REBUILD KERALA DEVELOPMENT PROGRAMME

A Resilient Recovery Policy Framework and Action Plan
for Shaping Kerala's Resilient, Risk-Informed Development and Recovery
from 2018 Floods

Rebuild Kerala Initiative

Preface

Between June 1 and 19 August 2018, our State of Kerala went through the worst ever floods in history since 1924. One sixth of the State's population — about 5.4 million of us, Keralites — were affected. The floods and the accompanying landslides were catastrophic in terms of loss of lives, livelihoods, property and infrastructure. Even as the social and economic fabric of our people were torn apart, and the capabilities and capacities of our institutions and communities were tested by the unprecedented scale of the disaster, Kerala rose up to the challenge. At all levels, its citizens, communities and the government joined hands to mount what was a unique people-driven and community-oriented endeavour to rescue, recover and rebuild Kerala. The disaster demonstrated what was unique about our State — the strong foundations of its institutions, the resilience of its communities and the fraternity of its diaspora.

Following the disaster, the Government of Kerala felt that the was a need to go beyond traditional approaches to recovery and reconstruction to not only recover fully from the current disaster but also to prepare better for future disasters. The Rebuild Kerala Initiative, led by the Chief Minister, Shri Pinarayi Vijayan, was thus born out of the vision that floods should be taken as "a challenge and an opportunity to rebuild the State to ensure better standards of living to all sections of the society". The Rebuild Kerala Initiative presents a unique approach to rebuilding the State. Through the Rebuild Kerala Development Programme, presented here, the Rebuild Kerala Initiative attempts at a bold vision for a Nava Keralam that is more resilient, green, inclusive and vibrant.

Developed through a consultative and inclusive process over the last four months, the Rebuild Kerala Development Programme outlines a roadmap for realizing a Nava Keralam. It encompasses key sectors of the economy such as agriculture, animal husbandry, fisheries, forestry, land, livelihoods, roads and bridges, transportation, urban services and infrastructure, water supply and sanitation, and water resources management; it also addresses crosscutting priorities, among them climate change and disaster risk management, environment, open data and public sector strengthening; and, finally, within the above, it covers policies, institutions and investments that will build the foundations for a resilient, green, inclusive and vibrant Nava Keralam.

The Rebuild Kerala Development Programme is not a panacea for everything that needs fixing in Kerala. For example, it does not cover may critical sectors such as health, education or safety nets. It does not also address every day issues — many of them critical — within the sectors it covers. It does not attempt to be all encompassing or comprehensive. Nevertheless, it offers a paradigm shift in the approach to towards post-disaster recovery, rebuilding and resilience. It also offers the design blueprint for a new development thinking for our State, one that is embedded in the principles of sustainability, equity, inclusiveness and effectiveness.

This document presenting the Rebuild Kerala Initiative and the Rebuild Kerala Development Programme has been prepared based on an extensive and inclusive process of public and expert consultations. It has been vetted by Government departments and sector agencies and brought together by the RKI team with the support of our international partners such as the World Bank and the United Nations. Nevertheless, I am sure, there are still many areas that might need fixes, clarifications and further analyses. Incorporating and integrating that into the rebuilding process will be an intrinsic part of the dynamic and iterative process of the Rebuild Kerala Development Programme.

Fellow Keralites, friends and partners, I invite you to join us in the journey of rebuilding our State through the Rebuild Kerala Development Programme.

