4 (44.4) [16.0]	2 (22.2) [13.3]	3 (33.4) [13.0]	**9** (100.0) [14.3]
Industrial sector	2 (40.0) [8.0]	2 (40.0) [13.3]	1 (20.0) [4.3]	**5** (100.0) [7.9]
Garbage burning /others	7 (58.3) [28.0]	3 (25.0) [20.0]	2 (16.7) [8.8]	**12** (100.0) [19.1]
Total	**25** (39.7) [100.0]	**15** (23.8) [100.0]	**23** (36.5) [100.0]	**63** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.8

Main Contributors of Air Pollution



The table shows that main contributors of polluted air are transport sector, construction activities, domestic fuel burning activities, industrial sector and garbage burning. Among them, transport sector occupies the top position in polluting the air by its emission of harmful gases to the environment. 38.1 percentage respondents considered transport sector as the chief agent of air pollution. 20.6 percent respondents consider construction sector responsible for air pollution, 19.1 percent considered garbage burning as the main agent of air pollution, 14.3 percent considered domestic fuel burning activities as the main contributor of polluted air and 7.9 percentage respondents considered industrial sector as the chief agent of air pollution.

In the sample area there are vegetable markets, bust stations, hospitals, some industrial units and other institutions. Due to failure of proper waste treatment, the wastes including plastic garbage are burned openly in roadsides and public places. Similarly existence of large number of public as well as private vehicles results in traffic congestion and are leading to high emissions of carbon monoxide.

The table 6.10 also shows that in the zone wise analysis, the respondents in large numbers from the three zones are admitted that the transport sector is the chief contributor of air pollution. In the Ayyanthole zone, construction sector is considered as the main agent of air pollution. 26.7 percent respondents admitted that construction activities are responsible for air pollution. Similarly, in the Koorkancheri zone, most of the respondents, that is, 43.5 percent and 30.4 percent articulated that air is polluted due to transport sector and construction sector respectively. Hence, it can be concluded that air pollution is the main environmental issue of urbanization which is contributed by transport sector and other urban amenities.

The pollution of air is a serious issue of urban life as it is influential in increasing the air related diseases. Polluted air is a life threatening one as it is leading to morbidity. Table 6.11 shows some of the airborne diseases affected by the respondents in sample areas.

Table 6.11

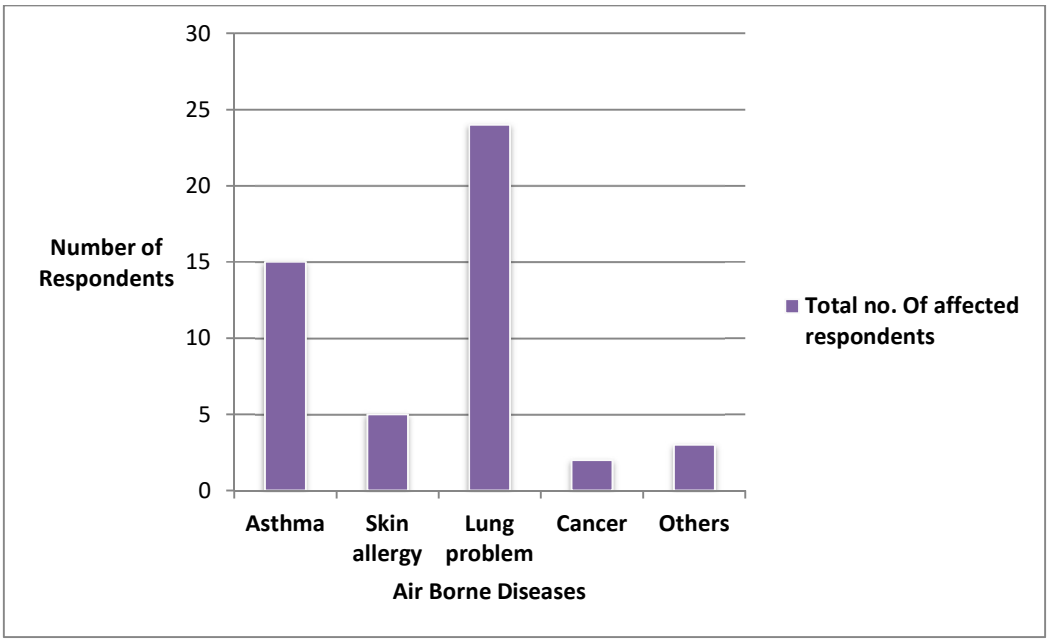
Name of the Air Borne Diseases Affected by the Respondents

Diseases	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Asthma	7 (46.7)	3 (20.0)	5 (33.3)	**15** (100.0) [30.6]
Skin Allergy	2 (40.0)	1 (20.0)	2 (40.0)	**5** (100.0) [10.2]
Lung Problem	8 (33.3)	7 (29.2)	9 (37.5)	**24** (100.0) [48.9]
Cancer	-	1 (50.0)	1 (50.0)	**2** (100.0) [4.1]
Others	2 (66.7)	-	1 (33.3)	**3** (100.0) [6.2]
Total	**19** (38.8)	**12** (24.5)	**18** (36.7)	**49** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.9

Name of the Air Borne Diseases Affected by the Respondents



The table 6.11 highlights that the respondents in sample areas are affected by diseases like Asthma, Skin Allergy, Lung problems, Cancer and other diseases due to polluted air. Due to the existence of carbon monoxide, Sulphur dioxide, nitrogen oxides and particulate matter, the air is worsening day by day and inhaling this polluted air leads to morbidity. Among the 49 respondents who are affected by air pollution, 48.9 percent have lung problems, 30.6 percent have Asthma, 10.2 percent have skin allergy, 4.1 percent have reported cancer and 6.2 percent have other related diseases.

Among the zones, Ayyanthole and Koorkancheri zones have higher incidence of cancer. This is because of the existence of waste dumping ground. In the Central zone, Asthma and lung problems are higher in respondents. The lung problems and Asthma are mainly found in the areas where there is existence of high level of particulate matter and carbon monoxide. Among the Asthma patients, 46.7 percent are from the Central zone and 33.3 percent are from the Koorkancheri zone. Hence, it can be concluded that there is relationship between air pollution and growing diseases in the sample areas.

The main contributors of air borne diseases in the city are CO, SO_2, NO_2, PM (Particulate Matter) and RSPM (Respirable Suspended Particulate Matter). In order to

analyze the health impacts of air pollution, the study concentrated to estimate the composite of air pollution in the city. Based on the state environment report and report of the pollution control board, the main air pollutants of the city are Carbon Monoxide (CO) which accounts for 64.4%, Sulphur Dioxide (SO_2) which accounts for 20.7%, Nitrogen Oxides (NO_2) which accounts for 2.9%, Particulate Matter (PM) which accounts for 6.9% and Ozone (O_3) which contributes 5.1% (State Pollution Control Board, 2016) . This data reveals the fact that, Carbon Monoxide dominates in the air pollutants which has been emitted by the motor vehicles in the sample area.

In order to find out the economic costs of air borne diseases or health impacts of air borne diseases, two concepts or methods are used in many countries. They are Work Loss Day Analysis (WLD), Dose – Response studies and Cost of Illness approach.

Work Loss Day (WLD):- The estimate of work loss day is an appropriate method to assess the impact of polluted air on health in the form of morbidity. This method is successfully used in USA during 1980's. To find out the association between morbidity and WLD the study took into consideration WLD for employed people and Restricted Activity Days (RAD) for the combined sample of adults and other non workers. Findings of the study revealed that, one percent increase in particulates would lead to an increase in WLD by about 0.45% and RAD by 0.31% for all people in the age group of 18-65 years. The results of the study proved thatthe association between air pollution and health impacts is stronger in developing countries compared to developed countries (Ostro, 1983).

Cost of Illness Approach:- Cropper (1982) employed Cost of Illness (COI) approach as an alternative for valuing morbidity. This approach uses estimates of the economic costs of health care and lost output up to recovery or death. COI comprises the sum of direct costs; which includes hospital treatment, medical care, drugs and so on and indirect costs, which is the value of output lost (wage rate X lost hours or imputed wage for home services).

Among the three estimates WLD is used to find out the impact of air pollution on working loss day of the respondents. This is represented in table 6.12. On the basis of the analysis 39.7 percent respondents lost their work less than 50 days in a year due to air pollution which consist of 44 percent in the Central zone, 32 percent in Koorkancheri zone and 24 percent in Ayyanthole zone. 25.4 percent respondents lost

their work for 50 -75 days which accounts for 43.7 percent in the Central zone, 25.0 percent in Ayyanthole zone and 31.3 percent in Koorkancheri zone. Similarly, it is estimated that 28.6 percent respondents who are affected by air pollution lost their work for 75 – 100 days in a year comprising of 44.5 percent in Koorkancheri zone, 33.3 percent in the Central zone and 22.2 percent in the Ayyanthole zone.

Table 6.12

Work Loss Days (Air Pollution) of the Respondents

WLD/year (Air)	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Less than 50	11 (44.0) [44.0]	6 (24.0) [40.0]	8 (32.0) [34.8]	**25** (100.0) [39.7]
50 – 75	7 (43.7) [28.0]	4 (25.0) [26.7]	5 (31.3) [21.7]	**16** (100.0) [25.4]
75 – 100	6 (33.3) [24.0]	4 (22.2) [26.7]	8 (44.5) [34.8]	**18** (100.0) [28.6]
More than 100	1 (25.0) [4.0]	1 (25.0) [6.6]	2 (50.0) [8.7]	**4** (100.0) [6.3]
Total	**25** (39.7) [100.0]	**15** (23.8) [100.0]	**23** (36.5) [100.0]	**63** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

The table also shows that 6.3 percent of the affected respondents lost their work for more than 100 days in a year. Hence, it can be concluded that the work loss days are comparatively higher in the Central as well as Ayyanthole zones. Due to increase in work loss day the respondents face huge economic crisis in meeting their day to day expenses. Thus health issues contributed by air pollution, influence badly on economic levels of the households.

The cost of air pollution implies the cost which has been incurred by the respondents for medical treatments due to air borne diseases. The particulars of the cost incurred

by the respondents towards averting their diseases in different locations are explained in table 6.13.

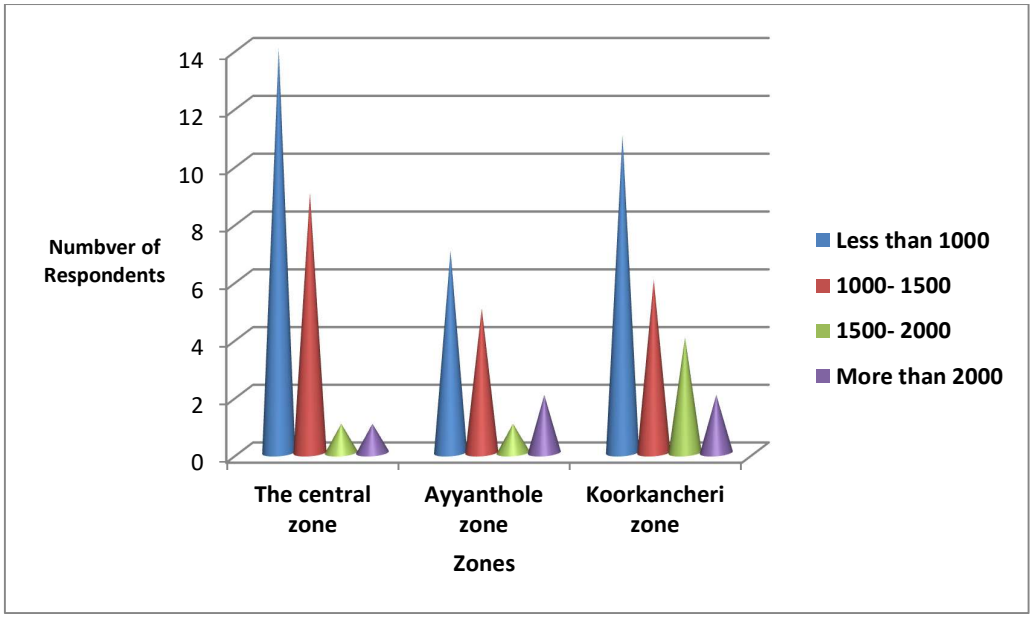
Table 6.13 Monthly Cost incurred on Air Borne Diseases

Total Cost in Rupees	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Less than 1000	14 (43.7) [56.0]	7 (21.9) [46.7]	11 (34.4) [47.8]	**32** (100.0) [50.8]
1000 - 1500	9 (45.0) [36.0]	5 (25.0) [33.3]	6 (30.0) [26.1]	**20** (100.0) [31.7]
1500 – 2000	1 (16.7) [4.0]	1 (16.7) [6.7]	4 (66.6) [17.4]	**6** (100.0) [9.6]
More than 2000	1 (20.0) [4.0]	2 (40.0) [13.3]	2 (40.0) [8.7]	**5** (100.0) [7.9]
Total	**25** (39.7) [100.0]	**15** (23.8) [100.0]	**23** (36.5) [100.0]	**63** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.10

Monthly Cost incurred on Air Borne Diseases (In Rupees)



The impact of air pollution is mainly upon the health status of people. A significant portion of the total income of the households is diverted towards meeting the medical expenses to avoid the diseases from pollution. It is observed that out of the total respondents who are affected by the air pollution, 50.8 percent pay out less than 1000 rupees per month, among this 43.7 percent are from the Central zone, 34.4 percent are from Koorkancheri zone and 21.9 percent are from the Ayyanthole zone. 31.7 percent respondents spend Rs. 1000 – 1500 monthly which consists of 45 percent from the Central zone, 30 percent are from the Ayyanthole zone. Similarly 9.6 percent respondents spend an amount of Rs. 1500 – 2000 per month and 7.9 percent spend more than 2000 rupees as medical expenses due to air pollution. The cost incurred as health issues are found higher in congested areas of slums of the Central as well as Koorkancheri zones. Hence, there is a need for higher expenditure on health issues due to polluted air. Thus there is negative impact of urbanization on environment as it leads to air pollution and related to health as well as economic issues.

Table 6.14 shows the allocation of expenditure/cost on different air borne diseases due to polluted air. The main diseases in the sample areas and the monthly cost incurred on each of them are furnished in the table.

Table 6.14

Monthly Cost of Air pollution and Air Borne Diseases

Cost in Rupees	Diseases Due to Air Pollution					**Total**
	Asthma	Skin Allergy	Lung Problem	Cancer	Others	
Less than 1000	6 (33.3)	3 (16.7)	6 (33.3)	2 (11.1)	1 (5.6)	**18** (100.0)
1000-1500	3 (15.0)	2 (10.0)	15 (75.0)	-	-	**20** (100.0)
1500-2000	3 (50.0)	-	2 (33.3)	-	1 (16.7)	**6** (100.0)
More than 2000	3 (60.0)	-	1 (20.0)	-	1 (20.0)	**5** (100.0)
Total	**15** (30.6)	**5** (10.2)	**24** (48.9)	**2** (4.1)	**3** (6.2)	**49** (100.0)

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.

Out of the total respondents who are adversely affected by air pollution spend an amount varies from less than 1000 rupees to more than 2000 rupees monthly on treatment of diseases like Asthma, Lung problem, Skin allergy, Cancer etc. 20 respondents spend 1000 – 1500 rupees monthly out of which 75 percent are suffering from lung problems, 15 percent have asthma and 10 percent have skin allergy problems. Similarly cost incurred on cancer treatment is prevailing in the sample areas. 18 respondents spend less than 1000 rupees as monthly cost of air pollution diseases, 6 respondents pay an amount of Rs, 1500 – 2000 as a cost on treatment of diseases like asthma, lung problem and other related diseases. This, it is clear that along with health issues, the household respondents have to face economic issues due to air pollution in urban areas. Thus unplanned urban development adversely related to environment.

In order to find out variances in air borne diseases in sample areas ANOVA method is applied. The method is used to study the differences in three sample zones in the spread of diseases due to air pollution. The result is given in the table 6.15.

