Chapter VII

Summary of Findings, Conclusions and Suggestions
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SUMMARY OF FINDINGS, CONCLUSIONS AND SUGGESTIONS

The geological entity known as Kuttanad is virtually the man-made granary of Kerala. Kuttanad is an ill-defined area with certain common physical features and cultivation practices. Kuttanad, the name of the place, should not be confused with the administrative thaluk ‘Kuttanad’, created recently due to the changes in the administrative boundaries which have been made from time to time. The image of Kuttanad, as low lying water logged region, which is transformed into a vast sheet of water of varying depth, during the monsoon season is a clear cut one. Kuttanad, a marshy delta region in southern Kerala, is a replica of earth’s topography. Kuttanad has a unique heritage of humanity with natural beauty and enterprising people, is a wonder land in God’s own country.

Sustainability of production and productivity is highly important in Kuttanad. Kuttanad soil, rich in organic matter is highly acidic and hence management of this soil is very important for maintaining its productive health. Innovative approaches are important to make agriculture sustainable in economic level. The Padasekharam approach in Kuttanad provides a good example of co-operative management of farming in clusters with collective co-ordination of major common activities like dewatering, bund construction and so on.
However, lack of proper water management is at the root of several ecological distresses in Kuttanad. Multiple human interventions causing obstruction to the natural and free flow of the river back water system and consequent disruption to the seasonal mixing of saline and fresh water and pollution of river and lake waters have drastically affected the dynamics of the people in the region. Another important contributor to the ecological decay is the inadequate management of salinity intrusion into Kuttanad. Kuttanad agriculture is also threatened by the salinity intrusion from Kayamkulam Lake in the South. A host of human activities in the lake and its surroundings such as unregulated fishing, dredging for white Kakka (Clam), destruction of aquatic life, hunting of Wetland birds cause ecological decay. A serious ecological threat is the biological and chemical pollution of Kuttanad water bodies. All these are making Kuttanad a very unpleasant place of human habitation with common threat of many serious water borne diseases like dengue fever, malaria, typhoid, cholera, dysentery, jaundice etc.

Hence, it is highly relevant to conduct a study on the environmental pollution and sustainable development of Kuttanad. It is only through public participation the problems can be minimized. Such a study, it is hoped, will throw light on the causes of pollution and barriers to sustainable development of Kuttanad. This will be highly beneficial to all those concerned with corrective measures to rectify the ecological disasters
prevailing in this area and designing future course of action for attaining the desired sustainable development of Kuttanad. The present study is an attempt with this end in view.

In the preceding chapters an attempt has been made to study public awareness and response to the environmental problems and sustainable development of Kuttanad. This chapter is devoted to summarise the findings of those chapters, draw conclusions and make suggestions on the basis of the findings of the study. This chapter is divided into three sections. Section A provides a summary of the entire study and its findings. Section B deals with conclusions drawn from the study and Section C contains the suggestions based on the findings and conclusions of the study.

SECTION A.

7.1 Summary of Chapters

The first chapter is introductory in nature. It unravels the subject and significance of the study, the objectives of the study, the hypotheses framed for initiating the study, the methodology adopted for conducting the study, the survey design of the study and limitations of the study

A brief review of the earlier studies in the area of public awareness and response to the environmental problems and sustainable development is presented in the second chapter. This chapter is divided in to three parts.
The first part gives a review of earlier studies at an international level. The second part is devoted for the national level studies and in the third part, Kerala level studies are presented.

In the third chapter an overview of the land, people and environmental specificities of Kuttanad is presented. It makes a brief review of history, topography, geological and geographical characteristics of Kuttanad. The ecological setting of Kuttanad and occupational distribution of population are explained in the first part of the chapter. Various types of environmental problems and its impact on human health and wellbeing is presented in the second part of the chapter. The major problems of the region are also identified in the last part of the chapter.

Chapter four examines the developmental projects of Kuttanad. It highlights various programmes and projects offered by government and non-governmental organizations. A brief review of Dr. Swaminathan Commission is also presented in this chapter. Environmental laws and pollution control form the last part of this chapter.

