GOVERNMENT OF KERALA
KERALA STATE PLANNING BOARD

FOURTEENTH FIVE-YEAR PLAN
(2022-2027)

WORKING GROUP ON
WATERSHED BASED PLANNING & AGRICULTURE
THE POTENTIAL IN KERALA

REPORT

AGRICULTURE DIVISION
MARCH 2022

FOREWORD

Kerala is the only State in India to formulate and implement Five-Year Plans. The Government of Kerala believes that the planning process is important for promoting economic growth and ensuring social justice in the State. A significant feature of the process of formulation of Plans in the State is its participatory and inclusive nature.

In September 2021, the State Planning Board initiated a programme of consultation and discussion for the formulation of the 14th Five-Year Plan. The State Planning Board constituted 44 Working Groups, with more than 1200 members in order to gain expert opinion on a range of socio-economic issues pertinent to this Plan. The members of the Working Groups represented a wide spectrum of society and include scholars, administrators, social and political activists and other experts. Members of the Working Groups contributed their specialised knowledge in different sectors, best practices in the field, issues of concern, and future strategies required in these sectors. The Report of each Working Group reflects the collective views of the members of the Group and the content of each Report will contribute to the formulation of the 14th Five-Year Plan. The Report has been finalised after several rounds of discussions and consultations held between September to December 2021.

This document is the Report of the Working Group on "Watershed based planning & agriculture: the potential in Kerala".The Co-Chairpersons of Working Group were Mr.I.B.Satheesh and Dr. Ishita Roy IAS. Dr.R.Ramakumar, Member of the State Planning Board co-ordinated the activities of the Working Group. Sri.S.S.Nagesh, Chief, Agriculture Division was the Convenor of the Working Group and Smt. G. C. Roshni, Agronomist, Agriculture Division was Co-Convenor. The terms of reference of the Working Group and its members are in Appendix 1 of the Report.

Member Secretary

PREFACE

As part of formulation of the 14th Five Year Plan, the Kerala State Planning Board had constituted working groups of experts in all the major sectors. In Agriculture and Allied Sectors, 6 working groups were constituted viz. Agriculture and Cooperation, Animal Husbandry and Dairy, Inland and Marine Fisheries, Forest and Environment, Water Resources and Regional Packages. To discuss and frame policies in each of these sectors, the working groups were further divided into 28 Expert Sub-Groups (ESG) with specific mandates.

Each Expert Subgroup held at least three meetings beside one focused group meeting before finalising the report. We, the Co-Chairs, place our deep appreciation and gratitude to all the esteemed members of the ESG for their valuable contributions in preparing the report. We are extremely grateful to Dr. V. K. Ramachandran, the Honourable Vice-Chairperson, Kerala State Planning Board, Dr. R. Ramakumar, Member, Kerala State Planning Board and Sri. S. S. Nagesh, Chief, Agriculture Division for their consistent guidance and suggestions in preparing the report. The drafting team put in commendable work in bringing together all the views and opinions of the members. We sincerely hope the recommendations in the report can lead to important changes in the public policy on agricultural development in the State.

Mr.I.B.Satheesh
Expert co-chairperson

Dr. Ishita Roy
Official co-chairperson

CONTENTS

WATERSHED BASED PLANNING & AGRICULTURE : THE POTENTIAL IN KERALA

HIGHLIGHTS

- This report is the terms of reference and discussions of the Expert Sub Group on Watershed Based Planning & Agriculture : the Potential in Kerala, constituted for the formulation of XIV Five Year Plan.
- Watershed master plans should have integrated activities of various Departments converging into improved productivity, better soil health, increase in farm and home income and employment opportunities.
- Recommendations include systematic watershed delineation, formation of nodal agencies at different levels, provision of trained personnel, well-set protocols, etc.

EXECUTIVE SUMMARY

This draft report is prepared on the basis of the terms of reference and discussions of the Expert Sub Group on Watershed Based Planning & Agriculture the Potential in Kerala, constituted for the formulation of XIV Five Year Plan. The contents of the draft report could be summarised as follows.

Approach

Integrated and multidisciplinary mode of planning and implementation of watershed master plans at LSGI level, compatible to the Agro-ecological zones and land use plans, with competent technical support and ensuring active peoples' participation in all phases from planning to post project maintenance.

Vision

- To formulate a sustainable development plan for the holistic development of an area through scientific natural resource management, enhanced production systems and added livelihood support systems leading to better socio-economic status of the community.
- To achieve ecological regeneration to the maximum possible level through these interventions so as to provide assured ecosystem services and to mitigate climate changes and natural calamities.

Strategy

Watershed master plans should have integrated activities of various Departments converging into improved productivity, better soil health, increase in farm and home income and employment oppurtunities. Capacity building for ensuring peoples' participation, use of geospatial techniques in mapping, planning and implementation, periodic monitoring and evaluation, impact studies and post project maintenance of assets will be addressed in the master plans.

Recommendations

1. Watershed delineation should proceed systematically from the river basin to its subwatersheds and to microwatersheds, and be superimposed with administrative/ revenue boundaries for effective development. Proposals of the watershed master plan should be based on the agro-ecologic zone and land use plans.
2. There should be a State Level Nodal Agency (SLNA) for co-ordinating and supervising the implementation, integration between departments and various schemes. Department of Soil Survey & Soil Conservation could be the SLNA, considering the prolonged experience and successful accomplishment in the implementation of watershed schemes.
3. There should be District Watershed Development Committee (DWDC) chaired by the District Panchayath President and convened by PAO/ District Soil Conservation Officer at district level and Block Watershed Development Committee (BWDC) with Block Panchayath President as chairman and Soil Conservation Officer as convenor at

block level for coordinating the activities of microwatershed. These committees should include officers of all line Departments to ensure integration of Natural Resource Management with land use plans, production systems and livelihood support activities. Professionals in Diploma in Watershed Management (DWM)/ Agriculture/ Agricultural Engineering/ Fisheries/ Veterinary etc. at State and district level also should be included.

4. Competent technical support should be assured throughout the planning and implementation of the watershed projects. The Block Watershed Development Committee should include a Diploma in Watershed Management professional.
5. Effective capacity building should be ensured for active peoples' participation at all stages. IWDM-K, Chadayamangalam could be assigned as the Nodal Training Institute for capacity building on natural resource management, geospatial techniques and related topics through campaigns, trainings and other extension activities, being the only training Institute in the State dealing exclusively with watershed management.
6. Suitable protocol for timely transfer of maps and data could be assured by constituting a committee comprising officers of all line Departments who posses the relevant data. Geo referenced data should be made available for mapping, decision making and implementation of watershed projects.
7. A practical and feasible exit strategy should be formulated in the master plan through beneficiary committees, user groups etc. to ensure post project maintenance of assets of completed projects and ensure their viability.

1. INTRODUCTION

Watershed based development is the most practical and scientific approach for management of natural resources, viz., soil, water and biomass for sustainable development and ecological restoration. The management plans proposed should ensure viable ecosystem services including nutrient cycling, carbon storage, erosion/ sedimentation control, enrichment of biodiversity, soil formation, wildlife, water storage, infiltration, flood control, climate change mitigation etc. It should also guarantee sustainable and enhanced production of food, fuel, timber, reduced vulnerability of species to extinction, carbon sequestration and regulation of climate change and other natural disasters.

Importance of Watershed Development in Agriculture, Land Use and Sustainable Development

Soil and water are the most important natural resources that sustain all forms of life on earth. Escalating pressure on land and water resources owing to burgeoning population demands leads to degradation of these resources. Land degradation is so serious in India that out of 329 million hectare (MHa.) geographical area, 146.8 MHa. face various threats of degradation. This leads to loss of cultivated area, productivity and farm income, in addition to ecosystem degeneration.

Though the country receives fair amount of annual rainfall (1190 mm) and possess adequate ground water resources, enhanced need for domestic, agriculture and industrial developmental activities and over-exploitation of water resources has led to severe exploitation pressure on water resources. The receding of ground water levels noticed throughout the country is a probable indicator of reduced availability of fresh water in future. Hence holistic development of soil and water resources has to be ensured for increased productivity, income and ecological restoration. Watershed based development planning is the scientific natural resource management plan to achieve social and economic development along with protection of natural ecosystems.

Kerala receives adequate annual rainfall (around 3000 mm.), the major proportion being contributed by the two monsoons. Owing to the sloppy, undulating topography of the State, high intensity rainfall and profuse drainage network of the 44 river systems within the comparatively small land area, a massive fraction of the rainfall received is lost as runoff. The annual average runoff through the river systems in the State is around 78 BCM. The total live storage capacity of the reservoirs is only around seven percent of the total runoff.