Table 6.15

ANOVA (Air- Borne Diseases)

Source of Variation	Sum of Sq. between Samples	D. f	Mean Sq. between Samples	F
The Central Zone	30	6	4.2	2.19
Ayyanthole Zone	28	8	3.5	1.96
Koorkancheri zone	26	7	3.7	2.85

Source: Survey Data

The Analysis of Variance in air- borne diseases in three sample zones shows that, the F ratio is significantly low in all the cases. Therefore, on the basis of the analysis it is found that there are no significant variations in air borne diseases in three sample zones. Hence, all the sample areas represent similar health impacts due to air pollution.

In short, the urban areas are under the threat of air pollution which is harmful to the living organisms. The emission of gases to the environment contributed by massive vehicular population adversely affects the air and brings health issues to human

resources. Similarly, construction activities, industrial sectorgarbage disposal and waste burning by households and other agents of air pollution contribute a large amount of pollution particles and gases to the environment. This makes the pollution level beyond the limit. The health impact of air pollution is higher in the state expenditure as medical expenses on such diseases enhances economic burden. This contribute economic burden to the households. Hence, the aim of sustainability (ecological, social and economic) is found to be unfulfilled.

Hypothesis Testing on Water and Air Pollution

For the purpose of hypothesis testing the monthly cost incurred on different diseases due to water and air pollution is considered.

Null Hypothesis (**Ho**):

The lower rate of water and air pollutions, leads to the higher amount of health cost in the sample areas.

Alternative Hypothesis (**H_1**):

The higher rate of water and air pollutions, leads to the higher amount of health cost in the sample areas.

Table 6.16 represents chi-square test value on water and air borne diseases and cost of these diseases incurred by the respondents in the form of medical expenses.

Table 6.16

Chi-square Test of Water and Air Pollution Diseases and Health Cost

Tests	Value	df	Asymp. Sig. (2-sided)
Pearson chi- square	52.021	12	.000
Likelihood Ratio	53.807	12	.000
Linear – by- linear Association	7.823	1	.005
No. of valid cases	110		

Note:a 10 cells (50.0%) have expected count less than 5. The minimum expected count is .60.

The test of hypothesis reveals that the calculated chi-square value of (52.021) cost of air pollution and diseases are greater than the tabulated value at one percent level of

significance. Therefore, null hypothesis is rejected and alternative hypothesis is accepted. That means the higher rate of water and air pollution leads to the higher amount of health cost in the sample areas of Thrissur District.

Inshort, the above analysis of water pollution and air pollution based on the household responses highlights the fact that there are water and air pollution in the urban areas with severe health impacts. The influence of health issues are found in the economic condition of the households. Hence, the impact of urbanization on sustainable environment is found to be negative in cities.

6.2.(iii) Solid waste Pollution Due to Urbanization

Unscientific urbanization brings waste as an inevitable by-product of human activities. Urbanization and improved standard of living increase the amount and complexity of solid waste. The generation of municipal solid waste may be either during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, or other human activities including municipal, agricultural and special. Increasing levels of solid waste result in degradation of the urban environment. Harmful impact on environment undermines sustainable development and this ultimately affects the people residing in that area. The present study tries to analyze the density of solid waste population due to urbanization of solid waste the responses from the sample areas.

Figure 6.11 Photographs of Solid Waste Pollution in Sample City

Municipal solid wastes are the most visible form of pollution. Thousands of tons of solid wastes one generated in the city from various sources. But a smaller percentage is properly collected and treated. The waste management system of the city is not functioning properly. Because of this, the amount of solid waste is mounting up day by day. The methods which are usually used for disposing waste pose serious threat to environment and human health, particularly to those living in slum areas. The responses of the households towards the causes for increasing solid waste in the city are given in table 6.17.

Table 6.17

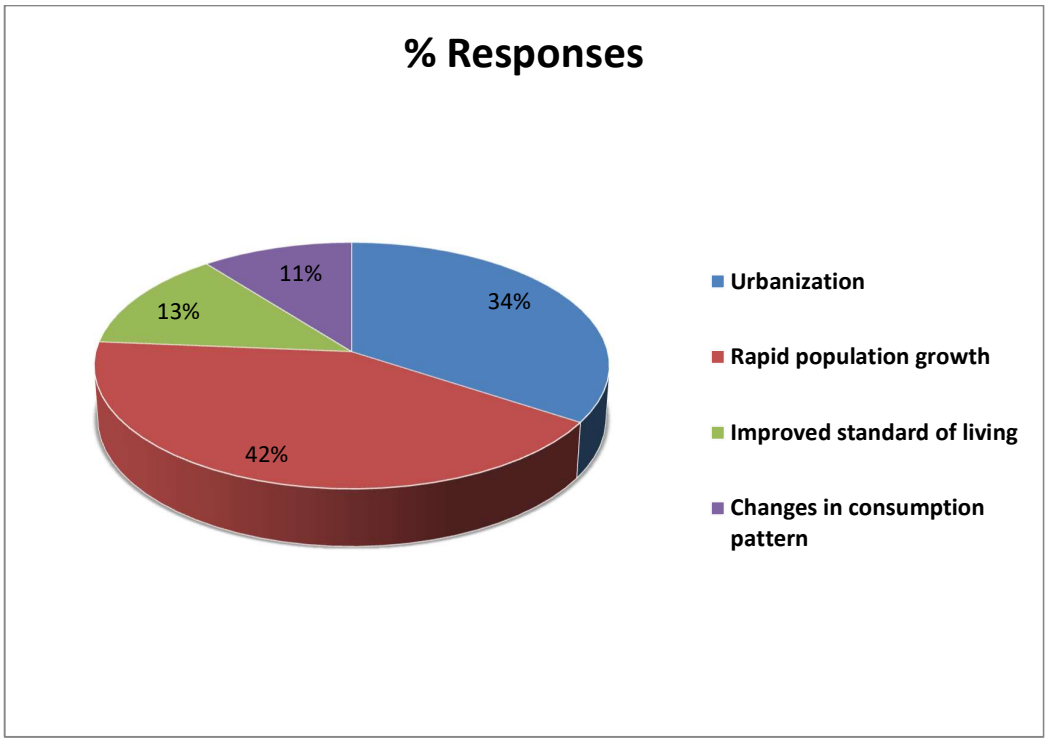
Causes for Increasing Municipal Solid Waste

Causes	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Urbanization	3 (23.0) [25.0]	5 (38.5) [38.5]	5 (38.5) [38.5]	**13** (100.0) [34.2]
Rapid population growth	7 (43.7) [58.4]	5 (31.3) [38.5]	4 (25.0) [30.7]	**16** (100.0) [42.1]
Improved standard of living	1 (20.0) [8.3]	2 (40.0) [15.4]	2 (40.0) [15.4]	**5** (100.0) [13.1]
Changes in consumption pattern	1 (25.0) [8.3]	1 (25.0) [7.6]	2 (50.0) [15.4]	**5** (100.0) [10.6]
Total	**12** (31.6) [100.0]	**13** (34.2) [100.0]	**13** (34.2) [100.0]	**38** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.12

Causes for Increasing Municipal Solid Waste



Among the causes for increasing municipal solid wastes, 42.1 percent respondents consider rapid population growth as the major cause in which 43.7 percent are from the Central zone, 31.3 percent are from the Ayyanthole zone and 25.0 percent are from the Koorkancheri zone. Similarly 34.2 percent respondents consider urbanization as the chief cause for mounting up of solid waste among which 38.5 percent each are from the Ayyanthole and Koorkancheri zone and 23 percent are from the Central zone. Out of the total respondents who consider municipal solid waste pollution as the main environmental pollution, 13.1 consider improved standard of living of the people as the main source of solid waste generation and 10.6 respondents admit that changes in the consumption pattern of the people are responsible for solid waste generation. Hence, it can be calculated that urbanization, rapid urban population growth, improved standard of living, and changes in consumption pattern are responsible for increasing the level of solid waste in urban areas.

Table 6.18 is furnished with the details of sources of solid waste generation in sample areas. The responses of the households are marked in percentages.

Table 6.18

Major Sources of Solid Waste Generation in the Sample Area

Sources	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Households	5 (38.4) [41.7]	4 (30.8) [30.8]	4 (30.8) [30.8]	**13** (100.0) [34.2]
Construction activities	1 (12.5) [8.3]	5 (62.5) [38.5]	2 (25.0) [15.4]	**8** (100.0) [21.0]
Shops & Markets	3 (27.2) [25.0]	3 (27.2) [23.1]	5 (45.6) [38.5]	**11** (100.0) [28.9]
Hospitals/Marriage halls/Institutions	2 (40.0) [16.7]	1 (20.0) [7.6]	2 (40.0) [15.3]	**5** (100.0) [13.2]
Others	1 (100.0) [8.3]	-	-	**1** (100.0) [2.7]
Total	**12** (31.6) [100.0]	**13** (34.2) [100.0]	**13** (34.2) [100.0]	**38** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

In the study area major sources of solid waste generation are households, construction activities, shops and markets, hospitals, marriage halls, institutions and other activities like street sweeping, slaughter houses etc. Among these sources, household sector is considered as the major source by 34.2 percent respondents in which 38.4 percent are from the Central zone, 30.8 each are from the Ayyanthole zone and Koorkancheri zone. The city is having higher number of shops and markets and hence the waste generated by these are considered as the major source by 28.9 percent respondents among which 45.6 percent are from the Koorkancheri zone and 27.2 percent each from the Central zone and the Ayyanthole zone. 21 percent respondents consider construction activities as the main source of solid waste pollution. Similarly, 13.2 percent respondents claim upon institutions, hospitals and marriage halls for creating solid waste pollution. Thus, generation of solid waste is severe problem in urban areas

whether it is from household sector or others. The huge amount of wastes which are dumped in the open places of the city are not treated or disposed properly.

Major threat of solid waste pollution is upon the resident households in the form of diseases which are given in table 6.19.

Usually, diseases such as breathing problem, irregular fever, various types of allergies, typhoid, malaria, lung infections are the different types of diseases associated with solid waste pollution. Improper disposal of wastes will bring lung problems or breathing problems to a large extend. Solid wastes are the chief sources of several types of bacteria and mosquitoes which create fever, malaria, typhoid and allergies. Out of the total respondents in solid waste pollution, 28.9 percent are suffering from breathing problems, 26.3 percent have irregular fever, 18.5 percent have lung infections, 15.8 percent respondents have allergies and 10.5 percent have typhoid/malaria.

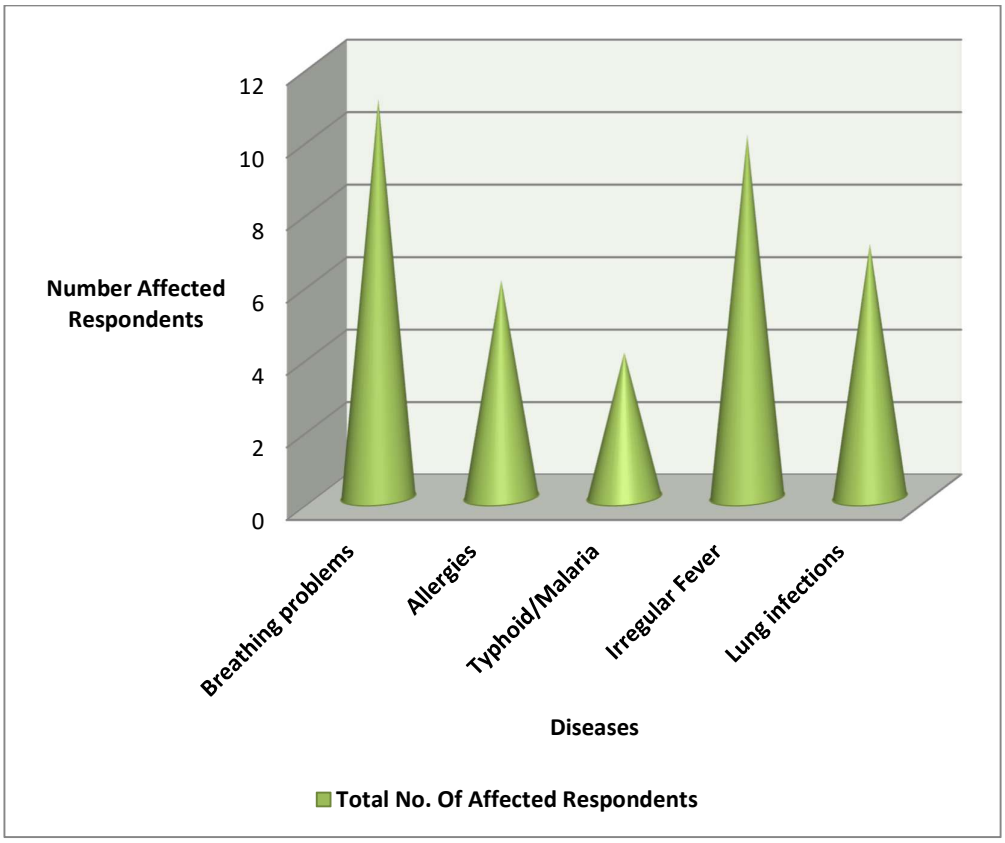
Table 6.19
Major Diseases Due to Solid Waste Pollution

Diseases	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Breathing Problems	3 (27.3) [25.0]	3 (27.3) [23.1]	5 (45.4) [38.5]	**11** (100.0) [28.9]
Allergies	3 (50.0) [25.0]	1 (16.7) [7.7]	2 (33.3) [15.4]	**6** (100.0) [15.8]
Typhoid /Malaria	1 (25.0) [8.3]	3 (75.0) [23.1]	-	**4** (100.0) [10.5]
Irregular Fever	4 (40.0) [33.4]	2 (20.0) [15.4]	4 (40.0) [30.7]	**10** (100.0) [26.3]
Lung Infections	1 (14.3) [8.3]	4 (57.1) [30.7]	2 (28.6) [15.4]	**7** (100.0) [18.5]
Total	**12** (31.6) [100.0]	**13** (34.2) [100.0]	**13** (34.2) [100.0]	**38** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.13

Major Diseases Due to Solid Waste Pollution



The zone wise analysis shows that in all the 3 zones, common diseases due to solid waste pollution are irregular fever, breathing problems lung infections etc. The incidence of these diseases is found higher in slum areas of the city where the amount of solid wastes is higher. The wastes on a large amount are dumped in open spaces and market places without the consideration of its health impacts. Thus there is close association between solid waste pollution and diseases.

The main impact of diseases due to solid waste pollution is the working loss days of the households. The number of WLD in 3 zones is given in table 6.20.

The table shows that among the total respondents who are affected by the solid waste pollution, 34.2 percent lost their work in between 35 – 45 days in a year which consist of 38.4 percent respondents from Koorkancheri zone, 30.8 percent each from the Central as well as the Ayyanthole zone. Likewise 26.3 percent respondents have working for less than 25 days in a year 21.1 percent have work loss for 25 – 35 days

and 18.4 percent respondents have loss of work days for more than 45 days. The data shows that because of these working loss days the income of the households reduces on the one hand; the cost needed to incur on meeting the medical expenses of diseases creates heavy economic burden on the other. Hence, the increasing solid waste generation and pollution leads to increasing number of work loss days of the households in urban areas.

Table 6.20

Work Loss Days of the Respondents Due to Solid Waste Pollution

WLD / Year	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Less than 25	3 (30.0) [25.0]	3 (30.0) [23.1]	4 (40.0) [30.8]	**10** (100.0) [26.3]
25 – 35	3 (37.5) [25.0]	2 (25.0) [15.3]	3 (37.5) [23.1]	**8** (100.0) [21.1]
35 – 45	4 (30.8) [33.3]	4 (30.8) [30.8]	5 (38.4) [38.4]	**13** (100.0) [34.2]
More than 45	2 (28.6) [16.7]	4 (57.1) [30.8]	1 (14.3) [7.7]	**7** (100.0) [18.4]
Total	**12** (31.6) [100.0]	**13** (34.2) [100.0]	**13** (34.2) [100.0]	**38** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

The annual cost incurred by the households on diseases due to solid waste pollution is highlighted in table 6.21.

Out of the total respondents of solid waste pollution, 31.6 percent spend less than Rs. 5000 annually as medical expenses due to waste generation in which 33.3 percent respondents are from the Central zone, 41.7 percent are from the Koorkancheri zone and 25 percent are from the Ayyanthole zone. 28.9 percent incur a cost of Rs. 7500 – 10000 annually among which 42.8 percent are from Koorkancheri, 28.6 percent each from the Central as well as the Ayyanthole zone.