Chapter five gives an empirical analysis of the environmental system of Kuttanad. In this chapter, the socio-economic background of the residents of Kuttanad is examined. An attempt is also made to identify the settlement variables and environmental problems faced by the people of
Kuttanad. The impact of environmental pollution on the people of Kuttanad is analysed in the last part of the chapter.

Chapter six inquires the awareness and response of the public on environmental problems of Kuttanad. This chapter is divided into three sections. Section I explains the awareness of the people of Kuttanad regarding the environmental problems and sustainable development. Section II deals with public response regarding the environmental problems and sustainable development. Section III gives an account of the perception of the people regarding various environmental issues.

Chapter seven, the present one, gives a summary of the findings of the study, draws conclusions and suggestions on the basis of the findings of the study.

7.2 Findings of the study

The following are the major findings of the study.

7.2.1 Overview of Land, People and Environmental specificities of Kuttanad

Kuttanad is a mix of homogeneity and heterogeneity. There is considerable homogeneity between different parts of Kuttanad with regard to the environmental influence, agricultural practices, interaction between people and their life styles. Heterogeneity can be observed with respect to incidence of flood submergence, degree of salinity and variation in configuration of agriculture.
From the agricultural point of view, Kuttanad, is divided in to six agronomic zones, such as Kayal Lands, Upper Kuttanad, Lower Kuttanad, North Kuttanad, Purakkad Kari and Vaikom Kari, each sharing 17.5 percent, 19.5 percent, 30 percent, 12 percent, 6.5 percent and 14.3 percent of the area, respectively. More than 75 percent of the paddy cultivation in the Alappuzha District falls in Kuttanad. Rice is grown during puncha season (Nov-March) and virippu season (May-Sept). A significant change has been taken place in the land- utilisation pattern in this area.

The literacy level of Kuttanad is 93 percent, people irrespective of literacy level, depended upon paddy cultivation.

The agricultural labourers of Kuttanad are proud owners of a rare legacy, the invincible power of human labour in transforming the major part of Vembanad Lake into golden paddy fields.

The Vembanad lake is reduced to less than $1/3$rd of its original expanse due to the large scale reclamation and encroachment, which reduced its capacity to absorb flood water by 78 percent. With the construction of Thanneermukkom barrier, the Vambanad lake is blocked and divided in to two and its water-depth has been reduced. Thannermukkom barrier was envisaged for arresting salinity intrusion, but it created new problems of water pollution and weed growth. Prolonged period of its closure, to facilitate
puncha rice crop, has created ecological problems and adversely affected the fishing community.

Along with rice cultivation, there is also the cultivation of commercial crops such as coconut, areca nut and plantain. Besides, non-agricultural occupations are also practiced here. Inland fishing is a major occupation in Kuttanad.

In Kuttaad paddy cultivation is always under natural, social and market pressures. The main cost of paddy cultivation are price of seed, rent, charge of plumbing, manures, pesticides, machinery charges harvesting and transportation charges.

The main agricultural problems of Kuttanad are problem of salinity, impact of fauna and flora, water pollution, flood, air pollution, pollution due to solid wastes, thermal pollution and soil pollution. Breach of bunds due to force of flood flow also leads to crop loss in Kuttaad.

The major environmental and other problems of Kuttanad are uncertainty of agricultural output, transportation, dewatering, power requirements, poor infrastructure, the ecological imbalance, inclement weather, non-availability of quality seeds, labour problems, instability of crops, lack of finance, marketing of produce and high cost of production.
Unscientific and inefficient management of floods, construction of leading channel, far smaller in size, improper spillway operation are all reflected as cause for ecological distress of Kuttanad.

Throwing of waste materials, bio-wastes and un-wanted things to rivers from towns, hospitals, industries, households, pilgrimage places, hotels and resorts, dumping of agricultural chemicals and coir-retting have contributed much to the pollution problem of Kuttanad.

### 7.2.2 The Developmental Projects of Kuttanad.

An Intensive Agricultural District Programme paved the way for substantial progress in Kuttanad.

Specific projects of Kuttanad include spillway at Thottapally, regulator at Thannermukkom and twenty-four kilometer long link road between Alappuzha and Changanacherry.

Thottapally spillway was commissioned to drain off floodwater from Vembanad Lake to the sea.