Tom Jose

Chief Secretary to Government

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Acronym List

ADAK: Agency for Development of Aquaculture Kerala
ADB: Asian Development Bank
AEMUs: Agroecological Management Units
AFD: Agence Française de Développement
AHD: Animal Husbandry Department
AIFs: Alternate Investment Funds
AIIB: Asian Infrastructure Investment Bank
AMRUT: Atal Mission for Rejuvenation and Urban Transformation
APIs: Application Programming Interfaces
ATMA: Agriculture Technology Management Agency
BFT: Bio- floc based farming technology
CADRF: Climate Adaptation and Disaster Resilience Fund
CAG: Comptroller and Auditor General
CAPEX: Capital Expenditures
CBDRM: Community-Based Disaster Risk Management
CCDU: Communication and Capacity Development Unit
CER: Centre for Eco-Restoration
CERF: Central Emergency Response Fund
CFC: Central Finance Commission
CMF: Crisis Management Fund
CMP: Comprehensive Mobility Plan
CRZ: Coastal Regulation Zone
CSOs: Civil Society Organizations
CTP: Chief Town Planner
CWC: Central Water Commission
CWRDM: Centre for Water Resources Development and Management
CZMP: Coastal Zone Management Authority
DBFOT: Design Build Finance Operate and Transfer
DDD: Dairy Development Department
DDMA: District Disaster Management Authority
DEM: Digital Elevation Model
DILRMP: Digital India Land Record Modernization Programme
DoA: Department of Agriculture
DoECC: Directorate of Environment & Climate Change
DoF: Department of Fisheries
DPCs: District Planning Committees
DPs: Development Plans
DRFI: Disaster Risk Financing and Insurance
DRM: Disaster Risk Management
DRR: Disaster Risk Reduction
DSS: Decision Support System
EAFM: Ecosystem Approach to Fisheries Management
EAP: Emergency Action Plans
EAP: Externally Aided Projects
ECBs: External Commercial Borrowings
ECMWF: European Centre for Medium-Range Weather Forecasts
EDCs: Eco-Development Committees
EEZ: Exclusive Economic Zone
EIA: Environmental Impact Assessment
EOC: Emergency Operations Centre
EPR: Extended Product Responsibility (EPR)
ESA: European Space Agency
FA: Financial Advisor
FAO: Food and Agriculture Organization
FD: Fiscal Deficit
FIDF: Fisheries and Aquaculture Infrastructure Development Fund
FIRMA: The Fiduciary and Investment Risk Management Association
FMPs: Fisheries Management Plans
FRBM: Fiscal Responsibility and Budget Management
GDP: Gross Domestic Product
GFD: Gross Fiscal Deficit
GIC: General Insurance Corporation
GIS: Geographical Information Systems
GoI: Government of India
GoK: Government of Kerala
GPs: Gram Panchayats
GSDP: Gross State Domestic Product
HLEC: High-Level Empowered Committee
HUDCO: Housing and Urban Development Corporation Limited
HUDCO: The Housing and Urban Development Corporation Limited
IAH & VB: Institute of Animal Health and Veterinary Biologicals
ICCS: Institute for Climate Change Studies
ICE: Integrated Concurrent Engineering
ICG: Indian Coast Guard
ICT: Information and Communications Technology
IMD: Indian Meteorological Department
IoT: Internet of Things
IPCC: Intergovernmental Panel on Climate Change
IRS: Incident Response System
ISRO: Indian Space Research Organization
IWRM: Integrated Water Resources Management
JICA: Japan International Cooperation Agency
JLGs: Joint Liability Groups