In addition, a sizable quantity of rainfall is lost as surface runoff also, which adds to soil erosion, floods and degradation of agriculture lands. Heavy runoff and low percolation of precipitation to ground water leads to droughts during post monsoon period also. In order to address this natural resource management crisis, proper strategies have to be devised and implemented for scientific soil and water conservation on watershed basis.

Relevance of Watershed Based Development in Nava Kerala Initiatives

Objectives of watershed based development are focussed towards the successful realization of various aspects of the State's development outlook.

1. Watershed management is possibly the most practical and sustainable solution for addressing natural calamities including floods, landslides, drought etc. through scientific management of soil and water. Hence watershed planning is an essential tool for Rebuild Kerala initiatives.
2. Watershed based planning is perhaps the only development strategy which is ultimately oriented towards adopting interventions for combating global warming and climate change. Ecological regeneration and assured ecosystem services are guaranteed through watershed based planning.
3. In tune with the Haritha Keralam initiative, watershed based development addresses the depletion of State's water resources and enhances soil quality.
4. Watershed activities lead to rise in water table, reduced period of drought and steady supply of fresh water as envisaged in 'Jalasamridhi' concept for water conservation.
5. Enhanced water resources and improved subsurface flow ensures perennial flow in streams and rivers contributing to Kerala model of 'room for river' project, 'ini njan ozhukatte'.
6. Various interventions in watershed development ultimately leads to enhanced agricultural production, thereby accelerating the Sujalam-Sufalam mission for agriculture development.

XIV Five Year Plan- Background of the Draft Report

With the objective of formulating the policies for Watershed based development planning for the fourteenth Five Year Plan, the Expert Sub Group on 'Watershed based planning and agriculture : the potential in Kerala' was constituted under the working group, Agriculture and Co-operation by the State Planning Board, Government of Kerala, with the following terms of reference.

1. To critically assess the status of preparation of watershed plans by LSGIs in Kerala over the past five years and identify the reasons for the poor performance of LSGIs in this regard.
2. To suggest and prepare a guidance note for the effective preparation antd development of watershed plans and its integration with land use plans and agricultural production systems with active support of geospatial technologies.
3. To suggest ways to integrate and converge the objectives and activities of multiple government agencies possessing data on water, water use, land use and agriculture to facilitate regular updating of watershed plans prepared by LSGIs.
4. To suggest a road map for a State level Peoples' Campaign to complete the watershed plans at the LSGI level over a specified minimum period.
5. To study the different successful models of watershed plans prepared by LSGIs in the State and study the possibilities of replications and preparation of a set of best practices.
6. To provide guidance on linking the existing schemes of the Government with a broader watershed based strategy of development planning.

With these objectives at hand, the expert subgroup on 'Watershed based planning and

agriculture the potential in Kerala' has put forth this draft report on proposals for effective implementation of watershed plans in Kerala during the fourteenth Five Year Plan.

2. STATUS OF PLANNING AND IMPLEMENTATION OF WATERSHED PLANS IN KERALA DURING THE LAST FIVE YEARS

Watershed Development Programmes in Kerala

Watershed based planning in the State claims a history of over three decades. Watershed development plans under various schemes, viz., NWDPRA, IWMP, WGDP, RIDF, AHADS, Haryali etc. have been taken up under various plan periods in the State. These plans were implemented through a set of common guidelines issued for the specific objectives emphasized. Several departments and agencies are involved in the implementation.

Department of Soil Survey and Soil Conservation has been undertaking River Valley Projects under watershed basis since 1972. The Department also undertakes watershed development in all districts and protection of catchment area of water supply schemes under the RIDF schemes which have recorded high progress in achieving the goals within the plan period. Rural Infrastructure Development Fund under NABARD and other CSS are being implemented by the Department in all districts. CWRDM, IRTC, Land Use Board, Agriculture Department, Rural Development, LSGIs etc. also has taken up various schemes for watershed development.

Status of Planning and Implementation of Watershed Plans During Last Five Years

Several initiatives are being undertaken by various Government departments, NGOs, R&D institutes and local self governments in watershed development since 2000, some of which have produced significant results. Some features of watershed development programme undertaken in the State during the last five years are listed.

1. Watershed master plans were prepared at LSGI level for the holistic development and enhanced socio-economic conditions of the watershed community during the previous five year plan period.
2. The watershed master plans were prepared with adequate technical support. Active involvement of elected representatives was also noticed in several projects.
3. Integration with MNREGS has resulted to generation of rural employment and enhanced family income and better socio- economic conditions.
4. Haritha Keralam Mission, Department of Soil Survey & Soil Conservation, Water Resources Department, Agriculture Department, Rural Development, MNREGS etc. were associated with the capacity building, preparation of master plans and their implementation. However, several of the watershed master plans are yet to yield the expected outcome.

Major Reasons for Shortfalls in Implementation

1. Inadequate technical support during implementation. Though the master plans were adequate, implementation was not systematic due to lack of technical backing up during implementation.
2. Lack of convergence and coordination among departments at the LSGI level. More effective technical support was needed at block level.

3. Lack of proper capacity building activities. This failed to create awareness among local public and hence resulted in weak peoples' participation.
4. Over emphasis on expenditure of funds leading to failure of realizing need based interventions.
5. Poor quality of extension services
6. Administrative, technical and financial constraints
7. Lack of timely and competent evaluation and monitoring
8. Insufficient integration of the needs of farmer
9. Lacking active peoples' participation and co-operation
10. Inefficiency of community organizations in follow up activities and maintenance of assets created.
11. Weak emphasis in developing a location specific watershed development policy

Role of Various Departments/ Agencies in Watershed Development- Recent Initiatives and Some Successful Models

1. RIDF, RVP and PCRWSS implemented by Department of Soil Survey and Soil Conservation have recorded high progress in achieving the goals within the plan period throughout the State with only few exceptions. Rise in ground water table, employment generation, improvement in soil health, and betterment of socioeconomic conditions were achieved. Chulliyar watershed under RIDF in Chittur Taluk of Palakkad district is one among several projects with outstanding outcome.
2. The performance of NWDPRA watersheds under the X and XI plans in districts of Alappuzha, Pathanamthitta and Thrissur are also successful examples.
3. CWRDM assisted Perumanna panchayath in Kozhikode in being the first local body to declare a water policy based on State Government's water policy, 2008.
4. IRTC, KILA and Haritha Keralam Mission have also taken up watershed projects at panchayath level. Kerala State Land Use Board also initiated watershed management/ water conservation projects.
5. Recent initiatives undertaken by the Nedumangad Block Panchayath and Kattakkada and Taliparamba assembly constituencies to prepare watershed management plan are remarkable attempts. The 'Samrudhi' project in Taliparamba constituency provides an exemplary example of success based on active peoples' participation.

Some Replicable Features of Successful Watershed Models

Analysis of successful watershed models which realized the anticipated outcome indicates that there are some common features in these projects which lead to their accomplishment. Most important features are listed.

1. Supervision of technically competent Department/ Agency
2. Elaborate capacity building and awareness campaigns for effective involvement of local community
3. Technical supervision of watershed activities at regular intervals during planning and implementation phases
4. Peoples' participation and active involvement throughout the plan period

5. Active involvement of peoples' representatives/ LSGI members in leading and mobilizing the watershed community for collective action
6. Concurrent evaluation and monitoring, timely correction of deviations
7. Active community organizations

The Taliparamba Model of Watershed-Based Planning

An integrated developmental model, 'Samrudhi' was undertaken by Taliparamba constituency in Kannur district with water security, food security, entrepreneurship development, energy conservation and clean environment as broad objectives. Department of Soil Survey and Soil Conservation has taken up the soil and water conservation activities of this project.

The catchment area of Valapattanam, Kuppam, Kavvayi and Ramapuram rivers were investigated and soil and water conservation projects were prepared for 88 micro watersheds extending to an area of 32693 hectare with a financial outlay of Rs. 800 crore. The watershed atlas prepared by the Department of Soil Survey and Soil Conservation was used for the delineation of micro watersheds.

Active peoples' participation was ensured throughout the planning and implementation phase. Various levels of community organizations including micro, nano and macro clusters formed under 'Samrudhi' project and micro watershed committees were actively involved in preparing the micro watershed development plans. Elected representatives played a lead role in mobilizing the community for active involvement. Appraisal was conducted by a team consisting farmers, elected representatives, volunteers and department officials during the planning phase.

The projects were funded under the State Government's Plan Fund allocation for micro watershed development and NABARD under NIDA (Nabard Infrastructure Development Assistance). Active technical support was assured throughout the implementation phase.

3. GUIDELINES FOR EFFECTIVE WATERSHED-BASED DEVELOPMENT PLAN

Relevance of Watershed DPR/ Master Plans

Watershed based development involves planning and implementation for conservation of natural resources and production activities for the social and economic development of the area on a watershed basis. The activities proposed in watershed based development programmes include conservation of land and water, enhancing the production and productivity of agriculture and allied sectors, livelihood activities including micro enterprises.