Thanneermukkam bund was constructed to check the intrusion of saline water from the sea through the Vembanad Lake, for the paddy intensification in low-lying areas of Kuttanad.

The Alappuzha – Changanacherry road constructed above the flood level, sets as the barrier to free movement of floodwaters from the upper Kuttanad to lower Kuttanad.
Alappuzha-Changanacherry road is designed with a parallel running Alappuzha-Changanacherry canal to protect from the damaging impact of the flood-level, but is lying heavily infested with water hyacinth, disturbed with side encroachments and unscientifically built side roads.

The major and smaller roads and the railways constructed across the direction of water flow, the bridges and culverts over the rivers and canals, narrowed the flood flow space and enhanced the water way blockages by silting and dysfunctioning of drainage systems.

The salinity problem affects the Kayal land of Kuttanad towards February. Thanneermukkom barrier was envisaged for the prevention of saline water and helps this area to raise a second crop during summer.

To control saline intrusion in Thrikkunnappuzha and similar region, a few temporary salinity barriers are also erected on annual basis.

Prevention of saline water intrusion helps the Kari land to raise a second crop during summer.

The Karapadam lands are affected by the intrusion of saline water during summer and Thannermukkom bund helped to prevent this intrusion.

The regulator at Thanneermukkom was designed to prevent salinity intrusion in the dry season and to retain the fresh water from rivers flowing into the lake.
For protecting the crops against flood during crop period several outer bunds have been made on the sides of padasekharas and is put to repair and strengthen, from time to time, so as to prevent their breaching during flooding.

The leading channel and the Thottappally spillway divert part of flood water to westwards and reach Arabian Sea instead of flowing through Kuttanad into the Vembanad Lake.

The combined effect of the spillway and the regulator was expected to increase the area under double crop paddy by enabling the sowing of the first crop to an advanced date in areas subject to north east monsoon flood and the raising of a second crop by preventing the intrusion of salinity upon water in the summer.

The second phase of Kuttanad Development Scheme consists of construction of permanent bunds, improvements in the approach channel leading to the Thottapally spillway, protective works of the bunds on fields affected by the operation of the spillway gates and work connected with the diversion of Idukki tail race waters from Muvattupuzha River.

The length of the present leading channel of the Thottapally spillway is 5200 meters. It is designed to change the capacity of the spillway. But experiences have shown that the spillway does not function at its designed capacity. The anticipated flow of water during flood through
the spillway is 19500 cubic meters per second, but at present the actual flow is only 600 cubic meter per second. This causes heavy flood every year. Flood is caused and lasts long when the incoming water is not absorbed into the lake or to the sea.

The rampant, unsystematic and unplanned development activities have threatened the ecological balance of this region. When compared to the remaining portion of the Alappuzha district, the development of the region is to be considered separately due to the identity of its agro-climatic zone and variations in the problems of this region.

7.2.3 **Environmental Laws and Pollution Control**

Authorities engaged in pollution control are State Pollution Control Boards, Central Pollution Control Board, State Government and Central Government.

The functions of State Pollution Control Board are advice the government in matters of water and air pollution, research and development and regulatory functions.

The Central Pollution Control Board has the same powers and regulatory functions as a State Board.

The State Government has the administrative power over the State Board, powers to make rules, power of revision against consent order
granted by the board, power about area of jurisdiction and special powers to direct State Board.

The Central Government has similar powers over the Central Board and the union territories as the powers of the State Government on State Board.

7.2.4 The Environmental system of Kuttanad-An Empirical Study

The environmental system of Kuttanad consists of physical, man-made, socio-economic, settlement variable and psychological. The socio-economic environment gives a clear picture of the life style of the people. The variables such as age, sex, income, and education are very important in the psychological approach towards the development of the region.

Majority of the people surveyed ie, 97 percent are above 25 years of age. This shows that people above 25 are more interested in responding to environmental problems.

Of the total units surveyed the vast majority ie, 85 percent are male. This shows that social problems are more important to men rather than women.

Majority of the sample units ie, 56 percent, are Hindus.

About 48 percent of the sample surveyed got secondary education and 28 percent have collegiate education.
An analysis of income level of the sample reveals that in aggregate 49 percent have income below Rs 25000. This shows that majority of the people have low income in the region.