JRDNA: Joint Rapid Damage Needs Assessment
KAPCO: Kuttanad and Alappuzha Prosperity Council
KCCL: Kerala Communicators Cable Limited
KCZMA: Kerala Coastal Zone Management Authority
KDA: Kole Development Agency
KDFWFB: Kerala Dairy Farmers Welfare Fund Board
KfW: Kreditanstalt für Wiederaufbau
KFWFB: Kerala Fishermen's Welfare Fund Board
KIIFB: Kerala Infrastructure Investment Fund Board
KMBR: Kerala Municipal Building Rules
KPBR: Kerala Panchayat Building Rules
KRBC: Kerala Road and the Bridges Development Corporation
KRDCL: Kerala Rail Development Corporation Limited
KRF: Kerala Road Fund
KRFB: Kerala Road Fund Board
KRSA: Kerala Road Safety Authority
KRWSA: Kerala Rural Water Supply and Sanitation Agency
KSBB: Kerala State Biodiversity Board
KSDI: Kerala State Spatial Data Infrastructure
KSDMA: Kerala State Disaster Management Authority
KSEB: Kerala State Electricity Board
KSEOC: Kerala State Emergency Operations Centre
KSIDC: Kerala State Industrial Development Corporation
KSPCB: Kerala State Pollution Control Board
KSRTC: Kerala State Road Transport Corporation
KSTP: Kerala State Transport Project
KSUDP: Kerala Sustainable Urban Development Project
KTDFC: Kerala Transport Development Finance Corporation
KVASU: Kerala Veterinary and Animal Sciences University
KWA: Kerala Water Authority
LAF: Liquidity Adjustment Facility
LAPCC: Local Action Plan for Climate Change
LIC: Life Insurance Corporation
LSGD: Local Self Government Department
LSGIs: Local Self Government Institutions
M&E: Monitoring and Evaluation
Major District Roads (MDR)
MASDAP: Malawi Spatial Data Platform
MCS: Monitoring, Control and Surveillance
MGNREGA: Mahatma Gandhi National Rural Employment Guarantee Act
MIS: Management Information Systems
MLD: Millions of Litres Per Day
MVD: Motor Vehicles Department
NABARD: National Bank for Agriculture and Rural Development
NASA: National Aeronautics and Space Administration
NBA: National Biodiversity Authority
NBAP: National Biodiversity Action Plan
NCDC: National Cooperative Development Corporation
NCESS: National Centre for Earth Sciences Studies
NDRF: National Disaster Response Force
NH: National Highway
NHAI: National Highways Authority of India
NIDA: NABARD Infrastructure Development Assistance
NOAA: National Oceanic and Atmospheric Administration
NSS: National Service Society
NSSO: National Sample Survey Office
O&M: Operations and Maintenance
ODF: Open Defecation Free
OPEX: Operating Expenses
PAH: Project Affected Household
PAP: Project Affected People
PDNA: Post-Disaster Needs Assessment
PEFA: Public Expenditure and Financial Accountability
PMAY: Pradhan Mantri Avas Yojna
PMFBY: Pradhan Mantri Fasal Bima Yojana
PMKSY: Pradhan Mantri Krishi Sinchai Yojana
PSM: Procurement Services Manager
PWD: Persons with Disability
PWD: Public Works Department
PWS: Piped Water Supply
R&BD: Roads and Buildings
RBI: Reserve Bank of India
RBMA: River Basin Management Authority
RD: Revenue Deficit
RFID: Radio-frequency Identification
RIDF: Rural Infrastructure Development Fund
RKDP: Rebuild Kerala Development Programme
RKI-IC: Rebuild Kerala Initiative Implementation Committee
RKI: Rebuild Kerala Initiative
RT: Responsible Tourism
RTDSS: Real-Time Decision Support Systems
SAPCC: State Action Plan on Climate Change
SBSAP: State Biodiversity Strategies and Action Plan
SCDP: Safety Corridor Demonstration Project
SDGs: Sustainable Development Goals
SDLs: State Development Loans
SDMA: State Disaster Management Authority
SDMP: State Disaster Management Plan
SEIAA: State Environmental Impact Assessment Agency
SFC: State Finance Commission
SGST: State Goods and Services Tax

SH: State Highway
SHGs: Self-help Groups
SIAD: State Institute for Animal Diseases
SLR: Statutory Liquidity Ratio
SLWM: Solid and Liquid Waste Management
SMEs: Small and Medium Enterprises
SPC: Student Police Cadet
SPF: Specific Pathogen Free
SPR: Specific Pathogen Resistant
SPVs: Special Purpose Vehicles
TDR: Transfer of Development Rights
TPA: Third Party Auditor
TPD: Tons Per Day
TSG: Technical Support Group
ULB: Urban Local Bodies
UMTA: Unified Metropolitan Transport Authority
UN-CBD: United Nations Convention on Biological Diversity
UN: United Nations
VAT: Value-added Tax
VFPCK: Vegetable and Fruit Promotion Council Keralam
VMS: Variable Message Signs
VSSs: Vana Samrakshana Samithies
WASH: Water, Sanitation and Hygiene
WB: World Bank
WBCIS: Weather Based Crop Insurance Scheme
WRD: Water Resources Department
WRIS: Water Resources Information System

Executive Summary

The Government of Kerala (GoK) responded to the devastating August 2018 Floods and Landslides with immediate relief operations. The timely and efficient rescue and relief operations saved many lives. The GoK's efforts were heavily supported by the affected Keralite communities mobilizing on their own. The people of Kerala showed remarkable resilience in the face of adversity to the extent that within one week of flood waters receding, most people returned to their homes to rebuild their lives.