Similarly, 21.1 percent respondents spend more than 10000 rupees annually and 18.4 percent spend 5000 – 7000 rupees for medical treatment. It is interesting to note that the Koorkancheri zone has shown higher percentage in medical expenses. This is due to higher level of solid waste pollution in that area. In the Central zone, 33.3 percent respondents spend less than 5000 rupees annually and 25 percent respondents spend Rs.7500-100000 annually for medical expenses. In the Ayyanthole zone major percent of the respondents spend an amount of rupees 7500-100000 annually for medical treatment due to solid waste pollution. Hence, there is higher amount of cost on health issues with higher level of solid waste pollution. The cost incurred due to solid waste pollution in all the three zones is higher which makes heavy economic burden on the households.

Table 6.21 Annual Cost Incurred on Solid Waste Pollution

Cost in Rupees	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Less than 5000	4 (33.3) [33.3]	3 (25.0) [23.1]	5 (41.7) [38.4]	**12** (100.0) [31.6]
5000 – 7500	2 (28.6) [16.7]	2 (28.6) [15.4]	3 (42.8) [23.1]	**7** (100.0) [18.4]
7500 – 10000	3 (27.3) [25.0]	5 (45.4) [38.4]	3 (27.3) [23.1]	**11** (100.0) [28.9]
More than 10000	3 (37.5) [25.0]	3 (37.5) [23.1]	2 (25.0) [15.4]	**8** (100.0) [21.1]
Total	**12** (31.6) [100.0]	**13** (34.2) [100.0]	**13** (34.2) [100.0]	**38** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.14

Annual Cost Incurred on Solid Waste Pollution (In Rupees)

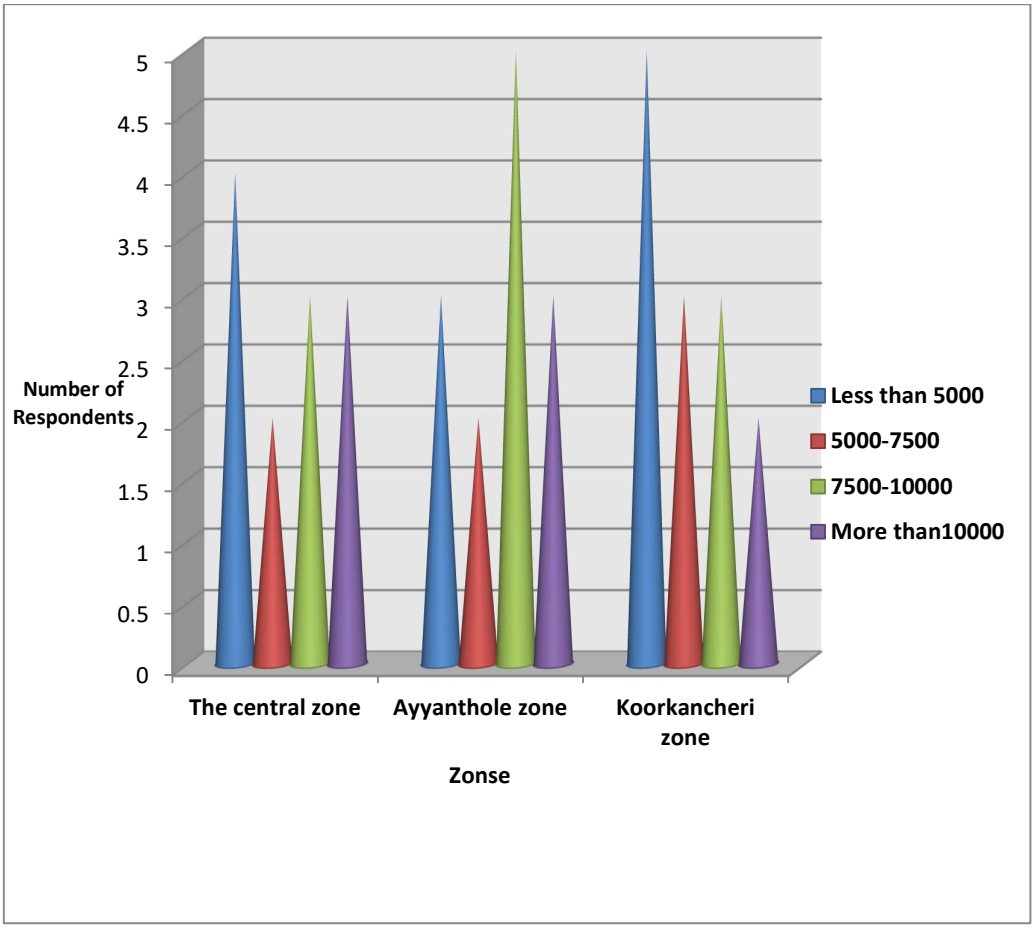


Table 6.22 shows a comparative analysis between the annual cost incurred in the form of medical expenses due to solid waste to pollution and the work loss days of the respondents.

The respondents who spend more than 10000 rupees annually have income loss due to working loss days for more than 45 days (87.5 percent). Similarly, 31.6 percent respondents who spend less than 5000 rupees annually have WLD ranging between less than 25 and 25 – 35 days annually. 28.9 percent respondents incur a cost of Rs, 7500- 10000 and loss their working days for 35 – 45 days annually.

Table 6.22

Annual Cost of Solid Waste Pollution and WLD of the Respondents

Cost in Rupees	Work Loss Days (Solid Waste)				**Total**
	Less than 25	25 -35	35 -45	More than 45	
Less than 5000	10 (83.3) [100.0]	2 (16.7) [25.0]	-	-	**12** (100.0) [31.6]
5000- 7500	-	5 (71.4) [62.5]	2 (28.6) [15.4]	-	**7** (100.0) [18.4]
7500 - 10000	-	-	11 (100.0) [84.6]	-	**11** (100.0) [28.9]
More than 10000	-	1 (12.5) [12.5]	-	7 (87.5) [100.0]	**8** (100.0) [21.1]
Total	**10** (26.3) [100.0]	**8** (21.1) [100.0]	**13** (34.2) [100.0]	**7** (18.4) [100.0]	**38** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Thus, the impact of solid waste pollution on households is very severe in the sense that it creates economic loss in the form of medical expenses and working loss days along with several health issues. These issues are found to be larger in slum areas where there are congested living conditions with limited facilities.

In short, the amount of municipal solid wastes in cities is mounting up day by day which are not suitably disposed by the authorities. These huge amounts of solid wastes are dumped in road sides, water resources and other land areas without any consideration of environment. The ultimate result is solid waste pollution and subsequent health and economic issues. The households of the sample area have

serious health issues due to this pollution. In order to promote a healthy living condition environment should be protected by avoiding such pollution. Then only urban development with sustainability is possible and this will be helpful to the future generations.

6.2. (iv) Noise Pollution Due to Urbanization

The sounds which are not pleasant to hear are called noises and an excess of noise in the outdoor leads to 'Noise Pollution'. The increasing ambient noise levels in public places from various sources like construction activity, vehicular horns, loud speakers, sound producing instruments, fire crackers, industrial activities, public address systems and sounds other mechanical devices is unhealthy to the people as it adversely affects the physiological as well as psychological conditions. According to the WHO guidelines for a sound sleep, the noise in a room should not exceed 30 dBA. It should not exceed 35 dBA in a class room for maintaining better concentration. If the noise level exceeds more than prescribed level on a continuous basis, it may harm physical as well as mental health of the people.

Usually people and authorities are much concerned about air pollution water pollution and solid waste pollution. But noise pollution is not taken seriously; in fact noise pollution is serious concern as it affects health conditions seriously. Hence, the study is an attempt to find out the noise pollution aspects in sample zones with special attention to health aspects of households.

Figure 6.15

Photographs of Noise Pollution in Sample City

The causes of noise level pollution are many. Table 6.23 shows the major causes responsible for noise pollution in the sample areas.

Table 6.23

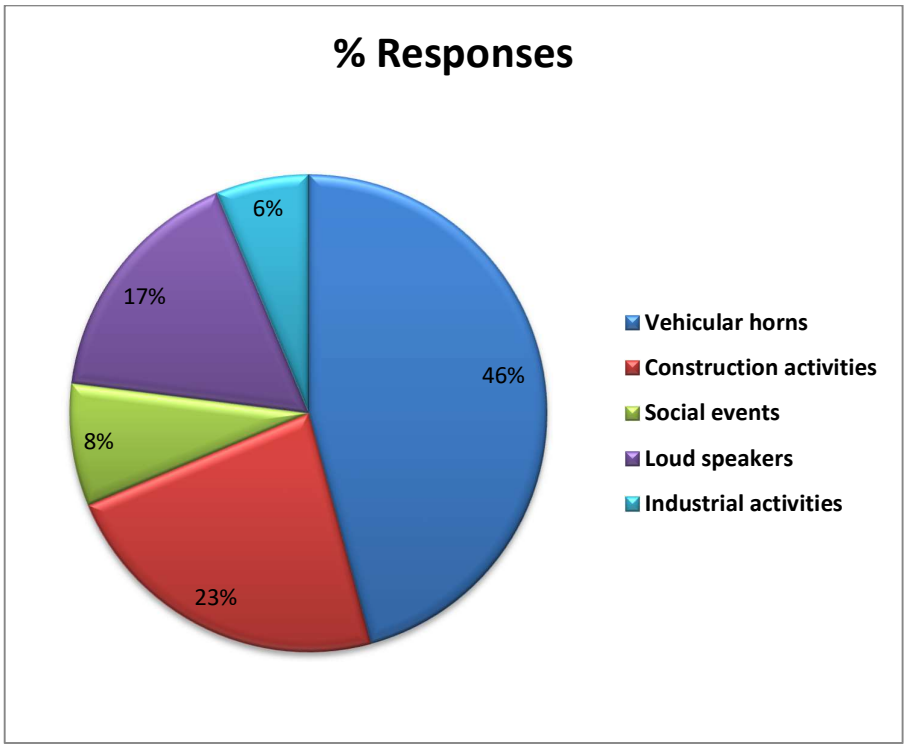
Major Causes for Noise Pollution

Causes	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Vehicular horns	6 (27.3) [40.0]	9 (40.9) [52.9]	7 (31.8) [43.7]	**22** (100.0) [45.8]
Construction activities	4 (36.4) [26.7]	5 (45.4) [29.4]	2 (18.2) [12.5]	**11** (100.0) [22.9]
Social Events	2 (50.0) [13.3]	-	2 (50.0) [12.5]	**4** (100.0) [8.3]
Loud speakers	3 (37.5) [20.0]	1 (12.5) [5.9]	4 (50.0) [25.0]	**8** (100.0) [16.7]
Industrial activities	-	2 (66.7) [11.8]	4 (33.3) [6.3]	**3** (100.0) [6.3]
Total	**15** (31.2) [100.0]	**17** (35.4) [100.0]	**16** (33.4) [100.0]	**48** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.16

Major Causes for Noise Pollution



Out of 48 respondents 45.8 percent argued that noise pollution is due to vehicular horns in the city. This seemed to be true because major roads of the city are narrow and congested. 22.9 percent respondents viewed construction activities as the major source of noise pollution among which 36.4 percent are from the Central zone 45.4 percent are from the Ayyanthole zone and 18.2 percent are from the Koorkancheri zone. 16.7 percent respondents considered the use of loudspeakers in many occasions as the reason for noise pollution in the city. Similarly, 8.3 percent of the respondents viewed social event and related celebrations as the major cause for noise pollution and 6.3 percent of the respondents considered industrial activities as the major source of noise pollution in the city. Hence the reasons for noise pollution are many, and the impact of such noise pollution is upon the urban households in the form of health issues.

Increased levels of noise create health issues like hearing problems, cardiovascular issues, sleeping disorders etc. The detailed analysis of such issues is given in table 6.24.

Table 6.24

Health Issues Due to Noise Pollution

Health Issues	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Hearing Problems	4 (36.4) [26.7]	5 (45.4) [29.4]	2 (18.2) [12.5]	**11** (100.0) [22.9]
Cardio Vascular Issues	4 (50.0) [26.7]	1 (12.5) [5.9]	3 (37.5) [18.8]	**8** (100.0) [16.7]
Sleeping Disorders	3 (15.8) [20.0]	7 (36.8) [41.2]	9 (47.4) [56.2]	**19** (100.0) [39.6]
Other issues like hyper tension & high stress levels	4 (40.0) [26.6]	4 (40.0) [23.5]	2 (20.0) [12.5]	**10** (100.0) [20.8]
Total	**15** (31.2) [100.0]	**17** (35.4) [100.0]	**16** (33.4) [100.0]	**48** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Major health issues related with noise pollution are sleeping disorders, hearing problems, cardio vascular issues, hyper tension, high stress level etc. Among these issues 39.6 percent respondents considered sleeping disorders as the major health issue in which 47.4 percent are from Koorkancheri zone, 3.6.8 percent are from the Ayyanthole zone and 15.8 percent respondents are from the Central zone. Similarly, 22.9 percent have hearing problems due to noise pollution, 20.8 percent respondents

have issues like hypertension and high stress levels, and 16.7 percent respondents have cardio vascular issues.

The zone wise analysis shows that, in the Central zone major health issues are hypertension & high stress level issues where 26.6 percent respondents have such issues. In the Ayyanthole zone major problem is sleeping disorders (41.2) and in Koorkancheri zone it is the same issue (56.2). Hence, the households have several health issues due to unpleasant sound or noise pollution in the city.

Table 6.25 shows the response of the households respondents in respect of the level of noise pollution.

Table 6.25

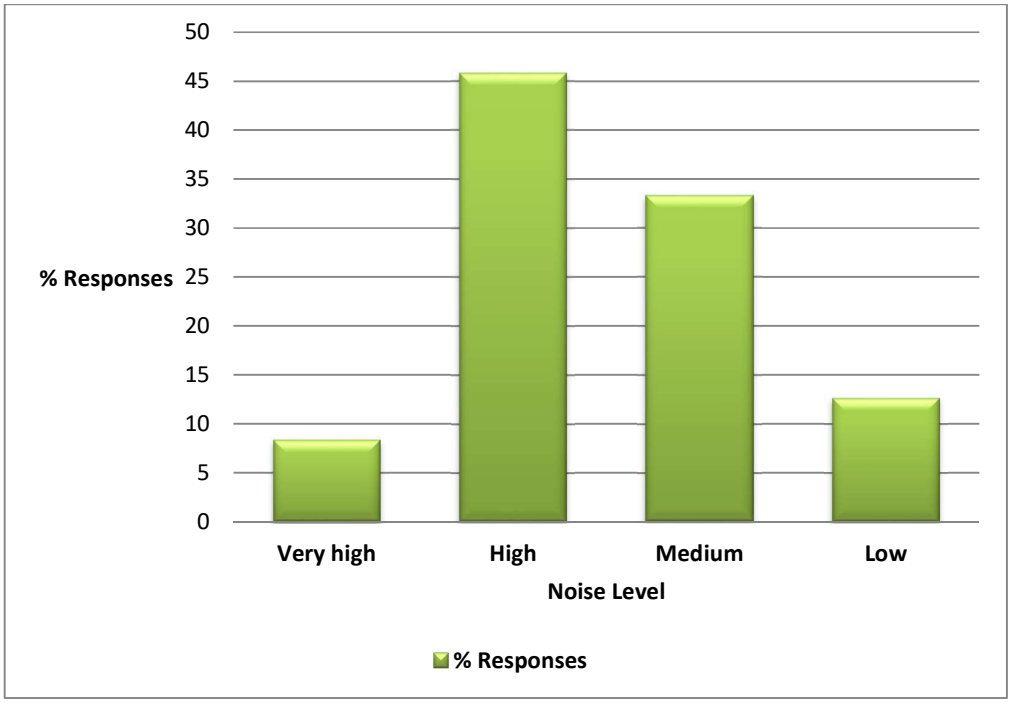
Level of Noise Pollution in the Sample Areas

Noise Level	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Very high	3 (75.0) [20.0]	-	1 (25.0) [6.2]	**4** (100.0) [8.3]
High	8 (36.4) [53.3]	9 (40.9) [52.9]	5 (22.7) [31.2]	**22** (100.0) [45.8]
Medium	3 (18.7) [20.0]	6 (37.5) [35.3]	7 (43.8) [43.8]	**16** (100.0) [33.3]
Low	1 (16.7) [6.7]	2 (33.3) [11.8]	3 (50.0) [18.8]	**6** (100.0) [12.6]
Total	**15** (31.2) [100.0]	**17** (35.4) [100.0]	**16** (33.4) [100.0]	**48** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.17

Level of Noise Pollution in the Sample Areas



It is estimated that, 45.8 percent respondents out of 48 respondents reported the noise level as high in the city, 33.3 percent considered noise pollution level as medium, 12.6 percent respondents considered the noise level as low and 8.3 percent respondents viewed very high level of noise pollution in the city. In the zone wise analysis, the respondents from all the three zones reported noise pollution level in the range of medium to high levels as major percentage comes under this category. In short, the noise pollution exists in the city whether it is very high or high or medium. This adversely affects the healthy living conditions of the households.