About 93 percent of the surveyed are permanent residents of Kuttanad. People are living here on a permanent basis rather than floating population.

Public tap is the most common source of drinking water for 55 percent of the sample units.

Agriculture is the main occupation of the people living in Kuttanad, eighty four percent of the people surveyed are agriculturists.

Majority of the sample units ie, 75 percent have below three acres of owned land.

Majority of the farmers ie, 73 percent have not reduced their area of cultivation.

Majority of the farmers ie, 60 percent are continuing rice cultivation, whereas forty percent have switched over to some other crops.

Out of the farmers who reduced the area under cultivation, 55 percent reduced between 25 and 50 percent of their total land holdings.
Out of the sample units who have switched over to other crops, 59 percent sought fish farming. So this is the alternative occupation for the farmers.

Lack of profitability of rice cultivation is the main reason for change over to other crops.

Majority of the farmers, ie, 72 percent of the surveyed agriculturalists, reduced the number of cultivation of land.

The main reason for the reduction in cultivation frequency is lack of profitability of rice cultivation. Sixty five percent of the sample have such an opinion.

Labour problems, marketing of produce and flood and its consequences are the other reasons for reducing the frequency of cultivation. The storage option of the crop is uneconomic since storage of grains demands its transportation from fields to centralized warehouses and drying of grains to storable moisture level.

Drinking water problem, annual floods, water-borne diseases and disturbances to fish cultivation are the major environmental problems faced by the people of Kuttanad.

Skin diseases, Arthritis and fungal infection are the major environmentally induced diseases in this region.
Majority of the families ie, 49 percent are spending more than Rs. 2000/- per year for the diseases.

7.2.5 Impact of Environmental Pollution among the People of Kuttanad

An analysis of impact of environmental pollution on the people of Kuttanad shows that water pollution is the main problem in Kuttanad. Skin diseases, diarrhoea, and transportation problems are also have much impact on the life of the people of Kuttanad. People are concerned about the waste disposal and reduction of fertility of land. The health security of local inhabitants is very closely linked with the ecological security of this region.

7.2.6 Awareness of the public on Environmental Problems

Both men and their counter parts are equally aware of the environmental pollution of the region.

There is wide-spread knowledge about environmental pollution among the people of all age groups.

With the advancement of education, awareness level also increased. People having primary education stand lowest with an average of 36.65 whereas people with professional qualification stand highest with an average of 39.75.
Out of the total respondents surveyed, 65 percent have average awareness regarding pollution created by chemical fertilizers and 23 percent has only little awareness on the subject.

Out of the sample surveyed 65 percent have average awareness regarding the use of organic fertilizers. Among them only 48 percent are high users of the same.

Majority of the respondents ie, 65 percent have only average awareness regarding the evil effects of chemical pesticides. Among them 75 percent are high users of the same.

Out of the total sample surveyed, 68 percent have only average awareness regarding the use of organic pesticides and 69 percent are moderate users of it.

7.2.7 Public Response Regarding the Environmental Pollution

According to majority of people ie, 229 the construction of flood barriers can prevent flood and thereby development can be achieved. For some others ie, 194 there should be proper drainage facilities for the development of the region.

Raising the boundary bunds above the mean sea level, desilting the water ways, produce new seeds suitable for the soil conditions and that can survive flood, encourage bio-farming and arrest salinity are the important measures to increase agricultural production in Kuttanad.
Majority of the sample surveyed suggested that support from voluntary organisations play a vital role in the development of Kuttanad. In addition, interaction with farmers by government and agriculture mechanization also do better for smoothening the agriculture of this region.

Majority of the sample ie, 251, have the opinion that sea face of the Thottapally spillway should be widened. Deepening the shallow portion of the Vembanad Lake and extending AC canal up to Pallathuruthy are also suggested by the respondents.

Even though, majority of the people participated in agitation and movements for the development of Kuttanad, they have only average awareness regarding the environmental problems.

Regarding membership in voluntary organisation, majority ie, 59 percent are members of the said organisations but 21 percent of them have low awareness regarding the working pattern of the organisations.

7.2.8 Public Response towards sustainable Development

People with secondary education have the highest awareness and as with advancement of education the level of awareness on sustainable development decreases.