The floods highlighted a number of structural constraints that left Kerala unprepared for major natural disasters or climate change shocks. This included inadequate policies and institutional frameworks to manage and monitor critical natural resources such as water and land, the absence of risk-informed spatial and sectoral planning policies and frameworks that led to extensive urban sprawl, unmanaged construction in hazard prone areas and exclusion of disaster risk preparedness in key socioeconomic sectors, gaps in basic infrastructure in urban areas along with aging and poorly maintained infrastructure, weak capacity of institutions to anticipate and respond to extreme events, poor availability and sharing of reliable data for disaster risk planning and management due to inadequate hydro-met system, and limited fiscal resources as well as absence of ex ante financing modalities for risk pooling and sharing. Due to these systemic weaknesses Kerala was at the mercy of the 2018 floods and landslides.

To recover from the floods in a resilient and sustainable manner, it was felt that a traditional approach to recovery and reconstruction would be insufficient. The State not only had to address the fundamental drivers of floods but also better prepare for future disasters. This would be through the development of an inclusive and comprehensive roadmap for a green and resilient Kerala. To facilitate this process, the Government established the Rebuild Kerala Initiative (RKI) to "*bring about a perceptible change in the lives and livelihoods of its citizens by adopting higher standards of infrastructure for recovery and reconstruction, and to build ecological and technical safeguards so that the restructured assets could better withstands floods in the future*". The RKI is the dedicated State-level institutional modality for formulating and coordinating the implementation a Resilient Kerala. Through establishing the RKI, the GoK puts in place a streamlined and transparent process of decision making for the comprehensive and resilient recovery and rebuilding from the 2018 floods.

The RKI's mandate is to develop, coordinate, facilitate and monitor the Rebuild Kerala Development Programme (RKDP) through a participatory and inclusive process. The RKDP constitutes the State's strategic roadmap for a Green and Resilient Kerala. The RKDP encompasses crosscutting and sector-based policy, regulatory and institutional actions as well as priority investment programs that are critical for resilient and sustainable recovery and rebuilding of the State. It aims to catalyze rebuilding of Kerala in a way that addresses key drivers of floods and other natural disasters and climate change risks and strengthens preparedness against future disasters. Through the RKDP, the GoK aims to ensure a resilient recovery and development pathway for a *Nava Keralam*.

The visionary roadmap proposed in RKDP is fully aligned with ongoing State priorities, programs and projects that aim at enhancing the lives of the people in the State. Within the vision set out for *Nava Keralam*, the RKI and the RKDP are guided by the goal of zero mortality due to disasters with minimum economic losses and disruption of services. Therefore, the principles of risk-informed programming will be embedded across all RKDP sector recovery plans with additional investments for disaster preparedness and response. Additionally, many proposed schemes of the State Planning Board's Annual Plan 2017-2018 are supported or further developed in the RKDP, such as instituting special agriculture zones, flood management of the wetland and coastal zone ecosystems, supporting village and small enterprise sectors, strengthening the bus system, road improvements through scientific development, capacity building and service delivery improvements in urban development, and so forth.

The major proposals underlined in RKDP are noted below. This is not an exhaustive list of all the policy, institutional and investment proposals in the RKDP but a compendium of the key ones.

Although the level of economic and human development is high in Kerala, the floods highlighted major gaps in infrastructure that contributed to the vulnerability of the State. The existing infrastructure is highly vulnerable to disasters risks and climate change. Further, despite low poverty rates overall, there are pockets of vulnerability that need targeted interventions to strengthen the resilience of the State's population. However, the fiscal constraints of the State act as a hurdle to tackle these issues comprehensively and in a short span of time. Hence there is an overarching need to maximize the allocation of scarce resources and enhance the management quality of public institutions. Addressing these challenges require greater focus on revenue enhancement, more prudent debt management and improved quality of public expenditures, as well as further strengthening of key public sector agencies to become more responsive, effective and efficient.