Table 6.26 represents annual work loss days of the respondents due to noise pollution.The major impact of noise pollution is increasing working loss days of the respondents due to several health issues. 54.2 percent respondents who are affected by noise pollution lost their work for less than 50 days annually in which 38.5 percent are from the Ayyanthole zone, 34.6 percent are from Koorkancheri zone and 26.9 percent are from the Central zone. 25 percent respondents lost working days in between 50 - 75 days annually among which 41.7 percent are from Ayyanthole zone, 33.3 percent are from Koorkancheri zone and 25 percent are from the Central zone. Similarly, 20.8

percent respondents had working loss days for more than 75 days per annum out of which 50 percent respondents are from the Central zone, 30 percent are from the Koorkancheri zone and 20 percent are from the Ayyanthole zone. In the central zone 46.7 percent respondents had working loss days for less than 50 days. 58.8 percent respondents of the Ayyanthole zone 56.3 percent of the Koorkancheri zone had WLD for less than 50 days.

Table 6.26

Work Loss Days of the Respondents Due to Noise Pollution

WLD/Year	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Less than 50	7 (26.9) [46.7]	10 (38.5) [58.8]	9 (34.6) [56.3]	**26** (100.0) [54.2]
50 -75	3 (25.0) [20.0]	5 (41.7) [29.4]	4 (33.3) [25.0]	**12** (100.0) [25.0]
More than 75	5 (50.0) [33.3]	2 (20.0) [11.8]	3 (30.0) [18.7]	**10** (100.0) [20.8]
Total	**15** (31.2) [100.0]	**17** (35.4) [100.0]	**16** (33.4) [100.0]	**48** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Due to increasing levels of noise pollution, households are suffering from several health issues and this ultimately leads to increased amount of cost incurred on health issues which is represented in table 6.27.

The Annual cost of illness due to noise pollution shows that 18 respondents (37.6) out of 48 respondents spend Rs. 5000-7500 annually towards the treatment of disease among which 44.4 percent are from the Koorkancheri zone, 27.8 percent each from

the Central as well as the Ayyanthole zone. 22.9 percent respondents spend more than 10000 rupees annually as the lost of illness due to noise pollution out of which 45.4 percent are from the Central zone, 27.3 percent respondents each from the Ayyanthole and Koorkancheri zones. 10 respondents (20.8) spend an amount of Rs.7500-10000 per annum as the health cost of noise pollution. 18.7 percent respondents spend less than 5000 rupees annually in order to meet the cost of health issues due to noise pollution.

Table 6.27

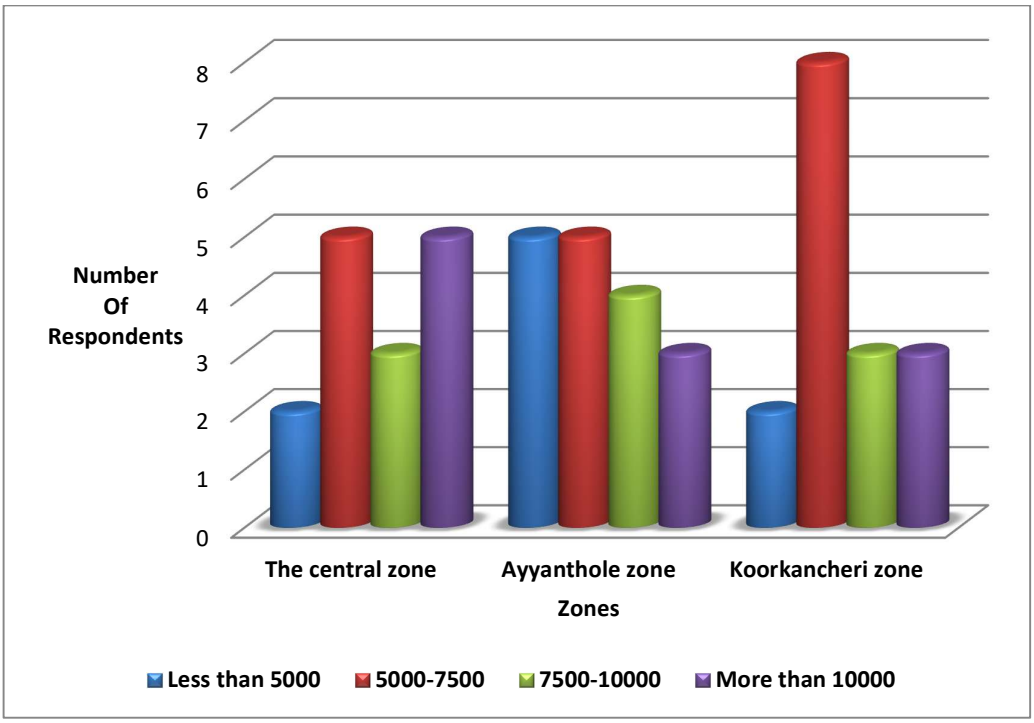
The Annual Cost Incurred Due to Noise Pollution (In Rupees)

Cost of Illness (In rupees)	Name of the Zones			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Less than 5000	2 (22.2) [13.4]	5 (55.6) [29.4]	2 (22.2) [12.6]	**9** (100.0) [18.7]
5000 – 7500	5 (27.8) [33.3]	5 (27.8) [29.4]	8 (44.4) [50.0]	**18** (100.0) [37.6]
7500 – 10000	**3** (30.0) [20.0]	**4** (40.0) [23.5]	**3** (30.0) [18.7]	**10** (100.0) [20.8]
More than 10000	**5** (45.4) [33.3]	**3** (27.3) [17.7]	**3** (27.3) [18.7]	**11** (100.0) [22.9]
Total	**15** (31.2) [100.0]	**17** (35.4) [100.0]	**16** (33.4) [100.0]	**48** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

Figure 6.18

The Annual Cost Incurred Due to Noise Pollution



The table also shows that in the Central zone 33.3 percent respondents spend more than 10000 rupees annually as the cost of illness and another 33.3 percent spend Rs.5000-7500/annum in order to meet health expenses. In the Ayyanthole as well as Koorkancheri Zones, major portion of the respondents spend Rs. 5000-7500 annually for medical treatment due to noise pollution.

Table 6.28 represents a comparative analysis of annual cost of noise pollution and working loss days of the respondents. Increased number of work loss days implies increased cost of illness in the sample areas.

The table represents that cost of illness is closely associated to working loss days of the respondents as these shown an increasing trend due to noise pollution. Out of the 48 respondents 54.2 percent respondent had lost their work for less than 50 days and at the same time they spend a huge sum annually as the cost of illness. Similar is the

case with other household respondents too. This shows the heavy economic burden upon the households due to noise pollution in the city.

Table 6.28

Annual Cost of Noise Pollution and WLD of the Respondents

Cost in Rupees	Work Loss Days (Noise)			**Total**
	Less than 50	50-75	More than 75	
Less than 5000	9 (100.0) [34.6]			**9** (100.0) [18.7]
5000-7500	17 (94.4) [65.4]	1 (5.6) [8.3]		**18** (100.0) [37.6]
7500-10000		10 (100.0) [83.4]		**10** (100.0) [20.8]
More than 10000		1 (9.1) [8.3]	10 (90.9) [100.0]	**11** (100.0) [22.9]
Total	**26** (54.2) [100.0]	**12** (25.0) [100.0]	**10** (20.8) [100.0]	**48** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

In short, the noise level in the city is high enough to influence health conditions of the resident households adversely. The level of noise in the city is in between the range of moderate to high which hinders peaceful living in the city. The major sources of noise pollution are transport sector and construction activities. The congested roads in the city lead to unpleasant vehicular horns. Because of such issues the health conditions of the households worsens day by day in the form of hearing problems, sleeping disorder and hyper stress and tension. This leads to increase the cost of illness and loss of working days which creates economic imbalance. Thus noise pollution like

other form of pollution adversely influences the environment and health in urban areas.

Hypothesis Testing on Solid Waste Pollution and Noise Pollution

For the purpose of testing of hypothesis related with solid waste pollution and noise pollution, annual cost of illness due to these pollutions is considered.

Null Hypothesis (**H_0**):

Thehigher levels of solid waste pollution and noise pollution, do not lead to the higher amount of health cost in the sample areas.

Alternative Hypothesis (**H_1**):

TheHigher levels of solid waste pollution and noise pollution, lead to the higher amount of health cost in the sample areas.

Table 6.29 represents the chi-square test value of health cost due to diseases by increasing levels of solid waste pollution and noise pollution.

Table 6.29

Chi- square Tests of Solid Waste and Noise Pollution and Health Cost

Tests	Value	df	Asymp.sig (2- sided)
Pearson's chi-square	216.826	6	.000
Likelihood Ratio	223.878	6	.000
Linear-by-Linear Association	102.379	1	.000
No. of valid cases	86		

Note: a 1 cell (8.3%) has expected count less than 5. The minimum expected count is 4.33.

It is evident from the table 6.29 that the calculated chi-square value (216.826) of the health cost due to solid waste pollution and noise pollution is greater than the tabulated value at one percent level of significance. Hence, the null hypothesis is rejected and alternative hypothesis is accepted, which implies that there is a close association between the health cost and pollution due to mounting solid waste and

noise levels. It means that the cost of illness increases with increase in solid waste and noise pollution.

Thus, the city is not free from environmental issues in the form of mounting solid wastes and increasing levels of noise. The health impacts contributed by these pollutions are having negative impacts upon the economic and living conditions of the households. Hence, proper protective measures needed to be implemented to overcome the detrimental impacts of pollution.

6.3. Method of Economic Valuation of Environmental Goods- The Contingent Valuation Method (CVM)

Environmental goods and services are often treated as public goods to some extent; and hence the excessive and careless use of such goods leads to environmental impacts. In order to protect the environmental goods from harmthe valuations of environmental goods are necessary. Methods based on economic theory have been devised widely to assign monetary values to environmental goods and services. Based on these values decision making can be made easier about a project related to environment. In other words, economic valuation is used to estimate economic benefits or costs associated with environmental quality such as air pollution, water pollution, solid waste pollution or noise and environmental amenities, such as aesthetic views or proximity to recreational sites etc. Thus economic valuation techniques are applied to the more human environment such as water, air, solid waste generation and noise.

Methods of valuation of environmental goods and services may broadly be classified into two categories- (1) Pecuniary and (2) Non- pecuniary. Pecuniary valuation methods obtain the 'Money equivalent' of these goods and services. While non-pecuniary methods may use any numeraire for valuation. Pecuniary methods usually use the concept of willingness to pay for valuing environmental goods (Mishra S.K. 2006). Willingness to pay (WTP) indicates individuals preferences for a good in question related to the environmental goods. Individual's preferences are identified by asking people how much they are willing to pay in order to maintain quality of environmental goods.

Environmental valuation methods are ultimately relying upon individual preferences. These are divided into two approaches direct methods and indirect methods. Direct methods are based on expressed preferences elicited though questionnaire surveys. Contingent valuation method is the direct method of valuation.

In other words, the most suitable method to determine willingness to pay is contingent valuation method (CVM). Contingent valuation methods are used to determine willingness to pay for improved quality of water, improved quality of air, reducing noise level and improved disposal of solid waste generation in urban areas. In short, contingent valuation method is a questionnaire based valuation technique whereby willingness to pay are directly obtained from the respondents with respect to a specific good.

A CVM study involves interviews with the participants, which can be undertaken as face to face, mail or telephone based. CVM study usually stars with informing the participate about the environmental resources in focus (such as water quality, air quality, reduction in noise level, proper solid waste disposal) along with information about the proposed change in the environmental resource and the procedure to be used to finance the proposed change in environmental resource. On the basic of such information the respondents are asked about willingness to pay or to accept compensation in order to avoid an environmental damage (Dr. Torben Holvad, 2000).

Questions concerning willingness to pay can be structured in many ways which include;

- Open ended
- Dichotomous choice
- Bidding games
- Payment card based forms

Here bidding games are used for approximating the willingness of household to pay for an environmental good. Single bid games, also known as the single – open ended is used to know the willingness of the household respondents. This is where the responds is asked to mention the amount he or she is willing to pay for a service described by the interviewee. The main factors affecting WTP are demographic

information such as age, gender, income, education and other information regarding the quality of water, air quality, noise level, and reducing solid wastes and associated health risk.

Thus, contingent valuation method involves informing the respondent about the prevailing environmental situation and then informs him, her about a change. The individual is asked to valve a particular change in environmental condition in future hypothetical scenario. Hence CVM have the advantages over the other methods of environmental valuation such as the Travel Cost and Hedonic Pricing techniques. The method can be used to quantify some types of benefits, such as non-use or passive use benefits, which lie outside the scope of travel-cost and hedonic pricing studies (Hanemann, 1994).

6.3. (i) Respondent's Attitude Towards Willingness to Pay for Improvement in Quality of Water

Increased amount of water pollution in sample areas tempted towards a study of willingness to pay for improved quality of water. Almost all the respondents in the sample area revealed then preferences and willingness to pay for attaining improved quality of water. This is represented in table 6.30.

Table 6.30

Willingness to Pay for Improved Quality of Water in the Sample Areas

Name of the zone	Willingness to pay		**Total**
	Yes	No	
The Central Zone	25 (80.6)	6 (19.4)	**31** (100.0)
Ayyanthole Zone	22 (81.4)	5 (18.6)	**27** (100.0)
Koorkancheri Zone	16 (88.9)	2 (11.1)	**18** (100.0)
Total	**63** (82.9)	**13** (17.1)	**76** (100.0)

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.

The table shows that out of 76 respondents who are responded towards water pollution are shown their opinion about attaining quality of water. It is estimated that 82.9 percent respondent are expressed their willingness to pay for the quality of water and the remaining 17.1 percent respondents are not willing to pay any amount for the quality of water. This may be due to the fact that these groups have facilities to attain quality water from various water sources.

While considering the area or location of residence, it is found that the major issues related with water pollution are in slum areas compared to non-slum areas. The residents of slum areas are willing to pay more for improved quality of water than the non slum residents. Hence, poor people are willing to pay more in this matter than the rich. Water pollution is associated with many health risks in the form of diseases. So the willingness to pay for improved water quality is aimed to avoid such health risks. In all the 3 sample zones more than 80 percent of the respondents are willing to pay for quality of water, viz, 80.6 percent of the Central zone, 81.4 percent of the Ayyanthole zone and 88.9 percent of the Koorkancheri zone. The Koorkancheri zone represents large number of slum population. Hence, more willingness to pay for water quality is found in that zone.

Bidding Amounts

Bidding amounts are used for approximating the willingness of household to pay for an environmental good. Here the bid amounts are used for improved quality of water supply. These amounts are finalized after carefully examining the socio-economic characteristics of the households like age, gender, income, education etc. This is because, these background informationhave greater influence upon the willingness to pay though bid amounts. The selection of bidding amounts in the 3 sample zones through the responses of the respondents in respect of their willingness to pay is given in table 6.31.

Table 6.31

Bidding Amounts for Improvement in Quality of Water According to the Sample Zones

Bid amounts (In Rupees)	Name of the Zones			**Total**
	The Central Zone	Ayyanthole Zone	Koorkancheri Zone	
Less than 200	11 [44.0]	7 [31.8]	7 [43.7]	**25** [39.7]
200-250	5 [20.0]	2 [9.1]	1 [6.3]	**8** [12.7]
250-300	7 [28.0]	7 [31.8]	6 [37.5]	**20** [31.7]
More than 300	2 [8.0]	6 [27.3]	2 [12.5]	**10** [15.9]
Total	**25** [100.0]	**22** [100.0]	**16** [100.0]	**63** [100.0]

Source: Survey Data
Note: Figure in the square brackets indicates column percentage.