People below 25 have better understanding about the concept of sustainable development. With the advancement in age, the awareness shows a decreasing trend.
Increase in water flow is the most essential factor for the development of Kuttanad. Safe drinking water and opening of Thannermukkom Bund are coming next in the order of importance. Soil health management and amassing of waste are also important as it is suggested by majority of the people.

Kuttanad Vikasana Samathy is playing a crucial role in the development of Kuttanad. Gandhi Smaraka Grama Seva Kendra comes next in the order.

7.2.9 Perception of people on various Developmental Issues.

Majority of the people, ie 98 percent believe that agriculture leads to sustainable development of Kuttanad.

Almost cent percent of sample surveyed perceived that pollution is the major problem in Kuttanad.

Out of the sample surveyed, only 35 percent strongly agreed to the statement that sustainable development is a serious issue before the people of Kuttanad.

Majority of the sample surveyed ie, 62 percent agreed that proposed projects of the Government lead to sustainable development.

The opinion about the role of Vikasana Samathies shows that only 7 percent strongly agree that samathies are playing a vital role in the life of the farmers of Kuttanad and 64 percent agree to such a statement.
About 66 percent of the people surveyed are of the opinion that existing environmental laws are sufficient for the prevention of pollution.

Majority of the people, ie, 97 percent is of the opinion that public participation is essential to prevent pollution of a region.

Cent percent of the people surveyed has the opinion that they are aware of the environment.

Ecological disasters are a serious problem for 74 percent of the people surveyed.

About 17 percent of the respondents strongly agree that Government have failed in the implementation of projects and 57 percent agree to such a statement.
SECTION B

7.3 Conclusions of the Study

The following are the major conclusions, arrived at, based on the findings of the study.

Majority of the people living in this region are agriculturists and earning low income from the occupation.

The land holdings for agriculture are below three acres and small-scale agricultural operations are carried on by the people.

 Majority of the farmers have not reduced their area of cultivation and continued with rice cultivation. The padasekharam approach in Kuttanad is an example of co-operative management of farming in clusters with collective co-ordination of major common activities like dewatering, bund protection, sowing, and harvest and so on.

There is a wide spread practice of reducing the number of cultivation in Kuttanad. The use of combined harvesters has helped the harvesting process but the procurement has not kept pace with the harvest. Large quantities of paddy lie in the open as the procurement have not commenced their operation effectively.

Farmers say millers often refuse to take the paddy alleging that it does not confirm to the quality stipulations and with the onset of summer
rains the moisture content of the grains will go further up. Movement of harvested paddy from the interior regions has also been affected due to the shortage of head load labourers. The problem has worsened as the water way is filled with hyacinth, making the movement of boats into the padasekharams impossible. No steps have been taken so far by the government for setting up warehouses in the nearby areas.

Along with rice cultivation, there is also the cultivation of commercial crops such as coconut, areca nut and plantain. Besides, non-agricultural occupations are also practiced, such as, fish farming and duck rearing.

The main reason for reduction in the number of cultivation and switching over to some other crops is lack of profit from rice cultivation.

Labour problems, marketing of produce and flood and their consequences are some of the other reasons for reducing the frequency of cultivation. The earlier resistance against introduction of machinery is decreasing. Though there is acute shortage of labour during weeding and harvesting operations, labourers are afraid of the decreasing number of employed man days per year.

The region is an unpleasant place of human habitation with common threat of many serious water-borne diseases like Dengue fever,
Elephantiasis, Malaria, Typhoid, Cholera, Dysentery, Gastroenteritis, Jaundice, and Chikungunya and so on.

Skin diseases, arthritis and fungal infection are the major environmentally induced diseases in this region.

Water pollution is the most important environmental problem of Kuttanad.

Skin diseases, diarrhoea diseases and transportation are major environmental issues of the people.

Waste disposal and reduction of fertility of land need consideration by the authorities.

There is a widespread knowledge about environmental pollution among the people of Kuttanad.

Even though people are aware of the evil effects of chemical fertilizers, they are the high users of the same.

Majority of the people is aware of the evil effect of chemical pesticides. Still they are using it for cultivation.