A Master Plan or a Detailed Project Report (DPR) is the primary requirement for a sound watershed based development programme. It is a comprehensive report that includes the location map of the watershed superimposed with revenue boundaries, characteristics, socio economic issues of the watershed, description of the interventions required to protect the natural resources, developmental measures required for enhancing agricultural production, livelihood activities, micro enterprises, description of the execution of the plan, nature and means of funding, monitoring during and after implementation and the exit strategy of the implementing agency.

Steps Involved in Preparation of DPR/ Master Plans

The following elements or steps are involved in the preparation of an effective watershed based development plan.

1. Delineation of the main watershed, sub watersheds and micro watersheds.
2. Super-impose the watershed boundaries with concerned grama panchayath and ward boundaries.
3. Detailed morphometric, hydrologic and socio economic analysis of the selected watershed
4. Carry out morphometric analysis of the watershed. It includes determination of area, perimeter, length, width, form factor, circularity ratio, stream frequency, stream order, drainage density etc. of the watershed.
5. Hydrologic analysis including rainfall and climatic parameters, determination of overland flow, interflow, base flow and stream flow.
6. Socio- economic analysis including surveys, PRA etc.
7. Identifying the problems faced. Prioritisation of watersheds for implementing interventions.
8. Identify land and water conservation measures required for the sustainable development of the watershed.
9. Formulate plans for the improvement of agriculture and allied activities.
10. Prepare strategies for livelihood activities and possible micro enterprises.
11. Prepare maps showing interventions for natural resources management, agricultural production system and all other activities.
12. Carry out cost benefit analysis like NPV, IRR, BCR etc. to assess the viability of selected watershed projects.

13. Prepare detailed funding plans, phasing of funding etc.
14. Prepare comprehensive plan of action for the execution of the interventions.
15. Prepare plan for monitoring during execution and post implementation stages.
16. Prepare plans for people's participation and capacity building measures.
17. Prepare detailed exit protocol, handing over of assets created, responsibilities of post project management and maintenance etc.
18. Continuing education and capacity building of the watershed community for carrying forward of the watershed development activities after the project implementation period.

Data Required for the Watershed Development Programme

Important data required for watershed development can be grouped as hydrologic data, environmental and social data. Hydrologic data can be further classified into hydro meteorologic data and physiographic data. Hydrometeorologic data includes rainfall, temperature, wind velocity and direction, sunshine hours etc. Physiographic data includes topographic, land use and soil information. Environmental and ecosystem data includes information on degradation of natural resources, ecosystem services, pollution etc. Socio economic data includes various quantitative information on demography, educational status, employment, migration and income of the people.

Data sources

Relevant data can be collected from IMD, Indian Remote Sensing Agency, Department of Soil Survey and Soil Conservation, Agriculture Department, CWRDM, Land Use Board, LSGIs, Central Ground Water Board, Central Water Commission, Ground water Department etc. In addition, freely downloadable digital resources available could be used.

Department of Soil Survey and Soil Conservation has a repository of soil and land based data at cadastral level on watershed basis for evolving Area Development Plans on microwatershed basis. A suitable protocol needs to be evolved for effective utilisation of these data. District level officer of the Department of Soil Survey & Soil Conservation should serve as Nodal Agency for maintenance, updation and use of georeferenced data.

Watershed Delineation and its integration with Revenue Boundaries and Physical Features

Watershed delineation is the most important step for the watershed development plans. There are different techniques such as from contour maps/ toposheets of SOI, satellite imageries, cadastral maps and computer techniques involving digital elevation models and GIS software. It is better to delineate the entire river watershed and its important sub watersheds in the first step. Micro watersheds of the desired sizes for the desired locations can be generated in the second stage. This exercise can be done very effectively with the help of Digital Elevation Model (DEM) and geospatial techniques using ArcGis or other free GIS softwares. Generation of sub micro watershed is possible for microscopic channels using software techniques.

Watershed Prioritisation

Through prioritisation, select only the microwatersheds requiring immediate attention from

the point of view of natural resources management, land degradation and rural production system enhancement as implementing watershed based development in all microwatersheds in one go is not feasible due to shortage of funds, geographical limitations, unavailability of human resource etc. Various methods or combination of different methods are employed for the watershed prioritisation as given below.

1. Morphometric analysis: By this, slope of the watershed, shape and channel parameters are analysed and priority ranks are quantitatively assigned to the watersheds. With the help of remote sensing and GIS, morphometric analysis can be carried out very easily.
2. Other conventional techniques including
    - Reconnaissance survey of the entire watershed gives an idea of the relative erosion status of the watersheds. This procedure is approximate and is to be used when no other method is available.
    - Detailed soil and land use surveys to assess erosion information of the watersheds. A careful interpretation of these reports could provide information on the relative erosion status of the various watersheds
    - Actual measurement of the silt load contributed by each of the watersheds recorded over a period of three to five years indicates the extent of erosion in the watersheds. The main difficulty with this procedure is that the data has to be collected over a period of years so that reliable conclusions can be drawn.

Understanding the Problems of the Watershed

The problems faced by the watersheds selected for treatments need to be thoroughly assessed in addition to the broad assessment done during the prioritisation stage. Problems or issues of the watershed can be categorised in to soil based, water based and socio-economic based.

Soil based problems - may be associated to erosion status of the watershed. In Kerala, water erosion is the major concern and it is highly predominant in high lands and mid lands. Other soil related problems are salinity and sodicity, often found in low land areas. This leads to reduced productivity and agricultural income.

Water related problems - like water scarcity, poor water quality, floods, water logging, drought etc. All these are associated to poor water management. Water scarcity has to be looked into from different categories of uses such as drinking water, irrigation water, industrial and recreational purposes.

Social problems - include low income status of community, unemployment, potentials for various livelihood activities, possibilities of micro enterprises which need to be understood and analysed to understand the socio-economic problems of the watershed.

Hydrologic analysis of the watershed utilising Remote Sensing and GIS sciences coupled with field survey and PRA exercises will help to understand the problems of the watershed.

Watershed Interventions

Various interventions are required for the sustainable development of the watershed. These interventions can be for soil and water conservation, improving production system and for livelihood activities and micro enterprises.

Natural resource management through scientific conservation of soil and water in arable lands is the most important and primary component of watershed activities. Protection of drainage courses through suitable low cost, eco friendly technology is also recommended for effective conservation of soil and water. The major broad objectives of these interventions include,

1. Enhancing the rate of infiltration and percolation of rain water
2. Increasing interception of rainfall through improved crop canopy, thereby reducing the kinetic energy of rain and their erosive capacity
3. Reducing the quantity and velocity of surface runoff through slope modification, land and crop management
4. Maintaining the velocity of stream flow below the erosive threshold
5. Improving the ground water table

Approaches of watershed management

1. Ridge to valley/ top to bottom approach- Priority should be given to hilly/ sloping upper reaches, proceeding to lower reaches and drainage lines
2. Low cost, local material based and eco-friendly watershed interventions combining biological, structural and bio-engineering methods is to be given emphasis.

Soil and water conservation measures in arable lands

The various activities undertaken in arable lands depend on slope of watershed, rainfall parameters, cropping pattern, geographical features etc. Various physical activities possible under watershed based development are listed below.

1. Earthen contour bunds and graded bunds
2. Stone pitched contour bunds and graded bunds
3. Moisture conservation/ recharge pits and trenches
4. Contour trenching for hilly and more sloping areas
5. Bench terraces by cut and fill with shoulder bunds
6. Centripetal terraces/ tree basins
7. Bunds with vegetative/ grass enforcement
8. Vegetative hedges
9. Coir geotextiles with agrostological support
10. Agrostological contour barriers
11. Live check dams across rills and gullies in primary order drains arising in the agricultural land
12. Roof water harvesting and well recharge systems
13. Collection, storage and recharging the surface runoff
14. Impervious surface runoff collection and recharge
15. Dug out type and embankment type ponds for water storage and recharge

Soil and water conservation measures for drainage channels

1. Side protection of channels using vegetative barriers
2. Gully plugging
3. Rubble/ brushwood/ gabion/ concrete check dams

4. Pipe spillway type check dams
5. Vented cross bars
6. Sub surface dykes

Measures for enhancing agriculture and allied production system
The adoption of various interventions under this component should be based on the agro-ecologic zone and other geographic considerations of the watershed.