Disaster risk management -

- The floods highlighted the need for a comprehensive approach to addressing disaster and climate change risks in the State. Kerala will, thus, embed inclusive disaster risk management (DRM) as a cross-cutting theme across its major development activities and several of the key resilience related actions will happen in relevant sectors.
- Based on the Sendai framework, four key pillars underpin Kerala's preparedness to address disaster and climate change risks: understanding disaster risk, strengthening disaster risk governance, investing in disaster risk reduction for resilience, and enhancing disaster preparedness for effective response. Within each of these pillars, a corresponding set of activities will drive the disaster risk and climate change mitigation framework.
- A number of policy and institutional priorities have been identified to strengthen the frameworks for DRM in the State. Among the most critical ones are: (1) updating State and District Disaster Management Plans, prepare and/or updating city level DM Plans in five city corporations; (2) reviewing and upgrading flood protection design standards in consultation with concerned departments; (3) improving access to disaster risk information in coordination with KSDI, NDEM and other existing platforms; (4) conducting comprehensive 1:10,000 scale land-use mapping and a 1:25,000 scale multi-hazard, vulnerability and risk assessment and preparing risk maps; (5) developing disaster damage and loss databases; and (6) preparing a State Disaster Risk Finance and Insurance Strategy.
- With regard to safeguarding communities, infrastructure and livelihoods better, Kerala will (1) enhance community preparedness and response capability and establish a Civil Defense Force in all districts; (2) construct multi-purpose emergency shelters; (3) construct and retrofit existing education and health infrastructure located in hazard-prone areas to higher standards; (4) formulate and implement a long-term Coastal Zone Disaster Mitigation Plan, Drought Preparedness and Management Plan, Integrated Flood Risk Management Plan and Landslide Management Strategy; (5) improve hydro-meteorological early warning systems including establishment of last mile hazard communication systems; and (6) strengthen State Disaster Response Force, Fire and Rescue Services, and Police with appropriate equipment.

Environment -

- At a policy level, developing State biodiversity strategies and action plan, policy for conservation of eco-sensitive areas and banning specific uses of throwaway/single use plastic materials.
- Declaration of State wetlands will be followed up with improved conservation and management of coasts and wetlands, including strengthening district level monitoring mechanism for wetlands.
- On the institutional front, strengthening the DoECC, improving the sharing of environmental data and information, and establishing Green Technology Centres at the local level are important.
- In terms of investments, the priorities are undertaking programmes to for integrated coastal zone management, investments to conserve the three Ramsar wetlands and pilot projects in low-carbon economy.

Water resources management –

- Among the drivers of the 2018 floods were longstanding issues associated with poor water resource and reservoir management. On the policy and institutional front, a major overhaul would include the restructuring of Water Resources Department (WRD) by basin groups and strengthening coordination across key agencies, including the WRD, KSEB, KSDMA, agriculture and fisheries; creation of a River Basin Management Authority (RBMA) to regulate water resources development and perform water resources management functions; establishing a Central Command Centre for integrated reservoir operation system in line with the pending Dam Safety Bill while strengthening the Dam Safety Authority with clear roles and responsibilities, and finally reorganizing the Irrigation Department around river basins.
- To strengthen information and analysis, the key proposal is establishing a Kerala Water Resources MIS in RBMA with interface with other systems under CWRDM, EoC, WRIS, etc.
- Reforming water allocation principles and modalities, including pricing, to ensure more equitable and efficient sharing of water resources for key water stakeholders, especially taking into account the needs of the poor and the vulnerable.
- In addition to assessing water storage capacity of dams, lakes, wetlands and other bodies in the State, developing masterplans, including investments, for Kuttanad and other critical flood plains and basin/catchment management plans for key catchments.