Majority of the people has average awareness regarding organic manures and pesticides and they are using it on low scale. This is a serious issue requiring attention of the policy makers.
Construction of flood barriers can prevent flood and thereby the development of Kuttanad can be achieved.

Raising the boundary bunds above the mean sea level, encourage bio-farming and arrest salinity are the important measures to increase agricultural production in Kuttanad. Moreover, the sea face of the Thottapally spill way should be widened.

Non-governmental organisations have a great role in the development of Kuttanad.

The public response to sustainable development of Kuttanad focused attention on increase in water flow, safe drinking water and opening of Thanneermukkom Bund.

People are of the opinion that it is agriculture through which the sustainable development of Kuttanad can be achieved.

The environment and water pollution are the serious problems of Kuttanad and the proposed projects of the Government lead to the reduction of the same.

The existing environmental laws are sufficient to prevent the pollution and public participation is essential to prevent the same.

Majority of the people has the opinion that Government have failed in the implementation of various projects for the development of Kuttanad.
Back Water tourism is a fast growing economic activity with potential for generating income and employment. Water tourism is adding more pollution either as solid waste or as fuel contamination. Kuttanad tourism development is hampered by the poor environmental conditions, poor hygiene, presence of water borne diseases and lack of good health facilities in the region. The growth of resort tourism has led to increase land conversion and encroachment into the Vembanad Lake.

Ecological restoration and sustenance will improve not just the quality of environment but also strengthen livelihoods and facilitate greater economic development. The findings and conclusions of the present study have relevance in restoring the unique Kuttanad as a ‘Paradise on earth’. People’s participation, their skill and will with adequate financial resources, backed by timely support from central and state Government schemes, are vitalized, to promote her heritage, beauty, potential, strength and development efforts, for the welfare of Kuttanad.
SECTION C

7.4 Suggestions

Based on the findings of the study and the conclusions drawn from it, the following suggestions are offered as feasible to achieve the development of Kuttanad.

The Government should declare Kuttanad as a Special Agricultural Zone (SAZ) to achieve holistic attention to conservation, cultivation, consumption and commerce. This will improve the productivity and profitability of rice cultivation, which are vital for the development of the region. The rice cultivation in Kuttanad is facing a crisis of reduction in productivity and profitability. Both Central and State Governments should seriously consider this crisis and form policies accordingly.

The main environmental issue before the people of Kuttanad is water pollution out of the chemicals and pesticides used for agriculture. To reduce the pollution, bio-farming should be encouraged and the use of chemical fertilizers is to be discouraged. Orientation programmes should be conducted by non-governmental organizations working in Kuttanad to spread the disastrous effects of chemical fertilizers and pesticides. The study revealed that, even though people are aware of the evil effects, they are using chemicals to a large extent. This should be curbed by
encouraging bio-farming. This will reduce the cost of cultivation and protect the health of the people living in the region.

Soil health management should be promoted to yield the productivity of land and improve the fertility of soil. This is a specialized area which needs continuous research and development. Rice research centers should develop various models of soil management. The fertility of the soil is washed away by continuous flood and intrusion of saline water. This is a serious problem in this region. So research centers should develop special manures for this region.

There should be a programme for water salinity management and flood control strategy in Vembanad Lake, which will help to harness the needs of both paddy and fish cultivation. The government should implement various programmes suggested by M.S.Swaminathan Commission, focused on Vembanad Lake and water salinity management and flood control.

Any further steps of reclamation or encroachment upon water bodies should be prevented and strict monitoring should be introduced on this regard.

The special legacy of Kuttanad known as ‘Padasekharam’ must be encouraged to strengthen the co-operative system of farming. It will be a farm management revolution through the provision of essential centralized
services like farm equipment threshing, drying and storage facilities, agri-clinics, agri-business centers and computer aided knowledge centers to support decentralized small scale production.

Keep open the Thanneermukkom Bund before the arrival of the monsoon or follow a practice of frequent opening for very short periods, without hurting the interests of both rice farming and fish farm communities.

Authorities should introduce credit and insurance system, which will help to minimize risks from floods and other natural calamities and ensure income and work security. Farmers are reducing the number of cultivation and shifting the cultivation from rice to some other crops because of the uncertainty prevailing in the rice cultivation in this region. The credit and insurance system will help to reduce the uncertainty of rice cultivation and increase the number of farmers doing the cultivation.