1. Contour and strip cropping
2. Mulching and cover cropping
3. Developing minor irrigation facilities
4. Introducing micro irrigation
5. More crop seasons per year in the case of seasonal crops
6. Land development activities for wastelands
7. Agroforestry
8. Inter cropping in monocropped areas
9. Integrated farming

Livelihood support system and micro enterprises

1. Protected cultivation with automatic irrigation and fertigation for high value crops
2. Mushroom cultivation with value addition
3. Animal husbandry units (cattle, goats, pigs, birds etc.)
4. Fish farming, vermicomposting etc.
5. Honey bee rearing with honey processing.
6. Value addition units for rice, cereals, fruits and vegetables, milk based items
7. Turnkey based mechanised agriculture service providers

Socio Economic Feasibility Studies

All activities involving considerable investments should work out their economic feasibility through benefit cost ratio analysis. All direct and indirect benefit of the intervention should be included in the analysis.

Strategy for Implementation

Responsibility of error free implementation of watershed based interventions should be clearly spelt out at all levels. Constitution of various committees for preparation of various master plans, implementation, technical supervision, monitoring & evaluation, auditing etc. has to be well balanced and bias free.

1. At the district level there will be a District level Watershed Development Committee (DWDC) which monitors activities of all micro watersheds in the district, with PAO/ District Soil Conservation Officer as Convenor. DWDC comprises of district level officers of all allied departments and peoples' representatives. It should include professionals from Agricultural Engineering, Agriculture, Diploma in Watershed Management, Fisheries, Veterinary etc. appointed on contract basis. DWDC is responsible for approving the master plans, timely funding and supervision of progress of master plans.

2. There will be a Block Watershed Development Committee (BWDC) at block level, which is a multidisciplinary technical team comprising of officers of concerned Departments. There should be professionals like Agriculture Graduate, Agricultural Engineer, Diploma holders in Watershed Management etc. appointed on contract basis to handle and coordinate various activities of the different micro watersheds in the BWDC. An accountant also could be posted on contract basis for record keeping and fund management. This committee will be responsible for the preparation of master plans/ DPR, periodic monitoring and evaluation, technical approval of minor deviations during implementation etc. The BWDC should report to the DWDC.
3. There will be one Watershed Development Committee (WDC), which is the implementing agency comprising of concerned peoples representatives, beneficiaries, farmers, professional with Diploma in Watershed Management on contract basis, representatives of CDS/SHG/UG organizations etc. for each micro watershed. This committee will be responsible for undertaking the implementation of the master plan, regular supervision of activities and should report to the BWDC periodically.
4. At State level there will be a State Level Nodal Agency (SLNA) to monitor the DWDC. State level officers of all concerned departments will be members of SLNA. There will be professionals from Agriculture, Agricultural Engineering, Diploma in Watershed Management, Fisheries, Veterinary, Hydrology etc. on contract basis.
5. The professionals recruited into the various watershed development committees will be given extensive conceptual and practical training in watershed based development.

Evaluation and monitoring

There will be an evaluation and monitoring team at the block level. This will be a multidisciplinary subcommittee of BWDC and may include professionals from the discipline of Agricultural Engineering, Agriculture, Diploma in Watershed Management etc. This committee will do evaluation of various interventions at the time of execution at a regular interval of three months and also post implementation end result evaluation. Continuous monitoring and course correction shall be carried out by the committee and the changes recommended should be communicated promptly to the WDC for effective implementation.

Funding, fund flow and phasing

Funds for the watershed development will be generated from the plan allotment of LSGIs and other implementing departments. The DWDC will release the funds to the BWDC after the watershed master plan is approved in a phased manner, which will be transferred to the LSGIs/ implementing agencies based on completion of watershed activities according to the approved action plan.

Institutional financing may be arranged from NABARD, Kerala Bank or other scheduled banks as loan. Scheduled banks will scrutinise the proposals for financial viability before sanctioning the loan. This loan also will be repaid by the agencies mentioned earlier.

Arable land interventions will be taken up during the initial years of the plan period. Treatment priority should be given to upper reaches of the watershed and progressing to lower reaches.

Application of Geospatial Mapping and Tools in Watershed Development

Geospatial applicattions could be extensively used for delineation of watersheds and natural resource mapping. Softwares like ArcGIS, watershed models and other open sources could be used for planning, implementation and evaluation of watershed projects. Creation of inventory on soil and water resources helps to employ modern technological tools for developing conservation strategies, changes in policy to protect natural resources and development of site-specific soil and water conservation measures. Easy access to the extensive geodatabases is necessary for enhanced transparency and credibility of watershed projects. A team comprising of officers of different Departments may be constituted for maintaining the available data, validating the data and for convergence of the data at Watershed Development Committee level.

4. MONITORING, EVALUATION AND POST PROJECT MAINTENANCE

Procedures for Monitoring and Evaluation

1. Regular monitoring of the project will have to be carried out at each stage by the members/ subcommittee for M&E of the multidisciplinary technical team. Concurrent, pre and post project evaluation is also required to diagnose the deficiencies, snags or failures and address them in time. It serves the purpose of avoiding the lag in implementation, incorporating mid-term corrections, improving the effectiveness, efficiency and beneficial impacts of the project objectives and activities.
2. Pre-project evaluation should assess the economic feasibility of the projects using indicators like net present value (NPV), benefit cost ratio (BCR), internal rate of return (IRR) etc. Concurrent evaluation for identifying and analyzing the pitfalls in the execution of the project has to be done every three months. Periodic auditing and review of progress is also needed.
3. The monitoring and evaluation committee should be well balanced, should include experts from agencies with technical expertise in watershed management, R &D agencies, financial agencies etc. to ensure unbiased, credible and effective outcome.

Exit Protocols

Appropriate withdrawal strategy should be framed prior to closure of the project. It should involve the implementing agency, LSGIs, watershed committee, user groups etc. for developing a maintenance protocol and management framework of assets created through the project to ensure viable and functional systems and sustainability of NRM based activities. Watershed committee and user groups have to be trained to execute their responsibilities on withdrawal of the technical team and implementing agency

Handing over of Assets and Post Project Maintenance

1. The LSGIs should willingly take over the operation and maintenance of assets created and arrange for administrative and financial requirements for maintenance and further development. The plans of concerned local bodies should include financial provisions for this component.
2. Proper maintenance and future development of the assets created during the project period should also be ensured for capacity building of community based organizations,sustainable management of NRM activities undertaken, maintenance and protection of Common Property Rights (CPRs) including water sources developed within the watershed.
3. The Watershed Development Master Plan should include a provision of about 1% of the total project cost towards post project maintenance of assets created in the previous plan watersheds within the block/ district.

Setting up Benchmarks for Evaluation and Impact Analysis

The outcome of watershed development activities should be assessed using various parameters relevant to the specific objectives and agro-climatic region. Some parameters/ variables are

listed. A judicious combination of these parameters could be used for assessment.

1. Rise in water table/ increase in surface and groundwater resources- Observations to be taken from selected reference points at monthly intervals starting from the pre plan survey, throughout the implementation of the plan, and has to be continued after completion of the project.
2. Reduction in period of drought/ drought months
3. Improvement of lean flow in streams and rivers
4. Reduction in flood flow during monsoon and heavy rains
5. Reduction in annual sediment yield
6. Enhancement of farm income through increase in agricultural productivity, increase in area of cultivation, more crops per year etc.
7. Intensification and diversification of agriculture, including changes in cropping systems and cropping pattern
8. Carbon sequestration and changes in carbon balance
9. Employment generated (in man days/ year)
10. Increase in livelihood opportunities
11. Addition of micro enterprises
12. Improvement in socio-economic conditions, including the social capital and institution building
13. Socio-economic indicators like changes in household income, per capita income, consumption expenditure, migration etc.

5. INTEGRATION AND CONVERGENCE OF ACTIVITIES OF VARIOUS DEPARTMENTS/ AGENCIES

Role of Various Government Departments/ Agencies/ Institutions in Watershed Planning and Management

Watershed management being a highly integrated activity, demands convergence of various disciplines at ground level for effective natural resource management, viable production systems and effective livelihood support. Major departments involved in watershed management are

- Department of Soil Survey and Soil Conservation
- CWRDM
- LSGIs
- Agriculture Development and Farmer's Welfare Department
- Poverty Alleviation Unit
- IRTC
- Kerala State Land Use Board
- Kerala Agricultural University
- Water Resources Department/ Minor Irrigation Department
- NABARD, Kerala Bank, Primary Co-operative Societies etc.
- MGNREGS, AUEGS etc.
- Harithakeralam Mission
- Social Forestry
- Animal Husbandry
- Fisheries
- Dairy Development
- Voluntary organizations, NGOs etc.

The portfolio of activities of these agencies should be integrated in an effective manner for successful implementation of watershed projects.