The bid amount for improve quality of water supply ranges from Rs.200 to Rs.300 per month containing a total of four bid amounts having an interval of Rs. 50. Various levels of bid amounts are shown in the table. Out of 63 respondents who are willing to pay for maintaining water quality, 39.7 percent are willing to pay an amount of less than 250 rupees per month, 31.7 percent respondents are willing to pay in between 250-300 rupees per month, 15.9 percent are willing to pay more than 300 rupees per month and 12.7 percent are willing to pay in between 200-250 rupees per month. Similarly, 44 percent respondents of the Central zone are willing to pay less than 200 rupees per month and only 8 percent of them are willing to pay more than 300 rupees. In the Ayyanthole zone, 31.8 percents respondents are willing to pay less than 200 rupees per month and another 31.8 percent of them are willing to pay an amount in between Rs.250-300 per month. Similar is the case with the Koorkancheri zone when 43.7 percent respondents are willing to pay less than 200 rupees and 12.5 percent of them are willing to pay more than 300 rupees per month. The respondents from the slum areas have shown more willingness to pay towards improved water quality.

The Logit Regression Model

In Contingent Valuation Method, the Logit regression model is used to obtain the willingness to pay for household for an improved water supply. The logit model is

used to determine the mean willingness to pay of households for improved water quality and the factors influencing their willingness to pay. The logit model is based mainly on the cumulative probability function and it deals with a dichotomous dependent variable on a well established theoretical background. Logit regression model is a uni/multivariate technique which allows for estimating the probability that an event will occur or not through prediction of a binary dependent outcome from a set of independent variables (Roopa, 2000). The logit model was adopted since the Ordinary Least Square (OLS) procedure was not appropriate particularly when the dependent variable is dichotomous.

To obtain the mean WTP of the households for an improvement in the quality of water, the responses of the households to the willingness to pay question were regressed on the prices they were asked to pay for the improved service. The coefficients estimates obtained were then used to calculate the mean willingness to pay of the households (Adepoju&Omonona B T, 2009).

The logit regression model is specified as;

$$P_i = E\left(y=\frac{1}{x^t}\right) = \frac{1}{1+e^{-\beta 0+\beta 1 x 1}}$$

Where;

Pi = Probability that Yi = 1

Xi = Set of independent variables.

Y= Dependent variable

β0 = Intercept which is constant

β1 = Coefficient of price that the households are willing to pay for improved water quality

The mean willingness to pay of the households for improved water quality service is then calculated using the formula derived by Hanemann (1989). The formula is given as;

$$\text{Mean WTP} = \frac{1}{|\beta 1|} \text{ in } (1+\exp \beta 0)$$

Where β1 and β0 are coefficient estimates obtained from the logistic regression and mean WTP is the mean willingness to pay of households for improved water quality service.

Factors Influencing Willingness to Pay of Households

In order to identify the factors influencing the willingness to pay of households for better quality water supply, the household's responses to the willingness to pay question are regressed on the household willingness to pay potential and other selected socio-economic characteristics of the households. The regression logit model is specified as;

$$Y = \frac{1}{1+exp^{Z}}$$

Where Y = the response of the household to the willingness to pay question which is either 1 if 'Yes' or O if 'No'. The variable Z is defined in equation as;

$$Z = \beta 0+\beta 1x1+\beta 2x2+\ldots\ldots+\beta 6x6$$

Where β0 is a pure constant and the parameter β1……..β6 are the coefficients of the explanatory variables x_1……x_6.

The X variables are represented as;

X_1=Age (Yrs)

X_2 = Literacy

X_3 = Size of the family (Number)

X_4 = Annual Household income (Rs)

X_5 = Savings (Rs)

X_6 = Health cost on water diseases (Rs)

The Chi-square and the Pseudo-R square were used to measure the goodness of fit of the model. On the basics of these, the determinates of WTP for improved quality of water services or the logit analysis of the factors that determine the willingness to pay for improved water quality is expressed in tables 6.32 and 6.33.

Table 6.32

The Logit Regression Model (Improvement in Water Quality)

	Coefficient	Std. Error	Z	p-Value
Const	9.27553	3.72560	2.4895	0.01277**
X1	0.359267	0.0136517	2.6318	0.00851***
X2	17.501	7.2518	2.4136	0.01579***
X3	4.87914	1.92306	2.5372	0.01116**
X4	0.740132	0.280826	2.6354	0.00840***
X5	24.6704	9.36065	2.6355	0.00841***
X6	0.0113316	0.00519996	2.1792	0.02392**

Source: Survey Data
Note: Observations 1-76 (n = 63)
Missing or incomplete observations dropped = 13

Dependent variable: WTP

Table 6.33

The Regression Model (Logit) Related to WTP for Improved Water Quality

Mean dependent var.	0.876291	S.D. Dependent var	0.330961
MC Fadden R- Squared	0.726943	Adjusted R-Squared	0.534112
Log likelihood	9.912859	Akaike criterion	33.82570
Schwarz = criterion	51.84874	Hannan-Quinn	41.11337

Note: Percentage of cases correctly predicted = 99.0 %
F (beta'x) at mean of independent var. = 0.331
Likelihood ratio test: Chi-square (6) = 52.7897 (0.000)
** indicates 5 percent level of significance.
*** indicates 1 percent level of significance.

The above test results implied that age, literacy, size of the family, household income, savings and health cost on water pollution diseases significantly influence the willingness to pay for improved water quality services at 5 and 1 percent levels of significance. It is observed that age literary levels income and savings are positively related to WTP for improved quality of water supply services at 1 percent level of significance whereas size of the family and health cost on waterborne diseases are positively related to the willingness to pay for quality water services at five percent level of significance. This implies that size of the family is influencing the willingness

to pay as big households will be will be willing to pay relatively less due to the associated high running cost (Income constraints). Similarly, literacy and income levels positively influence the WTP of the households.

Hence, the results reveal that 0.726 is the MC Fadden R^2 a probability of households WTP for improved quality of water supply which means that more than 72 per cent of the changes in the willingness to pay for improved water supply. The likelihood of paying for improved water supply increases by 9.91. The Schwarz-criteria is accounted for 51.84. Hence the model implies that there is a close association between the willingness to pay and improved quality of water supply. The respondents are ready to pay an amount for better water quality in urban areas. The Chi-square value accounts for 52.7897 at one percent level of significance. Hence, the water quality is positively related to the willingness to pay at percent level of significance.

6.3. (ii) Respondents Attitude Towards Willingness to Pay for Quality of Air

The respondents of the urban area are willing to pay for attaining fresh or quality air to breathe as they have experienced the health risks associated with polluted air. The study reveals the fact that increasing vehicular populations and subsequent gas emissions is the major source of air pollution in the sample area. The respondents are willing to pay for using alternative sources of transport system like public transport system instead of using their own vehicles to reduce air pollution and associated health risks.

Table 6.34 highlights the willingness of the household respondents to pay for improved quality of air in the urban area. Out of 63 respondents who are affected by air pollution, 49 (77.8 percent) are willing to pay for better quality of air. The table shows that 38.8 percent respondents from the Central zone, 36.7 percent from the Koorkancheri zone and 24.5 percent from the Ayyanthole zone are willing to pay for attaining better air quality.

Table 6.34

Willingness to Pay for Better Quality of Air in the Sample Areas

Name of the Zone	Willingness to Pay		**Total**
	Yes	No	
The Central zone	19 [38.8]	6 [42.8]	**25** [39.7]
Ayyanthole zone	12 [24.5]	3 [21.4]	**15** [23.8]
Koorkancheri zone	18 [36.7]	5 [35.8]	**23** [36.5]
Total	**49** (77.8) [100.0]	**14** (22.2) [100.0]	**63** (100.0) [100.0]

Source: Survey Data
Note: Figure in the square brackets indicates column percentage.
Figure in the parenthesis indicates row percentage.

The bid amounts for improved quality of air are represented in the table 6.35. The bid amounts in this environmental good is finalized after carefully examining the socio-economic conditions of the household respondents. The bid amount for air quality ranges from Rs.200 to Rs.300 per month containing a total of four bids having an interval of Rs. 50. Out of 49 respondents who are willing to pay to better air quality, 38.8 percent are willing to pay less than 200 rupees per month, 28.6 percent respondents are willing to pay in between 250-300 rupees per month, 22.4 percent are willing to pay more than 300 rupees per month and 10.2 percent are willing to pay 200-250 rupees per month. In the Koorkancheri zone the respondents showed their willingness to pay 250 rupees to more than 300 rupees per month. In the Central as well as in the Ayyanthole zone, most of the respondents are willing to pay less than 200 rupees per month.

Table 6.35

Bidding Amount for Better Quality of Air According to the Sample Zones

Bid amounts (In Rupees)	Name of the Zone			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Less than 200	8 [42.1]	5 [41.7]	6 [33.3]	**19** [38.8]
200-250	3 [15.8]	1 [8.3]	1 [5.6]	**5** [10.2]
250-300	5 [26.4]	4 [33.3]	5 [27.8]	**14** [28.6]
More than 300	3 [15.8]	2 [16.7]	6 [33.3]	**11** [22.4]
Total	**19** [100.0]	**12** [100.0]	**18** [100.0]	**49** [100.0]

Source: Survey Data
Note: Figure in the square bracket indicates column percentage.

Factors Influencing the Willingness to Pay of Households and the Logit Regression Model for Better Quality of Air

To identify the factors influencing the willingness to pay for better air quality, the household responses to the WTP questions are regressed against the households WTP potential and other socio-economic characteristics of the households. The logit regression model was used to obtain the willingness to pay for better quality of air by the households applied here is the same as mentioned in the earlier section and the factors influencing the willingness to pay are;

X1= Age (Yrs)

X2 = Size of the family (Numbers)

X3 = Household Income (Rs)

X4= Health cost on airborne diseases (RS)

X5 = Savings (Rs)

X6= Education level

The logit regression model based on these factors for improved air quality is represented in tables 6.36 and 6.37.

Table 6.36 The Logit Regression Model (Better Air Quality)

	Coefficient	Std. Error	Z	p- Value
Const	0.305114	2.34071	0.1304	0.89629**
X1	1.32117	1.35601	0.9743	0.32994***
X2	0.533568	0.359637	1.4836	0.13791***
X3	2.84520	2.78291	1.0423	0.29714***
X4	0.00385907	0.001428	2.7026	0.00686***
X5	0.00690050	0.00446072	1.5467	0.12188**
X6	1.30433	0.625803	2.0843	0.03713**

Source: Survey Data
Note: Observation 1-63 (n=49)
Missing or incomplete observations dropped = 14
Dependent Variable: WTP

Table 6.37

The Logit Regression Model for Better Quality of Air

Mean dependent var.	0.937007	S.D. dependent var.	0.243914
MC Fadden R – Squared	0.266789	Adjusted R-squared	0.032643
Log-Likelihood	21.89410	Akaike Criterion	57.78820
Schwarz criterion	77.69756	Hannan-Quinn	65.87713

Note: Percentage of cases correctly predicted = 94.5%
F (beta'x) at mean of dependent var = 0.243
Likelihood ratio test: Chi-square (6) = 15.9327 (0.0143)
** Indicates 5 percent level of significance
*** Indicates 1 percent level of significance.

The logit regression model specified above implies that there is high association of willingness to pay by the households and improvement in the quality of air in the

urban areas. The association of improved air quality and willingness to pay is represented bythe Chi-square value which is 15.9327 at one percent level of significance. Mean and S.D. of dependent variables are given as 0.937007 and 0.243914 respectively. The model implies that the factors like size of the family and savings of the households do not have significant influence on the willingness to pay for improvement in the quality of air.The log-likelihood for paying significant improvements in the quality of air represents the value of 21.89. All other factors like age, household income, health cost on airborne disease & education level have positive and direct influence upon the willingness to pay of the households towards improved air quality. To reduce the traffic congestion and vehicular emissions which is helpful to improve the quality of airthe household respondents have been expressed their readiness to use public transport system instead of private vehicles.

6.3. (iii) Respondents Attitude towards Willingness to Pay for Better Solid Waste Management

Unplanned or unscientific solid waste disposal in urban areas can lead to health issued due to water and sanitation related diseases and land pollution. Similarly, burning of solid wastes leads to air pollution and related health issues. Thus dumping of solid wastes in open areas in cites adversely affects the healthy living conditions of the resident household. Hence, the households are agreed to pay for better waste management in cities or they are willing to pay for suitable waste management services.

The table 6.38 represents the willingness to pay of the households for better waste management system.The table shows that out of 38 respondents who are affected by solid waste pollution, 84.2 percent are willing to pay for better waste management system, which comprises 37.5 percent respondents from the Central zone, 34.4 percent from the Ayyanthole zone and 28.1 percent from the Koorkancheri zone. The respondents or the Central zone are willing to pay more than other two zones for improved solid waste management services.

Table 6.38

Willingness to Pay for Better Solid Waste Management in the Sample Areas

Name of the Zone	Willingness to Pay		**Total**
	Yes	No	
The Central zone	12 [37.5]	-	**12** [31.6]
Ayyanthole zone	11 [34.4]	2 [33.3]	**13** [34.2]
Koorkancheri zone	9 [28.1]	4 [66.7]	**13** [34.2]
Total	**32** (84.2) [100.0]	**6** (15.8) [100.0]	**38** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

The bidding amounts for better waste management in urban areas suggested by the household respondents based on dichotomous choice are represented in table 6.39.The bid amounts for improved solid waste management in urban areas are finalized after carefully examining the socio economic characteristics of the households. The bid amount for better solid waste management starts from less than 200 to more than 300 rupees per month containing a total of four bids having an interval of Rs.50.

Out of the total respondents who are willing to pay an amount towards better solid waste management, 59.4 percent are willing to pay less than 200 rupees per month comprising 42.1 percent respondents from the Central zone, 31.6 percent from the Ayyanthole zone and 26.3 percent from the Koorkancheri Zone. 18.7 percent respondents are willing to pay in between 200-250 rupees per month in which 50 percent are from the Ayyanthole zone, 33.3 percent are from the Koorkancheri zone and 16.7 percent are from the Central zone. Similarly, 9.4 percent respondents are willing to pay 250-300 rupees per month and 12.5 percent are willing to pay more than 300 rupees per month for better waste management & treatment services. Hence, there are variations in the bid amounts in the sample zones. These variations may be due to the intensity of solid waste pollution in the sample zones.

Table 6.39

Bidding Amounts for Better Solid Waste Management According to the Sample Zones

Bid Amounts (In Rupees)	Name of the Zone			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Less than 200	8 (42.1) [66.7]	6 (31.6) [54.5]	5 (26.3) [55.6]	**19** (100.0) [59.4]
200-250	1 (16.7) [8.3]	3 (50.0) [27.3]	2 (33.3) [22.2]	**6** (100.0) [18.7]
250-300	1 (33.3) [8.3]	1 (33.3) [9.1]	1 (33.3) [11.1]	**3** (100.0) [9.4]
More than 300	2 (50.0) [16.7]	1 (25.0) [9.1]	1 (25.0) [11.1]	**4** (100.0) [12.5]
Total	**12** (37.5) [100.0]	**11** (34.4) [100.0]	**9** (28.1) [100.0]	**32** (100.0) [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

The Factors Influencing the Willingness to Pay of Households and the Logit Regression Model for Better solid Waste Management

Here,the household responses to the WTP question are regressed against the households WTP potential and other social economic characteristic of the household for identifying the factors influencing the willingness to pay for better quality of waste disposal services.The Logit regression model andthe methods used in this are the same as in the earlier sections of environmental goods- water and air.

The 'X' variables influencing the willingness to pay are represented as;

X1 = Age (Yrs)

X2 = Household family size (numbers)

X3 = Literacy levels

X4 = Household income (Rs)

X5= Health cost due to solid waste pollution (Rs.)

X6 = Working day loss

The logit regression model based on these factors for better waste management services is represented in tables 6.40 and 6.41 respectively.