The farmers of Kuttanad are facing severe marketing problem of their produce. To improve marketing infrastructure in order to help in avoiding distress sales and to add value to the produce through agro-processing, agro-processing centers should be opened in Kuttanad. The agricultural societies, civil supply corporation and non-governmental organizations can play a vital role in marketing the produce. Immediate procurement by an efficient system, involving private rice millers and
government, may help to avoid uneconomic storage of grains. Establishment of more rice mills and subsidiary industries using by-products of local production, may also generate more employment opportunities in Kuttanad.

Krishi Bhavan Officers and demonstrators must visit the farmers, at least, once in a week during the paddy cultivation to clear the doubts and suggest improvements. They must procure and supply high yielding varieties of seeds to farmers at affordable prices and in times. Authorities should conduct soil testing and implement schemes for seasonal paddy cultivation. The scientist and panchayath linkage and periodical interactions have to be promoted.

Agricultural Labourer’s pension should be given at the scheduled time. The living conditions of the people who are not able to do agriculture because of old age and other disabilities are very pathetic. The pension is the only source of income for them. Therefore, authorities should disburse it in time.

The researches and training infrastructure should be encouraged. Training of the youth in operation and maintenance of the machinery may add value to their skill and time as the young men and women are not keen to take up agriculture employment. The research works at Mancompu Rice
Research Center must be carried on a wider scale to reach the benefits to all over Kerala.

The agriculture department should take initiative for raising the paddy bunds of all major paddy fields to about three meters above the mean sea level with a minimum width of ten meters. A tarred road should also be provided in the bund just as in Holland, where in such bunds, roads and railway lines are built. If all the paddy boundaries are raised, flood will not harm the paddy and fish cultivation. It will add conveniences for tourism and travel to the local people.

The societies and agriculture department have to take up the responsibilities of extending harvesting machines and threshing machines to all the cultivators.

Availability of drinking water should be increased for the well being of the people of Kuttanad, by reviving ponds and wells and through desalination, that is, converting salt water into pure water. This is a good method for solving drinking water problem in Kuttanad, where there is ‘water every where but not a drop to drink’. Rain water harvest is another method for solving the problem.

 Restore free flow of water by removing the waterweeds from the entire water bodies in a systematic manner, maintain the quality and facilitate navigation and drainage of water ways.
Do away with Land Utilization Act and put the land for better use. Provision may be given to utilize paddy fields for vegetable farming, aquaculture and so on. Fish production must be encouraged by all means by encouraging one fish - one paddy approach.

Undertake developmental activities with a long range plan to achieve sustainable development. To achieve sustainable development with a participatory strategy, environmental awareness among the people is essential.

Ensure community participation in the development processes at all stages - planning, implementing and monitoring of the programmes. Introduce innovative methods of waste management and avoid the amassing of wastes.

Back water tourism should be encouraged in Kuttanad, where there is ample scope for the same. The tourism department should introduce eco-friendly tour packages for this region. Tourism development has to ensure that it benefits the livelihood of local communities and there is an equal spread effect of economic gains. The eco-tourism should help in restoring the wet land and its unique eco-system services to improve the livelihood of the fishing, farming or tourism sector community.

Crop integration or diversification with group farming, strengthen the technology development to improve the productivity, ensure market
linkages for fair price, easy and cheap access to credit, value addition to primary produce, and the like, would be welcomed to strengthen the livelihoods and to bring back the glory of being the rice bowl to Kuttanad.

7.5 **Scope for Further Research**

The present study brings out the public awareness and response to environmental problems and sustainable development of Kuttanad. Related to this region and area, some important aspects require a study in depth. The following areas are suggested for future research studies:

- The Soil Health Management and Flood Control Systems of Alappuzha District.
- The role of Non Governmental Organizations in the development of Kuttanad.
- A comparative study of rice cultivation of Kuttanad and Palakkad, the rice bowls of Kerala.
- A case study on the Developmental Projects of Kuttanad.
- A study on the problems and prospects of back water tourism in Kuttanad.