Recommendations for Integration of various Departments Involved in Watershed Development

1. Appraisal, planning and implementation of watershed master plans should be carried out jointly by the block level watershed development committee (BWDC) and watershed development committee (WDC) which converges to a common platform at LSGI level to ensure peoples' participation, transparency and effective completion within the project period.
2. Block level watershed development committee (BWDC) a multidisciplinary technical team should constituted at Block level which includes experts from the Departments of Soil Survey & Soil Conservation, Agriculture, Animal husbandry, Diary Development, Hydrology, KVK etc. with Soil Conservation Officer as convenor. Professionals with Agricultural engineering/ Agriculture graduates/ Diploma in Watershed Manage-

ment (DWM) should be posted on contract basis for five years in BWDC for ensuring technical support throughout the implementation period.

3. Supervision, monitoring and evaluation should be carried out by BWDC or its subcommittee in every three months to detect the deviations and to suggest corrective measures, so as to ensure effective and timely implementation.
4. Water auditing and budgeting should be carried out prior to preparation of watershed master plan to ensure proper strategies of water harvesting. Pre- project survey, PRA, concurrent evaluation, monitoring and supervision should be carried out by the multidisciplinary BWDC/ subcommittee at regular intervals during the planning and implementation phase.
5. Department of Soil Survey and Soil Conservation could be assigned as the State Level Nodal Agency (SLNA) for the supervision, monitoring and evaluation of the fourteenth plan watershed schemes considering the experience and technical expertise accrued through implementation of watershed schemes.
6. Activities under soil and water conservation, water harvesting and management, collection and utilization of surface run-off, improving production systems, intensification and diversification of agriculture and livelihood support system for the watershed master plan should be prepared by the BWDC based on PRA exercises and socio- economic and agro-ecologic zone considerations with the active assistance of WDC.
7. Local labour and enterprises could be utilized to the maximum extent, so that the implementation of the project will ensure better employment and enhanced socio-economic status of the community.
8. Soil health cards and automated soil nutrient recommendations should be made accessible to all beneficiaries. Soil sample survey should be undertaken prior to the project and after implementation.
9. Various projects undertaken by Agriculture and allied Departments may be integrated with the watershed projects. Integration of agroforestry, cattle, poultry, fodder etc. with watershed master plans will also provide for effective recycling of farm residues and improves soil health and farm productivity.
10. Provision for various micro enterprises and household income generating activities by Industries Department, Farmer Producer Organizations (FPO) of Small Farmers' Agri Consortium (SFAC) etc. should be incorporated with watershed master plans. Enterprises for vermicomposting, waste recycling, value addition and processing, cattle/ poultry/ fish farming etc. ensures better soil and water within the watershed in addition to providing steady income to farmers.
11. Institutional finance could also be arranged for FPO, SHG/ UG and other farmer/ commodity groups for micro enterprises and diversification of land use through NABARD, Kerala Bank or other scheduled banks to ensure sustainability of production systems by converging watershed master plans with land use plans.

Protocol for Integration and Convergence of Data Possessed by various Agencies

Preparation of master plans, implementation, monitoring and impact assessment of watershed development plans demand various levels of basic information. Baseline data on watershed, population statistics, spatial and non spatial soil resource data, land use, water resources, forest resources, geospatial and digital information etc. are possessed by various departments.

1. The database available with various departments should be converged to a common platform at watershed development committee (WDC) level for effective planning and implementation.
2. The base maps, geospatial data and other data relevant to watersheds are available with Department of Soil Survey and Soil Conservation, Agriculture Department, Ground Water Department, Land Use Board, LSGIs, Water Resources Department, KSREC etc.
3. Data from Central Government agencies like SOI, IMD, IIRS, GSI, CGWB, CWC, NCESS etc. should be made available based on requirement.
4. Geospatial data and techniques could be used in all stages of watershed planning, decision making and impact analysis. Soil health information and automated nutrient recommendation services could be made use of.
5. The watershed planning has to be integrated with various land use plans and agriculture production systems for effective convergence, better outcome and income for farming community. Geospatial mapping and superimposition may be made for ensuring the convergence.
6. Effective convergence of various departments, data repositories, training institutes, projects, R & D centres etc. have to be ensured at the pre planning stage itself.

6. ROADMAP FOR PEOPLES' CAMPAIGN FOR EFFECTIVE PLANNING

Need for Peoples' Involvement

The most important single factor contributing to the success of any programme, is the active involvement of all the stakeholders involved. Rapport building with the beneficiaries, their capacity building and continued awareness campaigns are required for the effective planning, implementation and post project sustainability of the watershed plan. Continuous trainings and enhancing awareness through exhibitions and other group activities will add to the cooperation and concern among the beneficiaries towards the project. The concerned elected representatives should be thoroughly trained on the procedures, methodology and objectives of the project, so that they could play an active role in ensuring active peoples participation.

Institutional Capacity Building

Various capacity building trainings and awareness campaigns required for watershed master plan preparation, implementation, M&E and post project maintenance could be entrusted with reputed training institutes like IWDMK, CWRDM, KILA etc. Institute for Watershed Development and Management, Kerala (IWDM-K, Chadayamangalam) could be assigned as the Nodal Training Institute for capacity building on natural resource management, geospatial techniques and related aspects during the XIV five year plan, being the only training Institute in the State dealing exclusively with watershed management and related aspects.

Ensuring People's Participation

1. Participatory Rural Appraisal (PRA) for appraisal, identification, planning, implementation, monitoring and evaluation helps to involve local community in the development projects of the watershed.
2. Students, youth, housewives etc of the watershed community should be actively involved in water literacy campaigns and exhibitions to reduce water usage and reuse of water
3. Student led Water Clubs, Water Parliament and Water Assemblies in schools will sensitize the community and ensure participation of all.
4. Jalamithrams/ volunteer committees in each LSGI ward
5. Mass awareness programmes such as rallies and public functions should be organized with the active participation of students, Kudumbashree, NGOs, National Service Scheme (NSS) units, youth clubs and Students Police Cadets.
6. Series of seminars, discussions, exhibitions, Kissan mela, writing scripts and songs for play/ skits, making slogans, posters and training could be conducted to ensure the community participation in project planning.
7. Developing communication teams/ satellite communicators involving villagers to interact with the community, women groups etc. to awaken and sensitize the local community to the issues of watershed management.

8. Stream walks (Neerthada Samrakshana Yathra) to enlighten the general public on the need for conserving water and making the streams perennial.
9. Street play (Kalajatha) on the need for conservation of soil and water with songs and visuals helping local people to quickly understand the importance of water conservation. The program introduces the issues of water scarcity, the importance of soil and water conservation, and various water conservation activities under MNREGS.
10. National Service Scheme Summer Camps can be redesigned and conducted near a water source. The students could conduct house to house campaigns on the need of the water conservation and plant trees in the households.
11. Paper carry bags with logo of watershed conservation and stickers emphasizing the need for conserving the water would sensitise people in water conservation activities.
12. Wide publicity through newspapers, TV, radio etc. at regular intervals
13. Exit protocol and post project maintenance of the developed watershed

7. SUMMARY AND CONCLUSION

With the objective of formulating practical and binding guidelines for the preparation and implementation of watershed master plans at LSGI level for the fourteenth Five Year Plan, the Expert Sub Group on Watershed based planning & Agriculture : the potential in Kerala was constituted under the Working Group on Agriculture and Co-operation by the State Planning Board. Based on the terms of references specified, the Expert Sub Group had several meetings and discussions on related topics. The drafting committee has prepared this draft based on the conclusions and suggestions made by the members of the Expert Sub Group.

The major points needed to be addressed were,

1. Reasons for shortfall of ongoing watershed development projects and measures for corrections
2. Bridging the gaps in planning, technology and implementation and ensuring constant technological support while implementation and post project phase
3. Formulating guidelines for the preparation of effective watershed based development plans.
4. Integration with land use plans and agriculture production systems involving geospatial techniques
5. Convergence of the various departments / institutions and data repositories at planning and implementation level
6. Preparing a road map for ensuring active people's participation in the watershed programmes

Looking into the above said vital points and deliberations, the Expert Sub Group has arrived at the following major conclusions and recommendations.

1. There should be a well structured technical support team at all levels for ensuring constant technical support and guidance throughout the planning and implementation phases of watershed projects. A State Level Nodal Agency for co-ordinating and supervising the implementation, integration between departments and various schemes is necessary.
2. A dedicated technical support team comprising of professionals in Diploma in Watershed Management/ Agriculture/ Agricultural Engineering/ Fisheries/ Veterinary etc. at all levels (Block, District and State) is needed for ensuring constant technical support and guidance throughout the planning and implementation phases.
3. Professionals appointed for the watershed development programmes be extensively trained in understanding the science behind watershed processes, watershed delineation, planning of interventions for natural resources management, enhancing production system, devising appropriate livelihood activities and micro enterprises. Training is also essential to enhance their social commitments and ethical standards.
4. A well thought out and scientifically prepared DPR, its fool proof implementation with people's participation, post implementation evaluation and maintenance are the

essence of any successful watershed development programme. Recommendations proposed should be based on the agro-ecologic zone characteristics of the watershed.