Water supply -

- Kerala lags notably on delivery of reliable, efficient and sustainable piped water to its citizens. This has serious implications on health and wellbeing of the population, especially for vulnerable groups and during natural disasters. To expand coverage, improve resilience of water supply infrastructure and enhance quality of service delivery, on the policy and institutional front, the key focus will be strengthening effectiveness through new institutional models of service delivery, including devolution of service delivery to local level, as well as strengthening the resilience of the networks and treatment plans through improved standards, and improving financial sustainability of water provision through reduced non-revenue water and improved cost recovery.
- Among key capital investments, in urban areas will be the development of 10 new WTP schemes covering ten municipalities with treatment plants and distribution components as well as the completion of seven existing schemes that require transmission and distribution components, and in rural areas will be 12 schemes that require distribution components and 17 schemes that require transmission and distribution components.

Sanitation -

- Lack of adequate sanitation led to dumping of liquid wastes in water bodies, leading to their reduced carrying capacity as well as propagation of water borne diseases among Keralites. The first critical step towards safe sanitation would be adopting a Sanitation and Waste Management Strategy and Programme by the Government. As part of the Programme, major investments will be undertaken to develop infrastructure for septage management and storm water drainage in ULBs.
- To strengthen the institutional foundations in sanitation, an inter sectoral WASH coordination platform of all stakeholders working in drinking water supply, sanitation, waste management and hygiene domain would be established.

Urban -

- As Kerala becomes increasingly urban, safeguarding cities and towns through resilient spatial planning, infrastructure development and service delivery is critical for the population and the economy. Major policy reform priorities are revising the annual planning and budgeting framework for Urban Local Bodies (ULBs) to avoid fund fragmentation and enable multi-year investment planning, along with amending the Town and Country Planning Act to ensure the preparation, notification and enforcement of masterplans in a time bound manner, and strengthening the building regulations regime to ensure improved standards of resilience to natural disasters and more transparent procedures for building plan approval in the State.
- At the municipal level, the focus would be on strengthening capacities in planning, infrastructure development, service delivery and revenue generation, while also making sure that the all the ULBs complete risk-informed master plans and capital investment plans over a five-year period.
- Municipalities will be supported in undertaking investments in resilient infrastructure, especially in areas and sectors that are prioritized in their master plans and capital investment plans. These could cover sectors like drainage, solid waste management, sanitation, other environmental infrastructure, etc.

Roads and bridges -

- Roads and bridges are key economic assets and ensuring a resilient road network is critical for enhanced preparedness against future natural disasters. Towards this, undertaking a comprehensive disaster and climate risk assessment of PWD road network and developing a State Road Transport Strategy/Master Plan to articulate a roadmap for a demand-driven balanced transport modal share in the State are among key priorities in the short term.
- In the medium term, the focus would be streamlining and strengthening key road sector agencies to eliminate institutional and resource fragmentation and ensuring greater technical and financial capacities of the PWD.
- The PWD also aims to institutionalise a Road Maintenance Management System (RMMS) to strengthen the management of the most critical part of the road network (the core road network) as well as performance-based maintenance contracting (PBMC) for asset management in the core road network with provisions for emergency response. In support of this, strengthening contractor capacities and developing a contractor performance rating framework.
- In terms of investments, contracting of 800 km of priority network using a landscape approach, which includes assessment of geohazard and flooding/erosion risks, as well as initiating feasibility studies using tools like Artificial Intelligence (AI), big data, satellite imagery etc. for select multi-modal

corridors with high freight traffic volumes identified under the Master Plan. This resilient approach would be extended to the rest of the network over time.

Transportation -

- The key elements of a resilient, sustainable and effective transportation system for Kerala include the following: integration with land-use policy, making connections through multi-modal transportation systems, addressing infrastructure gaps and points of friction in the system, revamping the bus system, enhancing safety, increasing use of ICTs, improving economic viability for all transport stakeholders and a robust public communication strategy.
- Among the priority policy and institutional are developing emergency management plans for public transit agencies, approving the Kerala Metropolitan Transport Authority Bill, establishing a Transport Sector Reform Group in the Transport Secretariat to take up issues like bus transport policy, congestion charge policy, bus route rationalization and State logistics policy
- Potential strategic investments include pilot schemes for Intelligent Transport Management Systems and establishing a high-speed corridor connecting the districts of Kerala longitudinally.
- Forestry -
- Given the experience of floods and landslides, emphasis will be on the strict implementation of Forest Conservation Act, including the decision to allow no new openings in forest areas.
- Strengthening policies for reclamation and restoration of the abandoned and/or illegal mines and quarries near forest as well as developing management action plans for ecologically sensitive zones around Protected Areas will be pursued by the Government.
- In terms of investments and on-the-ground action, among the priorities are rehabilitating and strengthening the forest infrastructure, habitat improvement of 20,000 ha over 5-year period and integrated approaches to conversion of plantations to natural forests and maintenance.