Table 6.40

The Logit Regression Model (Waste Management)

	Coefficient	Std. Error	Z	p-Value
Const	12.1146	5.07115	2.3890	0.01691***
X1	1.22330	0.486044	2.5167	0.01184***
X2	1.44738	0.667324	2.1688	0.03009**
X3	0.167232	0.407769	0.4104	0.01173***
X4	3.20976	1.55991	2.0573	0.03963**
X5	7.64085	2.20296	0.3469	0.72872**
X6	0.571234	0.344262	1.6594	0.09705***

Source: Survey Data
Note: Observations 1-38 (n = 32)
Missing or incomplete observations dropped = 6
Dependent Variable: WTP

Table 6.41
The Logit Regression Model for Better Waste Management System

Mean dependent var.	0.870965	S.D. dependent var.	0.337975
MC Fadden R-Squared	0.354874	Adjusted R-squared	0.0611268
Log-Likelihood	15.38089	Akaike criterion	44.76190
Schwarz criterion	59.65180	Hannan – Quinn	50.60803

Note: Percentage of cases correctly predicated = 87.1 %
f (beta'x) at mean of independent var. = 0.336
Likelihood ratio test: Chi-square (6) = 16.9212 (0.0096)
** Indicates 5 percent level of significance
*** Indicates 1 percent level of significance

The logit regression model represented here shows that there is high association of WTP and improvement in waste management system in urban areas. The Chi square value (16.9212) at one percent level of significance represents the association of WTP of the households based on the determinates and the improvements in quality of solid waste management services. The log-likelihood for better waste management through

willingnessto pay is increased by 15.38. Factors like literacy level, size of the family, household income, and health cost due to solid waste pollution have positive influence upon WTP for improved waste disposal. Other determinants like age, size of the family and working loss days do not show significant influence upon WTP for quality improvements in waste treatment services.

6.4. (iv) Respondents Attitude Towards Willingness to Pay for Reduction in Noise Pollution

The city life is usually associated with unpleasant noise from many sources. Motor vehicles, construction activities, use of loud speakers in many occasions, social events and industrial activities are responsible for noise pollution. Each and every household revealed then opinion to reduce the noise pollution level to a particular limit so as to reduce the health issues of such pollution. The study concentrated to attain the opinion of respondents regarding the status of noise level and to estimate the willingness to pay by the household towards reduction in noise level to a certain limit which is not unhealthy.

Table 6.42 represents the willingness to pay of the households for a particular degree of noise reduction in sample areas.

Table 6.42 Willingness to Pay for Reduction in Noise Pollution

Name of the Zone	Willingness to Pay		**Total**
	Yes	No	
The Central zone	9 (60.0)	6 (40.0)	**15** (100.0)
Ayyanthole zone	15 (88.2)	2 (11.8)	**17** (100.0)
Koorkancheri zone	15 (93.8)	1 (6.2)	**16** (100.0)
Total	**39** (81.2)	**9** (18.8)	**48** (100.0)

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.

The table shows that out of 48 respondents who are affected by noise pollution and related health issues, 81.2 percent are willing to pay for noise reduction services. In the Central zone, 60 percent respondents are willing to pay for nose reduction. Similarly, 88.2 percent respondents from the Ayyanthole zone and 93.8 percent

respondents from the Koorkancheri zone also are willing to pay an amount for noise reduction activities to reduce noise pollution.

The aim of noise pollution reduction activities is to reduce the level of unpleasant noise and to maintain a normal noise level. The bid amounts of Contingent Valuation Method, for maintaining normal level of noise by reduction in noise pollution in the sample areas are represented in table 6.43.

Table 6.43

Bidding Amounts for Noise Reduction According to the Sample Zones

Bid Amounts (In Rupees)	Name of the Zone			**Total**
	The Central zone	Ayyanthole zone	Koorkancheri zone	
Less than 200	6 (24.0) [66.7]	9 (36.0) [6.0]	10 (40.0) [66.7]	**25** (100.0) [64.1]
200-250	2 (33.2) [22.2]	2 (33.3) [13.3]	2 (33.3) [13.3]	**6** (100.0) [15.4]
250-300	-	2 (66.7) [13.3]	1 (33.3) [6.7]	**3** (100.0) [7.7]
More than 300	1 (20.0) [11.1]	2 (40.0) [13.3]	2 (40.0) 13.3	**5** (100.0) [12.8]
Total	**9** (23.2) [100.0]	**15** (38.4) [100.0]	**15** (38.4) [100.0]	**39** 100.0 [100.0]

Source: Survey Data
Note: Figure in the parenthesis indicates row percentage.
Figure in the square brackets indicates column percentage.

The bid amounts similar to the case with other environmental goods are confirmed after carefully examining the socio-economic characteristics of the households. The bid amounts for maintaining a normal noise level in the sample area starts from less than 200 rupees to more than 300 rupees per month containing a total of four bids having a interval of Rs.50. Our of 39 respondents who are willing to pay for noise education, 64.1 percent are willing to pay an amount of less than 200 rupees per month, among which 40 percent respondents are from the Koorkancheri zone, 36 percent are from the Ayyanthole zone and 24 percent are from the Central zone. 15.4

percent respondents are willing to pay an amount in between 200-250 rupees per month. 7.7 percent respondents are willing to pay an amount of 250-300 rupees per month and the remaining 12.8 percent respondents are willing to pay more than 300 rupees per month for reduction in noise level. Hence, the study shows that in all the 3 sample zones, most of the respondents are willing to pay the minimum level of bid amounts for maintaining a normal noise level.

Factors Influencing the Willingness to Pay of Households and the Logit Regression Model for Reduction in noise pollution

The Logit Regression Model was used to obtain the mean willingness to pay for noise reduction by the households and to maintain a normal noise level. The logit model is based on the cumulative probability function and it deals with dichotomous dependent variables on a well established theoretical background. To identify the factors influence the willingness to pay for noise reduction and to maintain a normal and pleasant noise level, the household responses to the WTP questions were regressed against the households WTP potential and other socio economic characteristics of the household. The logit regression model is the same as mentioned in the case of other environmental goods and the factors influencing the willingness to pay are;

X1 = Age (Yrs)

X2 = Annual Income (Rs)

X3 = Savings (Rs)

X 4 = Health cost due to noise pollution (Rs)

X5 = Working loss days

The logit regression model based on these influencing factors for better reduction in noise level is represented in tables 6.44 and 6.45.

Table 6.44 The Logit Regression Model (Noise Reduction)

	Coefficient	Std. Error	Z	p-Value
Const	0.542829	1.99797	0.2746	0.78377*
X1	0.0594681	0.0388211	1.5316	0.12553***
X2	0.00133401	0.0626054	0.0214	0.98300**
X3	0.444593	2.08683	0.0214	0.98300**
X4	0.000439172	0.0009069	0.4845	0.62813***
X5	0.148755	0.0342512	4.3430	0.00001**

Source: Survey Data
Note: Observations 1-48 (n=39)
Missing or incomplete observations dropped = 9
Dependent variable: WTP

Table 6.45

The Logit Regression Model for Reduction in Noise Level

Mean dependent var.	0.800001	S.D dependent var	0.402121
McFadden R-Squared	0.631623	Adjusted R-squared	0.505411
Log-likelihood	17.51191	Akaike criterion	47.02380
Schwarz criterion	62.34706	Hannan-Quinn	53.21557

Note: Percentage of cases correctly predicted = 94.6%
f (beta' x) at mean of independent vars. = 0.403
Likehood ratio test: Chi-square (5) = 60.0523 [0.0000]
**Indicate 5 percent level of significance
*Indicates 10 percent level of significance
***Indicates 1 percent level of significance

The logit analysis of the factors determining the willingness to pay the household regarding the reduction in noise level to a considerable normal level implies that age, annual income, health costs and number of working loss days have significant influence upon the willingness to pay of the households. The saving factor has not showed much influence upon the willingness to pay in this matter. The result shows that the R^2 on probability of household's willingness to pay for noise reduction is 0.631 which implies that, more than 63 percent of the changes in the willingness to pay for noise reduction in the sample areas. The mean and S.D. of dependent variable are given as 0.800001 and 0.402121 respectively. The log likelihood in the case of noise level is marked as 17.51191. Similarly, the Chi-square value accounts for 60.0523 at one percent level of significance. This implies that there is close association between the willingness to pay and reduction in noise level. Hence, the households are willing to reduce the use of private vehicular horns, fire crackers

during festivals, sound polluting loud speakers etc. in order to reduce the noise level and are willing to pay for using the public transport systems and other services for better environmental conservation. Thus along with the citizens the authorities should adopt proper environment friendly services in urban areas.

6.4. Implications of the Study

The analysis of the urbanization and environmental conditions in Thrissur District with special consideration to household living conditions implies that the city life is associated with many environmental issues. The Environmental goods such as water, air and land are influenced adversely due to unplanned or unscientific urbanization. Growing urban population without much consideration of environment leads to high amount of pollution. The study of environmental conditions conducted in 3 main zones of the district when there is presence of much urbanization and some amount of slum population reveals that, out of the total respondents 33.8 percent respondents are facing the problem of water pollution, 28 percent have air pollution problems, 21.3 percent have noise pollution related issues and 16.9 percent are facing solid waste pollution.

All these forms of pollution badly, influence the health conditions of the households in the form of diseases. Growing diseases in urban areas resulted in growing health expenditure and loss of work days. This ultimately created economic issues. The ANOVA applied in the study to know whether any variances in samples in three zones in case of health impacts due to major pollutions in the area such as water and air pollution revealed that there are not much significant variations in the sample zones. Thus, the impact of urbanization on sustainable environment in Kerala implies a worse relationship, where there is high amount of environmental issues with high urbanization. The unplanned urbanization without much consideration of ecology is the serious issue that Kerala is facing since last three decades like other cities of the nation. The rural urban migration results in congested city life and associated deterioration of the quality of environmental goods.

During the study almost all the household respondents have positively reacted towards adopting environmental conservation methods. The contingent valuation method which is adopted for economic valuation of environmental goods (land, water, air) implies household's willingness to pay towards environment friendly methods.

Households are willing to pay for improved quality of water and air, proper waste management services and reduction in noise pollution levels. For this, the authorities should come forward with suitable environmental conservation methods which will enhance the positive attitude of people towards protecting environment in urban areas. Only then, the aim of sustainable urban life is fructified.

CHAPTER- 7

FINDINGS AND SUGGESTIONS

CHAPTER-7

FINDINGS AND SUGGESTIONS

7.1 Introduction

The process of urbanization has made a profound impact on the environment of the cities of Kerala. The impact of urbanization on sustainable environment in Kerala is found to be negative, like many other cities of the nation. The present study was carried out to determine this relationship with special concentration on environmental degradation in the Thrissur District. Pollution of environmental goods such as water, land and air were studied in detail with the support of urban households who revealed their opinion about the current status of environmental goods and showed their willingness to pay for better conservation of environmental goods.

This chapter is classified under five heads. They are;

7.2 Major findings of the study
7.3 Conclusion
7.4 Suggestions and recommendations
7.5 Need for sustainable development
7.6 Scope for future research.

7.2 Major Findings of the Study

Urbanization trends in India show that the share of urban population to total population has grown from 10.84 percent in 1901 to 31.6 percent in 2011.The urban-rural ratio also increased to 45.26 percent. Similarly, the growth of million plus cities in the country shows an increasing trend, where it reached to 55 (2011 census) from 5 (1951 census). In Kerala, during all the census years from 1951 to 2011, there is considerable increase in total number of towns; that means, from 94 to 150. The percentage of urban population in 2011 is reached to 47.74 percent. The district wise analysis of urban population shows that, Ernakulam is the most urbanized district in Kerala with 68.07 percent of urban population, followed by Thrissur with 67.18 percent urban population. As per the ranking of districts by percentage of urban population, Thrissur District reached to the second position (2011) from 6th position

(2001). Similarly, the district has marked considerable growth in census towns from 21 (2001 Census) to 128 (2011 Census).

Growing number of slums is one of the major concern of unplanned urban growth. The major cities of the country are having large number of slums and slum population. In Kerala, the total number of slums reported as 1169 during 1996 in which the major share is in districts named Ernakulam, Palakkad, Thiruvananthapuram, Alappuzha, Kozhikkode and Malappuram. In Thrissur number of slums reported as 57 in 1996.

The sex wise distribution of the sample respondents reveals that among the 225 (total) respondents, 186 or 82.7 percent are male, and 39 or 17.3 percent are female heads. This implies that the male heads are dominating in the sample area. The age categorization of the households shows that there are vast differences in the age distribution of sample respondents. Among the total respondents, 25.8 percent belongs to the category of middle age (40-45 years), 22.2 percent belongs to the age category of 45-50 years and 14.7 percent are elder respondents who account for more than 50 years of age. This elder group found to be mostly affected due to environmental problems than younger ones.

The literacy (educational) status of the respondents shows that among the total respondents, 97.8 percent (220) are literates and only 2.2 percent (5) are illiterates. Similarly, among the total literates, 108 respondents have educational qualification of graduation level and higher education. In almost all the 3 zones, the level of educational attainment is the same. Likewise, the religion wise distribution, exhibits that among the total respondents (225), 53.8 percent are Hindus, 41.8 percent are Christians and 4.4 percent are Muslims. 50 percent of the Muslim respondents are settled in Koorkancheri zone.

The study reveals that 82.2 percent of the total respondents are married, 10.7 percent respondents are unmarried and 7.1 percent are widowed. The marital status of the household seemed to be highly influencing the living conditions of the sample respondents. Similarly, the size of the family of households shows that, 41.8 percent accounts for more than 4- member family, 30.2 percent respondents are having 4-member family, 19.1 percent comes under nuclear family, and only 8.9 percent are

having 2- member family. The family size and environmental conditions are seemed to be related in the sample areas.

The nature of occupation determines the living areas of the respondents which make the settlements in slum as well as non-slum areas. The study shows that 30.7 percent respondents out of total respondents are self employed, 20.9 percent are daily wage workers, 18.2 percent are government employees, 17.3 percent are having private sector jobs and 8 percent are engaged in other works. Among the total respondent, 4.9 percent are unemployed. They are mostly found in Koorkancheri zone.

The wealth possession of the respondents which is a key factor of economic status implies that, 28.4 percent of the total respondents have wealth at worth of Rs.10,00,000-15,00,000, and 26.7 percent have wealth at worth of Rs. 15,00,000-20,00,000. Only 10.2 percent respondents possess wealth at worth of less than 5,00,000 rupees and they are more in slum areas of Koorkancheri zone. Higher wealth holders (more than Rs.20,00,000) are settled in the Central zone (56.7 percent). Similarly, the annual income of the sample respondents reveals that 40.4 percent respondents earn annual income at a range of Rs.50,000-1,00,000. Another 20 percent of the respondents earn in between Rs.1,00,000-1,50,000, 18.3 percent earn income more than 2,00,000 rupees annually and 7.5 percent have annual income less than 50,000 rupees. Hence, there are income differences in slum as well as non-slum areas of the city.

The expenditure details of the households are classified into expenditure on food and non food items. The expenditure on food items shows that, among the total (225) respondents, 45.8 percent spend an amount of 75,000-1,00,000 rupees annually, 26.7 percent spend 50,000-75,000 rupees annually, and 20 percent respondents spent less than 50,000 rupees annually. The data of expenditure on non-food items shows that, 51.1 percent respondents out of total respondents, spend less than 50,000 rupees annually, and 22.7 percent respondents spend 50,000-75,000 rupees annually on non food items. Expenditure of more than 1,00,000 rupees for both food and non food items are in fewer percentage among the total household respondents.

The study shows that overall 40.4 percent of the respondents save their income at Rs.1000-1500 per month, 27.1 percent of them save less than 1000 rupees per month

and 11.2 percent save more than 2000 rupees per month. Hence, the saving differentials exist in the sample areas.

The housing conditions of the respondents show that, almost 69 percent of the total respondents are living in concrete house, 24.9 percent respondents are living in tiled houses and only less than 9 percent respondents are living in thatched or other type of houses. Hence, the housing conditions of the respondents are found to be good in the city. Similarly, among the total respondents, 83.1 percent are living in own house and only 16.9 percent respondents are residing in rented house. All the three zones have marked higher percentage of respondents with own houses.