5. Watersheds should be primarily delineated at the river catchment level and then subdivided to smaller watersheds for effective implementation. Development programmes be prepared for micro watersheds of 200-500 Ha. with proper superimposing of ward, Panchayath and Block Panchayath boundaries for the easy understanding of the location and area under each Local Self Government Institutions. If larger micro watersheds have already been delineated, smaller micro watersheds be identified within them for effective planning and implementation. As the size of micro watershed becomes smaller and smaller, it is easier to plan coordinate and execute interventions.
6. Use of geospatial technologies such as GIS, Remote Sensing, and Watershed modelling should be employed for the delineation, prioritisation, morphometric and hydrologic analysis of the watersheds, identifying locations for interventions etc. Effective convergence of various data sources at planning level and adoption of geospatial techniques for planning and implementation has to be ensured. District level officer of the Department of Soil Survey & Soil Conservation should serve as Nodal Agency for maintenance, updation and use of georeferenced data.
7. Effective convergence of different schemes of the State and Centre for area development be brought under watershed development programmes. Co-ordinated efforts at various levels of implementation will ensure error free and effective accomplishment of the watershed development plans during the fourteenth five year plan.
8. Ensuring active peoples' participation through elaborate capacity building programmes, awareness campaigns etc. Awareness programmes on benefit of watershed based development for the socio-economic development of an area, ecological and environmental balances etc. be done for the wilful and active participation of the people's representatives, Government servants and local people.
9. Adequate importance should be given for the monitoring and evaluation and for taking corrective measures during implementation and post implementation. Necessary plan of action is also required for the maintenance of interventions introduced.
10. Workable exit protocol, post project maintenance of assets through strengthening of community organizations be created
11. One model micro watershed based development programme each be developed in all districts of Kerala for demonstration through identified Government/ autonomous institutions within that district. Institutions such as IWDM-K, CWRDM, Soil Survey and Soil Conservation Department, IRTC, Agricultural University's Educational Campuses and Regional Institutions can be considered. Funds will be given directly to these institutions. Willingness of these institutions can be called for before entrusting responsibility to them.

APPENDIX-1

PROCEEDINGS OF THE MEMBER SECRETARY

STATE PLANNING BOARD

(Present: Sri. Teeka Ram Meena IAS)

Sub: - Formulation of Fourteenth Five Year Plan (2022-27) – Constitution of Working Group on Agriculture and Cooperation – Revised Proceedings - reg.

Read: 1. Note No. 297/2021/PCD/SPB dated: 27/08/2021
2. Guidelines on Working Groups
3. This Office order of even number dated 08.09.2021

ORDER No. SPB/342/2021-Agri(1) Dated:14.09.2021

As part of the formulation of Fourteenth Five Year Plan, it has been decided to constitute various Working Groups under the priority sectors. Accordingly, the Working Group on **Agriculture and Cooperation sector** is constituted. For the smooth functioning of the Sectoral Working Group (SWG), it is decided to split the Working Groups into Expert Sub Groups (ESG). Hence the Working Group is categorized into eleven Expert Sub Groups as indicated in the proceedings. The names of the members of the SWG are indicated under each ESG. The Working Group shall also take into consideration the guidelines read 2nd above in fulfilling the tasks outlined in the ToR for the Working Group.

1. A PLAN TO IMPROVE THE EFFICIENCY OF WORKING OF KRISHI BHAVANS

Co-chairperson

- Dr C. Bhaskaran, Professor of Agricultural Extension (Retd), Kerala Agricultural University
- Mr T. V. Subash IAS, Director, Agriculture

Members

- Dr P. Jayaraj, Programme Coordinator, KVK, Kannur
- Dr Sreevalsan J. Menon, Associate Director of Extension, Directorate of Extension, KAU
- Mr V. G. Sunil, Assistant Professor, Agricultural Extension, Communication Centre, Kerala Agricultural University
- Mr P. V. Jinraj, Assistant Director, Agmark Laboratory, Thiruvananthapuram
- Ms Asha K. Raj, Assistant Director of Agriculture, Small Farmers Agribusiness Consortium, Thiruvananthapuram
- Mr Kariyam Ravi,115 Journalist colony, NCC Nagar, Peroorkada
- Mr G. K. Manivarnan, Agricultural Officer, Pallikkal Grama Panchayath
- Mr R. Ajith Kumar, Assistant Professor, IIITM-K

- Mr Joy Sebastian, MD, VCONSOL
- Mr Sidharthan A.K, Assistant Director of Agriculture (Q C),Kozhikkodu

Terms of Reference

- To assess the present functioning of Krishi Bhavans in Kerala and suggest how to improve their effectiveness.
- To identify advanced technologies for use in Krishi Bhavans to ensure better delivery of services and their convergence with LSGIs, Cooperatives, FPOs, and KAU.

2. A PLAN TO EXPAND AND MODERNIZE SUPPLY CHAINS IN AGRICULTURE

Co-chairperson

- Dr Poornima Varma, Faculty, Centre for Management in Agriculture, IIM-Ahmedabad
- Dr A. Prema, Professor & Head, Department of Agricultural Economics, College of Horticulture, Vellanikkara, Thrissur

Members

- Ms L. R. Arathi IES, Mission Director, State Horticulture Mission, Kerala
- Dr A. Suresh, Principal Scientist, CIFT, Kochi
- Dr S. Jayasekhar, Senior Scientist, Social Science Division, CPCRI, Kasaragod
- Mr Valsan Panoli, Kerala Karshaka Sangham, Vapushas, Koothuparamba, Kannur
- Mr.V. P. Unnikrishnan, MFH Flat No.2003, Vrindavan Garden, Pattom Palace P O Thiruvananthapuram
- Ms Deepthi S. Nair, Deputy Director, Marketing, Coconut Development Board, Kochi
- Dr S. Asharaf, Professor, IIITMK
- Mr Mathew Abraham, Assistant Director, Marketing, Department of Agriculture
- Dr Sangeetha K. Prathap, Assistant Professor, School of Management Studies, Cochin University of Science and Technology, Kochi.
- Ms Chitra K. Pillai, Assistant Director of Agriculture, Agricultural Urban and Wholesale Market, Maradu
- Mr L. Subhash Babu, Deputy Director (Retd.), Department of Agriculture and Farmer's Welfare
- Mr Joy Sebastian, MD, VCONSOL
- Mr Ashar Thattarath, PGP IIM, Ahmedabad
- Mr Manu K.G, Public Relations Officer, Directorate of AD & FW

Terms of Reference

- To suggest a design of a unified supply chain for farm inputs and outputs with specific reference to aggregation/procurement, storage, and marketing.

- To suggest a framework where LSGIs, Cooperatives and FPCs can be effectively integrated into the unified supply chain.
- To suggest ways to ensure that the supply chains are integrated with the objectives of trade, value addition and processing - domestic and global – as well as agricultural finance institutions.
- To suggest ways in which the private agencies in procurement, trade and marketing are integrated with the supply chains.
- To ensure that the supply chains meet the requirements of *niche* sectors, such as organic farming, in certification and traceability.
- To suggest the major technological changes and infrastructural investments required to equip the State's supply chain systems to meet the needs of the farming community as well as domestic and international trade.

3. HOW CAN KERALA DOUBLE ITS VEGETABLE PRODUCTION IN THE NEXT FIVE YEARS?

Co-chairperson

- Ms C. A. Letha. IAS, Secretary, Agriculture, Government of Kerala
- Dr T. Pradeep Kumar, Director (Planning), Kerala Agricultural University, Thrissur

Members

- Dr P. Rajasekharan, Chairperson, State Agricultural Prices Board
- Mr V. Sivaramakrishnan, CEO, VFPCK
- Mr J Sajeev, Managing Director, Horticorp
- Ms L. R. Arathi IES, Mission Director, State Horticulture Mission
- Dr K. M. Sreekumar, Professor of Entomology, College of Agriculture, Padannakkad
- Mr Sridhar Radhakrishnan, Thirunelly Agri Producer Company (TAPCo)
- Mr Reghulal, Deputy Director of Agriculture (Rtd)
- Dr K. Mini, Deputy Manager, VFPCK, Idukki
- Mr Prakash Puthanmadathil, Assistant Director of Agriculture, Vengara
- Ms S. K. Preeja, Kerala Karshaka Sangham, Pallichal, Nemom, Trivandrum
- Mr R Balachandran, Chithiramangalam, Ulloor Medical CollegePO, Thiruvananthapuram,
- Mr Reji Jacob, Kunnamkotu House, Nediyassala PO, Thodupuzha, Idukki
- Ms Bindu.J, Assistant Engineer, Office of the Assistant Executive Engineer, Malampuzha, Palakkad

Terms of Reference

- To assess the progress achieved in increasing area, production, and productivity of vegetables in Kerala over the past five years.
- To suggest a roadmap to double vegetable production in Kerala over the next five years with special focus on increasing productivity and farmer's income.

