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*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.

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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

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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.
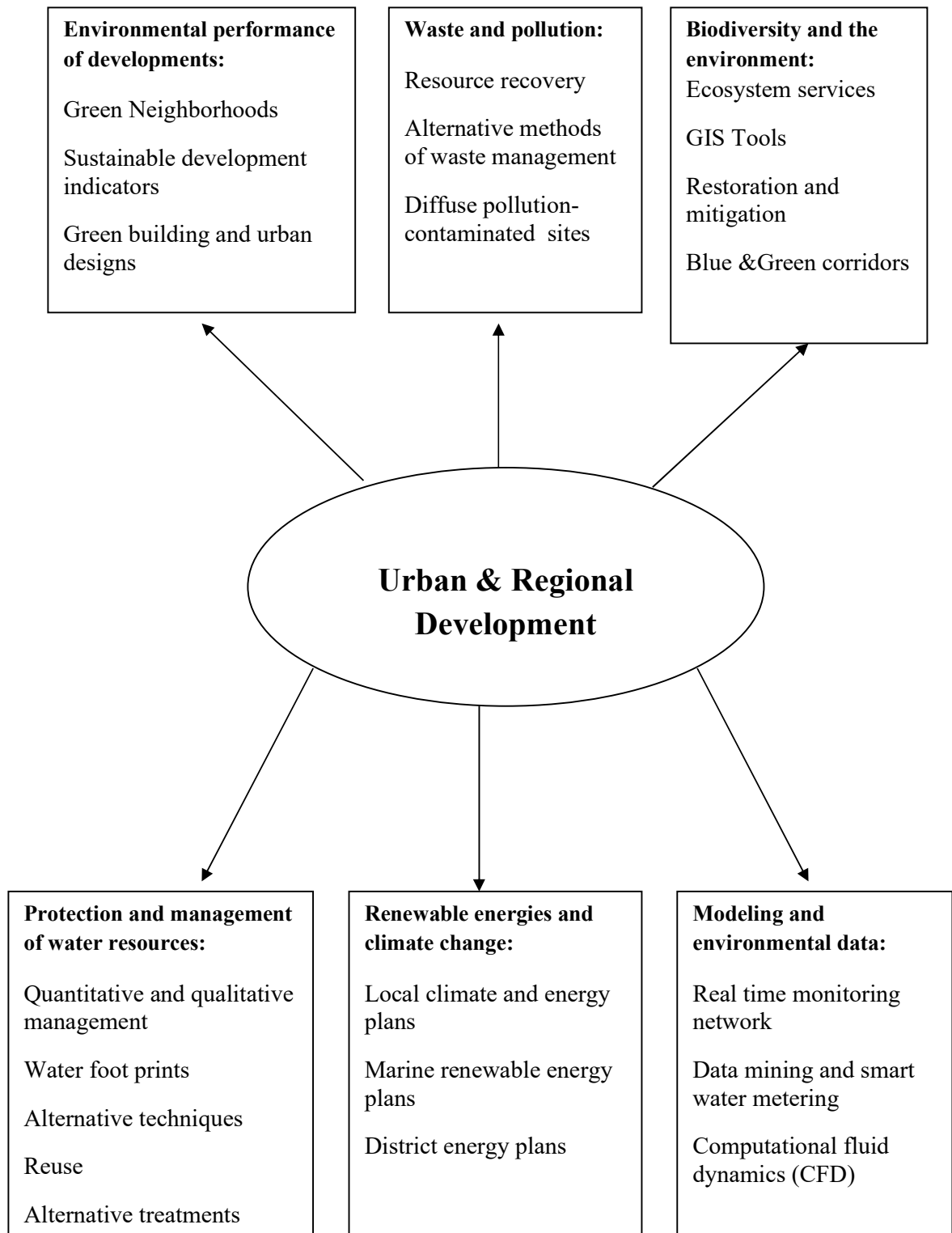
## 7.5 Need for Sustainable Development

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**

**Environmental performance of developments:**

Green Neighborhoods

Sustainable development indicators

Green building and urban designs

**Waste and pollution:**

Resource recovery

Alternative methods of waste management

Diffuse pollution-contaminated sites

**Biodiversity and the environment:**
Ecosystem services

GIS Tools

Restoration and mitigation

Blue &Green corridors

**Urban & Regional Development**

**Protection and management of water resources:**

Quantitative and qualitative management

Water foot prints

Alternative techniques

Reuse

Alternative treatments

**Renewable energies and climate change:**

Local climate and energy plans

Marine renewable energy plans

District energy plans

**Modeling and environmental data:**

Real time monitoring network

Data mining and smart water metering

Computational fluid dynamics (CFD)

**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.