By and large 41.8 percent respondents reveal that, the availability of water in their location is adequate and 58.2 percent remarked it as inadequate. Similarly, almost 87 percent houses in the study area are electrified and only 13.8 percent are lacking this facility. This pinpoints that the housing and associated facilities in the city are satisfactory.

The study the impact of urbanization on sustainable environment in Kerala, the analysis of data from the selected samples of Thrissur district shows that, among the total (225) respondents, 76 respondents are having water pollution issues, 63 respondents are affected by air pollution, 48 respondents are having problems with noise pollution and 38 respondents are suffering from solid waste pollution. A combined analysis of pollution problems at various income levels of the households pinpoints the fact that at lower income levels the pollution problems are found to be higher than the higher income groups.

Water contamination is the serious issue in the city as majority of the respondents (nearly 40 percent) reported that the quality of water is bad. 22.4 percent respondents out of 76 respondents marked water quality as very bad and only 11.8 percent considered it as very good. Similarly, 26.3 percent respondents categorized the available water quality as good for domestic purpose. Water pollution ultimately results in health issues in the form of water borne diseases. Among the 76 respondents 61 respondents (80.3 percent) are affected badly due to water contamination and only 19.7 per cent are not affected by this. Higher proportion of affected respondents, are found in the Central zone compared to the other zones.

The health impact of water pollution is appeared in the form of diseases such as Typhoid, Cholera, Diarrhoea, Hepatitis A/E and other related diseases. Acute Diarrhea is the common disease in the city when 34.4 percent respondents are affected by this and the major portion is in the Central zone. Similarly, typhoid and hepatitis are affected by 29.5 percent and 18 percent respondents respectively. The spread of waterborne diseases leads to higher health costs for the respondents. About 40.9 percent respondents have to spend rupees 1000-1500 monthly for medical treatment due to polluted water. 29.5 percent respondents spend 500-1000 rupees monthly to treat water borne diseases. Thus, waterborne diseases due to contaminated water result in higher health costs and economic burden to households. The ANOVA result shows that there are no significant variances or variations in health impacts due to water pollution between sample zones. Hence, the study represents similar situation in all the sampling zones.

Among the 63 respondents who are responded towards the details of air pollution, nearly 78 percent are affected by air pollution. Among the pollution affected respondents, 39.7 percent are from the central zone, 23.8 percent belongs to the Ayyanthole zone and remaining 36.5 percent belongs to the Koorkancheri zone.

The main contributors of air pollution in the city are transport sector which is accounted for 38.1 percent, construction activities (20.6 percent), garbage burning activities (19.1 percent), domestic fuel burning activities (14.3 percent) and industrial activities which is accounted for 7.9 percent. The major air pollution in the area from all these sources are carbon monoxide (CO) which accounts for 64.4 percentages, Sulphur Dioxide (SO2) which accounts for 20.7 percentage, particulate matter (PM) which accounts for 6.9 percentage and nitrogen oxides (NOx) which contributes 2.9 percentage. This implies that carbon monoxide dominate in the city which has been emitted by the motor vehicles in the urban area.

The polluted air in the urban area results in increasing the morbidity rate of the households, in the form of diseases and health issues. Lung problems are the major form of disease affected by the households which account for 48.9 percent, followed by Asthma (30.6 percent), skin allergy, cancer and other related diseases. It is important to note that among the sampling zones, Ayyanthole and Koorkancheri zones have higher incidence of cancer.

The work loss day analysis shows that, among the respondents who are affected by air pollution, 39.7 percent have lost their work for less than 50 days annually which implies the adverse impact of air pollution diseases. 25.4 percent respondents lost their work for 50-75 days annually and about 29 percent respondents lost their work for 75-100 days annually. The increasing number of work loss days is leading to huge economic crisis in meeting the day to day expenses of the household respondents.

The monthly cost incurred by the respondents towards averting their diseases due to air pollution implies that, 50.8 percent of the affected respondents pay out less than 1000 rupees per month, 31.7 percent respondents spend 1000-1500 rupees per month, 9.6 percent of them spend 1500-2000 rupees per month and 7.9 percent spend more than 2000 rupees per month in the form of medical expenses due to airborne diseases. The cost incurred on health issues are found higher in congested areas of slums of the Central as well as Koorkancheri zones. The study also finds that 48.9 percent of the respondents who have lung problem spend Rs.1000-1500 monthly for medical treatment and 15 percentage respondents spend the same amount for treatment of asthma. Similarly, amount ranging from less than 1000 to more than 2000 rupees are spend by household respondents for the treatment of diseases like skin allergy, cancer and such related diseases.

The ANOVA applied to know the variances in health issues due to air pollution in three sampling zones implied that there are no significant variances among the zones and hence, all the major zones show similar health impacts.

The testing of hypothesis on water and air pollution and the health cost implied that the health cost on water and air borne diseases increases with increased rate of water and air pollution.

The study emphasized the major causes for increasing municipal solid waste in the city. The respondents who are affected by solid waste pollution replied towards the major causes for solid waste pollution. 42.1 percent respondent out of 38 respondents considers rapid population growth as the major reason for mounting the level of solid waste. 34.2 percent considered urbanization as the major cause for solid waste pollution. Similarly, changes in consumption pattern and improved standard of living also contribute to increasing the amount of solid waste in the city. The major source

of solid waste generation is households, followed by shops & markets, construction activities and other institutions.

Solid waste pollution results in health issues in the form of diseases like breathing problems, irregular fever, lung infections, allergies, typhoid, malaria etc. The major issues due to solid waste pollution in the city are breathing problems which accounts for 28.9 percent and irregular fever (26.3 percent). The incidence of these diseases is found higher in the slum areas of the sample zones, where the amount of solid wastes is higher.

The main impact of diseases due to solid waste pollution is the working loss days of the households. Among the 38 respondents, 34.2 percent respondents lost their work in between 35-45 days annually, 26.3 percent lost their work for less than 25 days and 21.1 percent respondents lost WLD for 25-35 days. This trend is almost similar in all the 3 zones of the city. It is worth to note that because of work loss days, the income of the households reduces on the one hand, the cost needed to incur on meeting the medical expenses of diseases creates heavy economic burden on the other.

The annual cost incurred by the householders on diseases due to solid waste pollution implies that 31.6 percent respondents spend less than 5000 rupees annually as medical expenses due to waste generation, 28.9 percent spend Rs. 7500-10,000 annually, and 21.1 percent respondents spend more than 10,000 rupees annually for meeting the medical expenses due to solid waste pollution. Among the 3 zones the Koorkancheri zone has shown higher percentage of medical expenses as there is higher amount of solid waste pollution in that area. The health issues and related medical expenses (cost of Illness) along with working loss days is the impact of solid waste pollution on households in urban areas.

The study pointed out that, out of 48 respondents who are responded towards noise pollution issues, 45.8 percent respondents consider vehicular horns as the main cause for noise pollution in the city. Similarly, construction activities (22.9 percent) and use of loud speakers (16.7 percent) contribute to produce unpleasant noise in the city.

Major health issues related with noise pollution are sleeping disorders, hearing problems, hyper tension, high stress levels and cardio vascular issues which are common in all the 3 sample zones. 45.8 percent respondents replied that the level of

noise pollution in the city is high among which 36.4 percent respondents are from the Central zone, 40.9 percent are from the Ayyanthole zone and 22.7 percent are from the Koorkancheri zone.

The working loss days is the impact of health issues due to noise pollution as 54.2 percent households lost their working days for less than 50 days per annum, 25 percent had WLD for 50-75 days and another 20.8 percent respondents lost their working days for more than 75 days per annum. This implies income loss to the households due to environmental pollution. Similarly, health issues due to noise pollution lead to economic burden in the form of medical expenses (Cost of Illness) where the households have to spend amount ranging from 5000 rupees to more than 10,000 rupees annually. Major percentage of the respondents (37.6 percentage) spend Rs. 5000-7500 annually in which 44.4 percent respondents belong to Koorkancheri zone, and 27.8 percent each from the Central as well as Ayyanthole zone.

The Chi-square test value of solid waste pollution and noise pollution implies that there is increase in the amount of health cost due to increased levels of solid waste and noise pollution.

For economic valuation of environmental goods such as land, water, air, and normal noise levels Contingent Valuation Method (CVM) is used which tried to estimate the monetary values to environmental goods and services. The method tried to estimate economic benefits or costs associated with environmental issues such as air pollution, water pollution, solid waste pollution and noise pollution. The willingness to pay (WTP) is used in the sampling area to find out the attitude of the households towards protecting the environmental goods. WTP on the basic of dichotomous choice applied in the study and the households are responded and revealed their willingness to pay an amount ranges from Rs. 200-300 having an interval of Rs.50 on a monthly basis in order to attain better quality of air and water, reduce noise level and to better management of solid wastes in the city.

The logit regression model is used to find out the mean willingness to pay for improving the quality of all these environmental goods which considers socio economic factors of the households in determining the WTP. The study estimated the WTP for improved quality of water and air, better waste management services, and reducing the level of noise in the city. Factors like age, household income, savings,

literacy levels, size of the family, WLD and cost of illness found to have influence upon the WTP of the households for environmental goods.

7.3 Conclusion

The study concludes that rapid population growth and urbanization are associated with degradation of environmental goods. It is worth to mention that urbanization brings positive impacts on economic and social aspects of households. Urbanization plays a vital role in improving the standard of living of the citizens with better job opportunities and living conditions. This makes the rural urban migration in unexpected rate. Thus, the rapid population growth in urban areas along with demographic changes interacts with environmental goods. This makes the relationship between urbanization and environment complicated. Interactions with natural and human-made environment bring ambient pollution of environmental goods (water, land and air). Excessive population and congested city life are the key indicators of Indian urbanization where there is high environmental degradation in the form of water pollution, air pollution, solid waste pollution and noise pollution.

On the basis of the study it is clear that there is tremendous growth in urban population in Kerala since 2001 and the facilities available in the cities and towns should not shown such expansion. Hence, high population density in cities and fewer developments in city's infrastructural developments create disproportionality which ultimately leading to environmental problems. This is the major reason behind growing pollution levels and subsequent health impacts in cities. In Kerala, the linkage between urbanization and environment is similar to that of other Indian cities where there is high environmental degradation with high level of urbanization. As per the census report of 2011, the percentage of urban population in Kerala is 47.27. About half of the population in Kerala is living in urban area, and occupies third among the states in India having the highest share of urban population. This unexpected urban population growth brings vulnerability in physical environmental of the state. The study concentrated on urban Kerala exhibits the environmental degradation in urban areas of the state which ultimately influences the health and living conditions of households.

The magnitude of water pollution in the state is high which pulls up the urban households to diseases/ health hazards. Due to such health issues the households have

sufferings physically along with economic burden. Similarly, the magnitude of air pollution in the state is also high which produces respiratory diseases and related uncomfortable situations to households .The generation of solid waste in the state is marked as high due to reasons like high amount of population, changes in consumption pattern, changes in standard of living etc. The wastes generated in cities are not collected and treated property due to inefficiency in administration. Prevalence of mounting wastes in resident areas of the city is a common phenomenon in the slum areas of cities of Kerala. According to the survey finding, the solid waste pollution is a serious problem in slums where households are living in unhealthy environment. Similarly, growth of motor vehicles and construction activities in cities bring air and noise pollutions and associated health hazards. It is important to note that, all these environmental issues and related health hazards are affecting more the poor or slum households rather the rich urban households.

Therefore, the government should adopt programs for improvement of living conditions of poor households more and should take care of the environmental goods from further degradation in order to achieve sustainable urban environment for sustainability in development. The sustainable urban development will consider economic, social and environmental aspects simultaneously and will inherit all the resources to future generations without damage. Throughout the study, it is revealed from the household side that as they have sufficient literacy standards and concerns about environment and health; they are willing to pay towards better environment protection. Overall majority of the respondents are ready to pay an extra amount to adopt environment friendly measures. They showed their willingness to use public transport networks to avoid noise and air pollution levels, proper waste treatment at the household and city level and are willing to conserve the existing water resources. Hence, the government authorities should adopt environment protection measures; which incorporates the support from the citizens for environmental friendly city life. This policy fructifies sustainable urban development.

7.3 Major Suggestions and Recommendations

For healthy living and achieving the goal of sustainable development more emphasis should be given to the measures to environment protection. Social awareness programs should be adopted to educate the public about the dangers of pollution of

land, water and air. The legislative measures along with citizen's attention can contribute to check the problem of pollution. The Environmental Protection Act was passed in 1986 in India with the objective to enhance the quality of environment by measures to check deterioration of environmental goods. Economic development and environment protection should be the prior developmental policies in cities. Inorder to develop healthy human resources which can contribute much to the economic development of nation the provision of clean environment is required. Hence, urban development should be planned as sustainable urban development which combines the major concepts of sustainable development (economic, social and ecological aspects). The suggestive measures to reduce pollution of land, water, air and noises are explained below.

7.4. (i) Suggestions for Improvement in the Quality of Water

1. Proper management of sewage treatment process to improve the quality of drinking water.
2. The city drainage system which contains large amount of polluted or waste water should be properly treated in order to avoid contamination of drinking water.
3. Run the dishwasher or clothes washer only when there is full load. This conserves electricity and water.
4. Minimize the use of pesticides and fertilizers. Avoid the dispose of chemicals and other automotive fluids into the sewer systems as this end at the rivers.
5. Use minimum amount of detergent or bleach for washing clothes or dishes.
6. Garbage disposal in the water sources should be avoided and solid waste should keep as solid. Compost pile from vegetable scraps can be used to treat solid wastes.
7. Ensure self hygiene and protective measures at home to keep drinking water clean.
8. Prevent the human and animal excreta to mix with the drinking water to avoid water pollution and related health issues.
9. Installation of water efficient toilets will reduce the use of water.
10. Proper awareness should be given to the public about the adverse effect of water pollution and the need for water protection and conservation.

11. Voluntary organizations should initiate program to educate people about environmental problems.
12. Legislative measures and laws should be implemented related to environmental protection and conservation and each citizen should be responsible to follow the laws.

7.4. (ii) Suggestions for Improvement in the Quality of Air

1. Follow stricter testing and controls of vehicles to reduce emission of NOx.
2. Adopt vehicle bans in city centers.
3. The usage of public transports should be promoted to reduce the use of private vehicles.
4. Promote the use of bicycles. This will reduce fuel emissions.
5. Promote the use of e-mobility (battery driven vehicles) instead of fuel vehicles.
6. The pollution control board of the state should monitor air quality frequently to check the pollution level arising out of fuel emissions from increasing vehicular population.
7. There should be proper monitoring of the quality of fuel supplied to vehicles.
8. Avoid waste burning in open spaces. This will help to reduce the spread of harmful gases.
9. To reduce dust problems in the construction activities, proper regulations should be adopted.
10. Introduce campaigns through voluntary institutions to educate public about the need for preservation of air quality to reduce health issues.
11. To improve city's air quality environmental enhancement program like 'greening the city' can be implemented.

7.4. (iii) Suggestions to Reduce Noise Level

1. Measures should be adopted to control noise level near sensitive areas.
2. Authorities should ensure that the limits of noise level are strictly followed.
3. To avoid unnecessary usage of vehicular horns traffic regulations should be implemented properly.
4. The Government should concentrate on proper maintenance of roads for avoiding traffic congestion and resulting noise pollution.

5. For monitoring the fitness of the motor vehicles periodical checking should be undertaken and old & poor vehicles should ban.
6. Creating quiet areas in parks and other recreational areas.
7. Installing noise barriers in public places.
8. There should be complete ban of loudspeakers from 8p.m to 7a.m.
9. Keep the volume of radio, T.V and other equipments at a low level.
10. There should be minimum use of loud speakers and amplifiers in sensitive areas.
11. There must be separate Noise Pollution Act at the government level.
12. Planting trees and shrubs along roads is an effective measure to reduce the level of noises to a considerable limit.