- To examine the ways in which the institutions of LSGIs, Cooperatives and FPCs can be utilised to participate in vegetable production efforts.
- To suggest ways in which existing systems of vegetable production are modernised and integrated with the different schemes of the government as well as post-production activities.
- To review the existing procurement and distribution systems, including government initiatives, and suggest a transparent, technology-driven platform with the active support of LSGIs, Cooperatives and FPCs.
- To suggest ways to reform the existing government schemes to support vegetable production.

4. CONSTRAINTS TO TECHNOLOGY ADOPTION AND THE POTENTIAL TO RAISE PRODUCTIVITY IN KERALA AGRICULTURE

Co-chairperson

- Dr C. Chandra Babu, Vice Chancellor, Kerala Agricultural University
- Dr K. C. Bansal, Former Director, National Bureau of Plant Genetic Resources, Indian Council of Agricultural Research (ICAR), New Delhi

Members

- Dr M.N. Sheela, Director, CTCRI, Sreekaryam
- Dr C. Thampan, Principal Scientist, CPCRI, Kasargod
- Dr Madhu Subramonian, Director of Research, KAU
- Dr Jacob John, Professor & Head, Integrated Farming Systems Research Station, Karamana, KAU
- Dr P. Indira Devi, Director of Research (Retd), KAU
- Dr R. Beena, Assistant Professor, College of Agriculture, Vellayani
- Dr Archana Sathyan, Assistant Professor, Agricultural Extension, CoA, Vellayani, KAU
- Dr P. Rajeev, Principal Scientist, IISR
- Adv. Thomas V T, Varacheriyil, Pala PO, Kottayam
- Dr Nishanth K. Raman, Assistant Professor, CoA, Padannakkad, KAU
- Mr Rijish Rajan, CEO, Simplified Enterprises Management, Palakkad
- Dr Thomas Aneesh Johnson, Soil Survey Officer, Office of the Deputy Director and Soil Survey, Thrissur (North)

Terms of reference

- To assess the status of productivity of major crops of Kerala and estimate yield gaps.
- To identify linkages between the adoption and use of modern technology and the gaps in yield in major crops.

- To examine the potential for raising productivity in major crops with the existing technologies.
- To identify gap in the availability of technology and suggest measures to hasten the development of these technologies.
- To suggest measures to improve the research-extension linkages in Kerala's agriculture.
- To suggest a policy framework to transform homesteads into profit centres through the practice of technology-driven agriculture.

5. PREPARATION OF SOIL AND LAND USE PLANS IN LSGIs FOR AGRICULTURAL GROWTH

Co-chairperson

- Dr Srikumar Chattopadhyay, Faculty, GIFT
- Mr S. Subramanian IIS, Director, Soil Survey & Soil Conservation, Trivandrum

Members

- Mr T. Gangadharan, Extension Faculty, KILA, KSSP
- Mr K. S. Hiroshkumar, Scientific Officer, IFSRS, Karamana, KAU
- Mr B. P. Murali, Member, Nagaroor, Kilimanoor Block (KBPA)
- Mr R. Sukhalal, Swararagam,Cherthala South PO, Alappuzha
- Mr A. Nizamudeen, Land Use Commissioner, Kerala State Land Use Board
- Mr K.P. Abdussamad, District Soil Conservation Officer, Kannur
- Mr Anand Vishnu Prakash, Agricultural Officer, Manakkad Krishibhavan, Idukki

Terms of reference

- To critically assess the status of preparation of land use plans by LSGIs in Kerala over the past five years and identify the reasons for the poor performance of LSGIs in this regard.
- To suggest and prepare a guidance note for the effective preparation and development of land use plans, and its integration with watershed plans and agricultural production systems.
- To suggest ways to integrate and converge the objectives and activities of multiple government agencies possessing data on land ownership, land use and agriculture to facilitate regular updating of land use plans prepared by LSGIs.
- To suggest a road map for a State-level people's campaign to complete the preparation of land use plans at the LSGI-level over a period of six months.

6. WATERSHED-BASED PLANNING AND AGRICULTURE: THE POTENTIAL IN KERALA

Co-chairperson

- Dr Ishita Roy IAS, Agriculture Production Commissioner
- Mr I. B. Satheesh, MLA, Kattakada Constituency

Members

- Dr K. K. Sathiyan, Dean, KCAET, Thavanur
- Dr Celine George, Senior Principal Scientist & Head, CWRDM, Manimalakunnu
- Dr Anu Mary C. Philip, Assistant Director, Soil Conservation; IWDMK, Chadayamangalam
- Mr S. U. Sanjeev, Assistant Director of Agriculture (Rtd.)
- Mr U. Janardanan, CEO, Mayyil Rice Producer Company Ltd., Kannur
- Dr A. R. Durga, Assistant Professor, Department of Agricultural Economics, College of Agriculture, Vellayani, KAU
- Mr M. Prakasan Master, Kerala Karshaka Sangham, Pranavam, Azheekode South, Kannur
- Mr T. K. Rajan Master, Nini Nivas, Edachery PO, Kozhikode
- Mr Jo Jose, Assistant Principal Agricultural Officer, PAO Office, Kottayam
- Mr Mohanachandran, Deputy Director (Retd), Kollam

Terms of reference

- To critically assess the status of preparation of watershed plans by LSGIs in Kerala over the past five years and identify the reasons for the poor performance of LSGIs in this regard.
- To suggest and prepare a guidance note for the effective preparation and development of watershed plans, and its integration with land use plans and agricultural production systems with active support of geospatial technologies.
- To suggest ways to integrate and converge the objectives and activities of multiple government agencies possessing data on water, water use, land use and agriculture to facilitate regular updating of watershed plans prepared by LSGIs.
- To suggest a road map for a State-level people's campaign to complete the preparation of watershed plans at the LSGI-level over a specified minimum period.
- To study the different successful models of watershed plans prepared by LSGIs in the State and study the possibilities of replications, and preparation of a set of best practices.
- To provide guidance on linking the existing schemes of the government with a broader watershed-based strategy of development planning.

7. A PROGRAMME TO MODERNIZE AND UPDATE STATISTICAL DATABASES IN AGRICULTURE

Co-chairperson

- Dr Madhura Swaminathan, Professor, Indian Statistical Institute, Bengaluru
- Mr P. V. Babu, Director, Dept of Economics & Statistics

Members

- Dr U. S. Mishra, Professor, Centre for Development Studies, Trivandrum
- Ms L. R. Arathi IES, Mission Director, State Horticulture Mission
- Dr Brigit Joseph, Professor, Dept of Agricultural Statistics, CoA, Vellayani
- Dr K. P. Chandran, Senior Scientist, CPCRI, Kasargod
- Mr T. Paul Lazarus, Assistant Professor, Agricultural Economics, CoA, Vellayani
- Dr Pratheesh Gopinath, Assistant Professor, Agricultural Statistics, CoA, Vellayani
- Mr Deepak Mercy Johnson, Senior Fellow, Indian Statistical Institute, Bangalore
- Mr S. Ajayghosh, Vrindavan, Vadakkan Mainagapally PO, Kollam
- Mr Ramesh P K, TA to Director of Agriculture, Directorate of AD and FW

Terms of reference

- To critically assess the status and robustness of Kerala's statistical databases in agriculture and identify areas of concern.
- To suggest measures to improve the design, collection, analysis and dissemination of statistical data, such as area, production, yield, costs of cultivation, trade, farm harvest prices, wholesale prices, retail prices, market arrivals and so on, related to agriculture.
- To provide a framework for a better use of new technologies to improve the statistical system related to agriculture.
- To suggest ways in which Kerala's statistical system in agriculture should be geared towards meeting the challenges posed by integrated multiple-/inter-cropping based in homesteads and garden lands, apart from wetlands.
- To examine the possibilities of integrating all data on agriculture collected by different agencies in a single electronic platform.

8. A PLAN FOR VALUE ADDITION AND INDUSTRIAL INVESTMENT IN KERALA'S POST-HARVEST AGRICULTURE

Co-chairperson

- Dr K. P. Sudheer, Professor & Head, Department of Agricultural Engineering, College of Horticulture, KAU
- Mr Manu George, Strategist, Agency for the Development of Food Processing Industries in Kerala (ADFIK), KINFRA

Members

- Mr Rajeev Bhushan Prasad, Chief Coconut Development Officer, Coconut Development Board
- Dr E. Jayashree, Senior Scientist, ICAR-Indian Institute of Spices Research (IISR), Kozhikode
- Dr Lijo Thomas, Senior Scientist, ICAR-Indian Institute of Spices Research (IISR), Kozhikode
- Dr M. R. Manikantan, Principal Scientist, Harvest & Post Harvest Technology, CPCRI, Kasargod
- Mr K. K. Rajendrababu, Kunnath Veedu, Alappad PO, Thrissur
- Mr R. Manikuttan,Santhivila, Vandanmedu PO, Idukki,
- Dr V. R. Sinija, Professor & Head, Business Incubation Unit, IIFPT, Thanjavur
- Dr M. S. Sajeev, Principal Scientist & Head Crop Utilization Division, CTCRI, Sreekaryam
- Dr P. R. Geethalakshmi, Assistant Professor, Department of Post-Harvest Technology, College of Agriculture, Vellayani
- Ms K. Thulasi, Kerala Karshaka Sangham, Novelty, Matoor, Kalady, Ernakulam
- Dr P. Nisha, Principal Scientist, CSIR-National Institute for Interdisciplinary Science and Technology, Trivandrum
- Mr Abraham John Tharakan, Chairman, Amalgam Foods
- Mr Madathiveetil Ramesh, Director, Brahma Indic Nutriments Private Limited
- Mr Appu Anitha Muraleedharan, Theeram Agro World
- Ms Mini Srinivasan, Annam Flour and Batter Solutions, Coimbatore
- Mr Ajoy Sukumaran, Assistant Director of Agriculture, Directorate of AD and FW

Terms of reference

- To prepare a roadmap for the development of an entrepreneurship-driven system post-harvest value addition in agriculture while ensuring the generation of employment and skills.
- To suggest measures to effectively integrate the functioning of LSGIs, Cooperative institutions, including FPCs, and line departments towards the development of value chains in post-harvest agriculture.
- To suggest measures to ensure facilities for investment, quality control, traceability, logistics and export, including the necessary arrangements for payment systems.
- To suggest measures to augment Kerala's export of processed products, particularly in high value and *niche* segments.

9. EASE OF ENTREPRENEURSHIP IN AGRICULTURE: REFORMS IN POLICY AND ADMINISTRATION

Co-chairperson

- Mr S. Harikishore IAS, Director, Industries & Commerce Department
- Dr K. J. Joseph, Director, Gulati Institute of Finance and Taxation, Trivandrum

Members

- Dr Binoo P. Bonny, Professor & Head, Department of Agricultural Extension, CoA, Vellanikkara, KAU
- Dr K. P. Sudheer, Professor & Head, Department of Agricultural Engineering, College of Horticulture, KAU
- Mr G Prakash, Joint Director, MSME Institute, Thrissur
- Mr Roshan Kynadi, Agripreneur, Kynadi Plantations
- Mr T. Thulasidasa Menon, Krishnakripa,Thrithalangode PO, Malappuram,
- Mr M. Ramesh, Industry Expert, RABI-KAU Incubation Committee
- Mr Saji George, CEO, BIONEST
- Mr Shan Kadavil, MD, Fresh to Home Foods Private Ltd
- Mr Jamsheed, Agricultural Officer, Kannamangalam, Malappuram

Terms of reference

- To suggest a broad quantitative framework to regularly assess ease of entrepreneurship in agriculture in Kerala.
- To identify the constraints to the flow of entrepreneurial capital into the processing and value addition segments in agriculture.
- To suggest short-term, medium-term, and long-term measures to improve the ease of entrepreneurship in agriculture.
- To suggest legal and administrative measures to be initiated at different levels of governance, including LSGIs, to improve the ease of entrepreneurship in agriculture.

10. HOW CAN KERALA USE THE POWER OF COOPERATION TO RAISE AGRICULTURAL GROWTH?

Co-chairperson

- Mr P B Nooh IAS, RCS, Kerala
- Mr James Mathew, Ex- MLA, Taliparamba

Members

- Dr P. S. Geethakutty, Professor (Retd.), KAU
- Mr Salin Thapasi, Project Leader, SFAC

- Mr Paleri Ramesan, Chairman, ULCCS
- Mr James, Perambra Coconut FPC
- Fr John Choorapuzhayil, Chairman, BIOWIN, Mananthavady, Wayanad
- Dr J. Thomas, PDS Organic Spices, Kuttikanam, Idukki
- Mr G. R Rajeev, Kollam
- Mr Bimalghosh, MD, Aralam Farming Corporation
- Ms Rema K. Nair, Deputy Director of Agriculture (Retd.), Department of Agriculture
- Mr V Ravindran, Senior Manager, Kerala Bank

Terms of reference

- To critically assess the role and position of Cooperative institutions in Kerala's agricultural development pattern.
- To identify weaknesses in the cooperative institutional framework with respect to their contribution to the agricultural production processes.
- To chart out a pathway to effectively leverage Kerala's historical strengths in cooperative action – including both cooperatives and farmer producer companies (FPC) – to improve agricultural growth and farmer's income.
- To critically assess the performance of Kerala's cooperative credit system to finance agricultural activities.
- To suggest measures to modernise the functioning of Cooperatives in the State.
- To suggest measures on how cooperatives can contribute to the development of supply chains and value addition in agriculture.
- To suggest measures to improve coordination across line departments, LSGIs, Cooperatives and FPCs to contribute to agricultural growth.
- To suggest measures for transforming Kerala Bank to support the resource needs of the productive sector of the State.

11. COOPERATIVE BANKING IN KERALA: REVAMPING THE ROLE OF KERALA BANK

Chairperson

- Ms Mini Antony IAS, Secretary, Corporation

Co-Chairperson

- Dr Pallavi Chavan, Director, Reserve Bank of India, Mumbai

Members

- Mr Sasikumar M V,Director, Institute of Co-operative Management, Parasinikkadavu, Kannur
- Mr Jose T Abraham, Additional Private Secretary to the Finance Minister

- Mr K. C. Sahadevan, Chief General Manager, Kerala Bank
- Mr V. Raveendran, Senior Manager, PACS Development Department, Kerala Bank
- Mr Raja Kurup, Board Member, Kadirur PACS, Kannur
- Mr Anoop Kishore, Development Standing Committee Chairman, Wadakkanchery Municipality and District Facilitator of Decentralised plan
- Mr Romio Kattapana, President, Thankamony Service Co-operative Bank
- Mr K.C.S Nambiar, Director, Ancharakandy FSC Bank and Sahakari Coconut Processing facility
- Mr P. R. Sanjeev, Managing Director (Retd.), MILMA
- Mr R K Bhoodes Pillai, Chairman, Federation of Indian Cashew Industries, Former CEPCI
- Mr Sudheer K, Additional Director of Industries and Commerce
- Mr Damodhar, President, Kerala State Small Industries Association

Terms of reference

- To suggest broad measures to deepen and expand the participation of the cooperative sector in the process of economic growth of the State, and to involve youth in the cooperative movement in the State.
- To suggest measures to upgrade the use of technology in the functioning of primary cooperatives, such as the introduction of unified software.
- To suggest measures to improve professionalism in the functioning of cooperative societies in the State.
- To prepare a guidance note on Business Process Reengineering of the Kerala Bank to serve as a key provider of resources to the productive sectors, such as agriculture and MSMEs as well as tourism.

Convener

Sri. S S Nagesh, Chief, Agriculture Division, State Planning Board

Co- Convener

Smt. G C Roshini, Agronomist, State Planning Board

Terms of Reference (General)

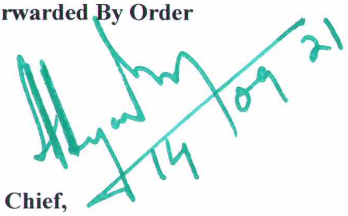
1. The non-official members (and invitees) of the Working Group will be entitled to travelling allowances as per existing government norms. The Class I Officers of GoI will be entitled to TA as per rules if reimbursement is not allowed from Departments.

2. The expenditure towards TA, DA and Honorarium will be met from the following Head of Account of the State Planning Board "3451-00-101-93"- Preparation of Plans and Conduct of Surveys and Studies.

The order read as reference 3 is modified to this extent.

(Sd/-)
Member Secretary

Forwarded By Order



Chief,
Agriculture Division

To

The Members concerned

Copy to

PS to Vice Chairperson
PA to Member Secretary
CA to Member (Dr.Ramakumar.R)
Economic Advisor to VC
Chief, PCD,SPB
Sr. A.O, SPB
The Accountant General, Kerala
Finance Officer, SPB
Publication Officer, SPB
Sub Treasury, Vellayambalam
Accounts Section
File/Stock File