7.4. (iv) Suggestions to Reduce Solid Waste pollution

1. Consume less to avoid more wastes.
2. Unnecessary packaging should be eliminated.
3. Do not accept bags for purchases if it is really needed.
4. Take a bag or basket to the grocery and market.
5. Buy vegetables loose rather than in Plastic Bags.
6. Don't waste food items and try to store leftovers in a reusable waste treatment system.
7. Compost vegetable or green wastes properly by adopting a suitable waste treatment system.
8. To reduce the purchase of products frequently, design them as they last for longer.
9. Products which are easy to repair, reuse, manufacture, compost or recycle should be given more importance.
10. To produce less waste and pollution redesign manufacturing processes and techniques.
11. Policies should be implemented by the Government like 'Shuchitwa Mission' and 'Malinya Mukta Keralam' to reduce the amount of wastes in public places.
12. In cities proper waste treatment plans should be started and the concerned authorities should ensure its regular functioning.

13. Public should give awareness about the threat of pollution on healthy living conditions.

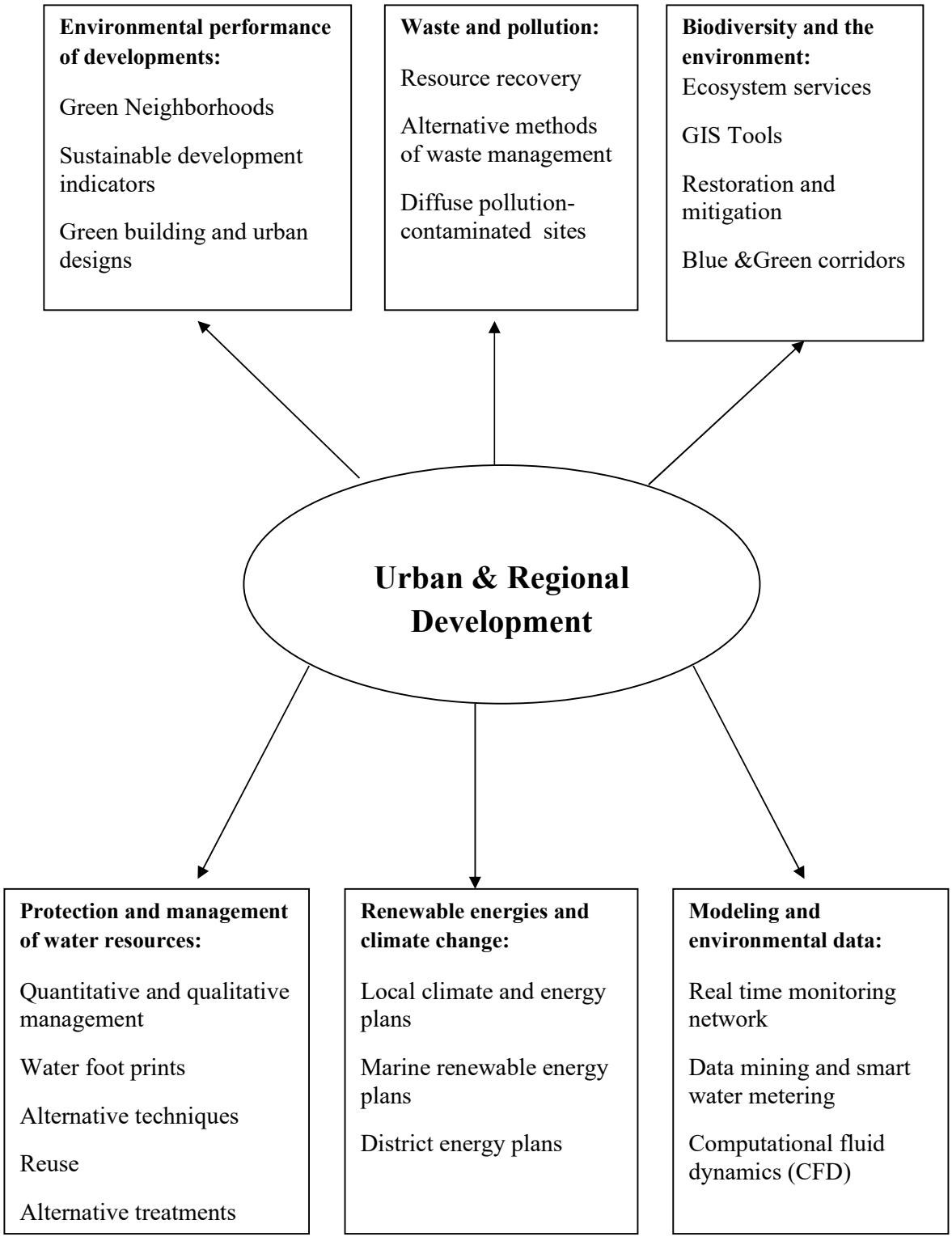
7.5 Need for Sustainable Development

For making urban development a progressive environment friendly, the focus should be given to enhance sustainable development. The concept of sustainable development has been the subject of discussion since the publication of the Brundtland Commission Report (WCED, 1987). The World Commission on Environment and Development (WCED) defines sustainable development as "development is sustainable if the present generation can satisfy its needs without compromising the ability of future generations to meet their own".

There are three pillars that support the concept of S.D. They are; (1) Economy, (2) Society and (3) Environment (ecology) (UN, 2002, Munasinghe, 1993; Ciegis et, al; 2009b) where the three should be mutually supportive and involved in the development process.

Chart 7.1 shows the aspects of urban development with special consideration of sustainability. In urban and regional development, the sustainability concept can be included aspects like; (1) Environmental performance of developments; (2) Waste and pollution; (3) Bio- diversity and the environment; (4) Protection and management of water resources; (5) Renewable energies & climate change; and (6) Modelling and environmental data. The concepts or factors associated with these aspects are needed to be identified (Ulgiati and Brown, 1998, Parris and Kates, 2003).

Chart 7.1 Concept of Sustainability in Urban and Regional Development



Source: imgsoup.com [Bohringer and Joschem, 2007]

The environmental performance of developments needed to concentrate on the aspects like ensuring green neighborhoods, maintaining sustainable development indicators and implementing green building and urban designs. Resource recovery, adopting alternative methods of waste management in cities and diffusing the pollution contaminated sites are the strategies which come under the concept of waste and pollution. Similarly for maintaining biodiversity ecosystem services, implementing blue and green corridors GIS tools with ecosystem services needed. For protecting water resources quantitative and qualitative measures along with reuse strategies and alternative techniques which reminds water footprints are required. For protecting energy sources more concentration should be given to renewable energy plans and marine energy plans. Lastly, each and every aspects of sustainability needed to be monitored with methods like data mining, computational fluid dynamics and real time monitoring.

In short, urban planners should consider economic, social and environmental conditions of the city and policy decisions should be concerned about decreasing economic disparities & environmental damage and increase the possibilities for long-term sustainability.

7.6 Scope for Future Research

The present study deals only with the impact of urbanization on sustainable environment in Kerala based on an analysis of Thrissur district. In this study the emphasis was laid only on components of the environment, namely – Air, water, and land with special emphasis on their pollution. Due to constraints of time and resources other aspects of environment could not cover in a detailed manner.

The area of environment and ecology is a wide one where there are several aspects of ecosystems with special dimensions of sustainable development. The present analysis is undertaken in a city, but cultural and other aspects of cities may be different. Similarly, the environmental impacts and health issues may be different in different cities. So a comprehensive study is needed to have better outcome of environmental and urbanization research. Hence, the present study is useful for researchers from different disciplines and from different cities to have a better outline about the relationship between urbanization and environment.

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APPENDICES

APPENDIX- I

INTERVIEW SCHEDULE

Topic: Impact of Urbanization on Sustainable Environment in Kerala- A Study Based on Thrissur District

I. Identification:

1. Name of the Respondent:

2. Sex:

3. Age:

4. Mother tongue:

5. Religion:

6. Marital Status: Married / Unmarried/ Widowed

7. Literacy Status: Literate/ Illiterate

8. Educational Levels:

Primary	Secondary	Higher Secondary	Graduation	Higher

9. Total number of members in your family:

II. Economic Background:

10. What is your occupation?

i. Government job

ii. Private sector job

iii. Business

iv. Daily wage work

v. Others

11. How much is your annual income from all sources? (in rupees)

i. less than 50,000

ii. 50,000- 1,00,000

iii. 1,00,000- 1,50,000

iv. 1,50,000- 2,00,000

v. more than 2,00,000

12. How much will be the money value of the wealth you possess from all sources?(in rupees)

i. less than 5,00,000

ii. 5,00,000- 10,00,000

iii. 10,00,000- 15,00,000

iv. 15,00,000- 20,00,000

v. more than 20,00,000

13. Do you save money? Yes/ No

14. How much is your monthly saving? Rs…….

15. Do you have any economic debt? Yes/ No

III. Expenditure Details:

16. How much is your total annual expenditure?

Items	Amount (in Rupees)
Food	
Non Food	

IV. Housing and Health Conditions:

17. Nature of Residence: Rented/ Owned/

18. Type of Residence: Concrete/ Tiled/ Tatched/ Others

19. Do you have water facilities? Yes/ No

20. What is your opinion about the availability of water in your residence? Adequate/ Inadequate

21. Do you have electricity availability? Yes/ No

Remarks by the enumerator	

V. Environmental Conditions and Health Issues

22. Do you have any environmental problems in this area? Yes/ No

23. If yes, what is the major environmental issue that you have?

Problems	Tick mark
Water pollution	
Solid waste pollution	
Air pollution	
Noise Pollution	

24. If it is Water related problems, what is your opinion about the quality of water in your area?

Very Good/ Good/ Bad/ Very Bad

25. Can you mention the colour of the water which available to your usage?

Blue/ Light Blue/ Green/ Orange

26. Do you suffer any diseases due to low quality of water? Yes/ No

27. What are the major diseases do you have due to contaminated water?

i. Diarrhoea

ii. Cholera

iii. Typhoid Fever

iv. Hepatitis A/E

v. Others

28. Do you go for medical treatment for such diseases? Yes/ No

29. How much amount you spend monthly for medical treatment of water borne diseases? Rs……

30. If the major problem is solid waste pollution, what do you think is the reason for increasing amount of municipal solid wastes?

i. Urbanization

ii. Rapid Population Growth

iii. Changes in Consumption Pattern

iv. Improved Standard of Living

v. Others

31. What are the major sources of wastes in your city?

i. Construction Activities

ii. Shops and Markets

iii. Households

iv. Hospitals, Marriage Halls and Institutions

v. Others

32. What are the major diseases do you have due to solid waste pollution?

i. Allergies

ii. Breathing problems

iii. Irregular fever

iv. Typhoid/ Malaria

v. Lung Infections

33. Do you have work lost days because of such diseases? Yes/ No

34. If yes, how many working days you lost yearly? …….days.

35. How much amount you spend annually as medical expenses for diseases due to solid waste pollution? Rs……..

36. If the major problem you consider is air pollution, what do you think is the main agent of such pollution?

i. Transport sector

ii. Construction Sector

iii. Industrial Sector

iv. Domestic Fuel Burning Activities

v. Garbage Burning/ Others

37. Do you have any diseases due to polluted air? Yes/ No

38. What are the major diseases do you have due to air pollution?

i. Asthma

ii. Lung Problem

iii. Skin Allergy

iv. Cancer

v. Others

39. Do you have work lost days because of such air borne diseases? Yes/ No

40. If yes, how many working days you lost yearly? ……days

41. How much amount you spend annually as medical expenses for diseases due to air pollution? Rs…….

42. If the major problem you consider is noise pollution, what do you think is the major cause for such pollution?

i. Vehicular Horns

ii. Construction Activities

iii. Industrial Activities

iv. Loud Speakers

v. Social Events

43. What do you think is the level of noise pollution in your area?

Very high	High	Medium	Low

44. Do you have any health issues due to noise pollution? Yes/ No

45. What are the major health issues do you have due to noise pollution?

i. Hearing Problems

ii. Sleeping Disorders

iii. Cardio Vascular Issues

iv. Hyper Tension & High Stress Levels

46. Do you have work lost days due to health issues of noise pollution? Yes/ No

47. If yes, how many working days you lost yearly? …….days

48. How much amount you spend annually as medical expenses for health issues due to noise pollution? Rs……

Remarks by the enumerator	

VI. Measurement of Willingness to Pay

Let us suppose that Thrissur Municipal Corporation (TMC) is undertaking a project for bringing down pollution levels. In association with an NGO or agency, the authority is going to take up measures to improve the environmental situation.

The NGO will test the quality of water supplied weekly & will take measures to reduce water contamination and will assure improved quality of water. For this, a fee is charged from the local residents.

49. Are you willing to pay for such improved quality of water? Yes/ No

50. If yes, in consideration of your budgetary limitations, are you willing to pay less than 200 rupees per month? Yes/ No

51. If yes, are you willing to pay Rs. 200- 250 per month? Yes/ No

52. If yes, are you willing to pay Rs. 250- 300 per month? Yes/ No

53. If yes, are you willing to pay more than 300 rupees per month? Yes/ No

If yes, continue increasing by Rs. 50 till the respondent reaches No. Record the highest value of willingness to pay.

Suppose that TMC and District Pollution Control Board are going to take up a major pollution control program. Under this program all air polluting units in the city are controlled and monitored. Remedial measures are suggested in the field of transport system. This is based on some money charges which are to be collected from the residents.

54. Are you willing to pay for such improved quality of air? Yes/ No

55. If yes, in consideration of your budgetary limitations, are you willing to pay less than 200 rupees per month? Yes/ No

56. If yes, are you willing to pay Rs. 200- 250 per month? Yes/ No

57. If yes, are you willing to pay Rs. 250- 300 per month? Yes/ No

58. If yes, are you willing to pay more than 300 rupees per month? Yes/ No

If yes, continue increasing by Rs. 50 till the respondent reaches No. Record the highest value of willingness to pay.

Suppose the TMC appoint a private agency or NGO to solve the issue of solid wastes. The agency will initiate measures to clean the city by regular collection and treatment of wastes. A fee is charged for this from the local residents.

59. Are you willing to pay for better waste management system? Yes/ No

60. If yes, in consideration of your budgetary limitations, are you willing to pay less than 200 rupees per month? Yes/ No

61. If yes, are you willing to pay Rs. 200- 250 per month? Yes/ No

62. If yes, are you willing to pay Rs. 250- 300 per month? Yes/ No

63. If yes, are you willing to pay more than 300 rupees per month? Yes/ No

If yes, continue increasing by Rs. 50 till the respondent reaches No. Record the highest value of willingness to pay.

Suppose an NGO comes forward in the city to solve the problem of noise pollution by proper monitoring of noise levels and suggesting alternative measures to reduce noise levels. A fee is collected for this from the resident households.

64. Are you willing to pay for this? Yes/ No

65. If yes, in consideration of your budgetary limitations, are you willing to pay less than 200 rupees per month? Yes/ No

66. If yes, are you willing to pay Rs. 200- 250 per month? Yes/ No

67. If yes, are you willing to pay Rs. 250- 300 per month? Yes/ No

68. If yes, are you willing to pay more than 300 rupees per month? Yes/ No

If yes, continue increasing by Rs. 50 till the respondent reaches No. Record the highest value of willingness to pay.

Remarks by the enumerator	

Thank You.

APPENDIX- II

Selected Sample Zones of Thrissur Municipal Corporation

Sl. No.	The Central Zone	No. of Samples Selected
1	Poonkunnam	4
2	Kuttankulangara	6
3	Patturaikkal	4
4	Chembukkavu	4
5	Kizhakkumpattukara	5
6	Paravattani	5
7	Nadathara	4
8	Chelakkottukara	4
9	Mission Quarters	5
10	Pallikkulam	7
11	Thekkinkadu	6
12	Kottappuram	5
13	Poothole	10
14	Kokkalai	10
15	Kanattukara	4

Sl. No.	Ayyanthole Zone	No. of Samples Selected
1	Kariattukara	6
2	Chettupuzha	10
3	Pullazhi	8
4	Olari	8
5	Elthuruth	5
6	Laloor	12
7	Aranattukara	7
8	Ayyanthole	6
9	Civil Station	5
10	Puthoorkkara	5

Sl. No.	Koorkancheri Zone	No. of Samples Selected
1	Chiyyaram South	7
2	Chiyyaram North	7
3	Kannamkulangara	10
4	Vadookara	8
5	Koorkancheri	12
6	Kanimangalam	12
7	Panamukku	6
8	Nedupuzha	8