Agriculture -

- The floods have highlighted the need to adopt an ecological approach for sustainable and resilient agriculture development in Kerala. Echoing this, a major paradigm shift will be moving towards agriculture based on agroecological zones and agroecological management units across Kerala. Towards this, the State will be zoned into five major agroecological zones and the Agriculture Department and allied agencies will be realigned in support of this policy and investment shift. Also, as part of this, promoting disaster resilient crop varieties in specific agroecological zones.
- The State will be developing a strategic plan for agro-marketing of key Kerala crops, leveraging private sector resources and capacities, as well as preparing detailed masterplans and actions plans for select agroecological zones.

Animal husbandry -

- Animal husbandry has a key role in the livelihoods of poor households. Key priorities include re-engineering the institutional framework for effective last mile delivery, reorganization of Animal Husbandry and Diary Development Departments, developing veterinary services, improvements in livestock and poultry development, strengthening R&D and fostering innovative technologies.
- Among the priority activities are establishing four distinct dairy development zones in the State and providing support based on the characteristics of each zone, rolling out Herd Induction Programmes to compensate for loss of milch animals due to the floods, introducing calamity-resistant

dairying/livestock/poultry farming technologies, rolling out an extensive fodder development programme, enacting laws for ensuring safety and quality of cattle and poultry feed and creating value addition of milk, meat and poultry products to increase profitability and sustainability for producers.

Fisheries -

- Key objective in the fisheries sector is improving the availability of fish by increasing fish production and reducing wastage along with enhancing employment and income generation for the fisher community and minimizing loss of fish wealth. Towards achieving this objective, there are five priority areas for attention: creating an enabling environment through policy and institutional improvements, ensuring productive and sustainable management of marine fisheries and sustainable inland capture fisheries, developing an environmentally sensitive aquaculture industry and optimizing the benefits of a productive fisheries sector to advance social goals
- Priorities include formulating or strengthening policies related to deep sea fishing, seed certification and seed production centres, feed mills standardization and promotion of integrated farming systems. In parallel, establishing one-stop aquaculture centres and an advanced control room for online tracking, communication mechanism and rescue along with modernizing and strengthening the Matsyabhavans will support fishermen and fish farmers better.
- Among key areas of public and private investments are expanding aquaculture into more than 15000 hectares of inland water bodies, establishing fish multiplication centres, disease surveillance and control laboratories, constructing boat building yards, and modernizing harbours, fish landing centres and fish markets.

Livelihoods -

- Key livelihood and employment categories for resilient rebuilding are farm, off-farm (livestock, poultry, fisheries, etc.) and non-farm livelihoods (manufacturing, trading and service enterprises, including tourism, MSME, Kudumbashree, etc.), informal/unorganized sector workers, and skilled labour. Short-term recovery measures would aim at mitigating the losses suffered by the most vulnerable segments such as MGNREGS job card holders, SC/ST, fisherfolk, disabled, informal workers, petty traders, women JLGs and micro-entrepreneurs. In the medium term, the focus would be on strengthening livelihoods, self-employment avenues and skilling initiatives. Long-term measures will involve disaster, climate and livelihood governance through active participation of stakeholders at the grassroots level.
- Instituting policies for leased land cultivation that addresses aspects such as rehabilitation, issues of land ownership, leased land regulations, decent wages and insurance, revisiting the 'Responsible Tourism' policy framework to incorporate disaster and climate risks and the Microenterprise policy framework to strengthen value chains, develop productive alliances with retailers, exporters and other institutions, improve availability of financing, as well as developing Livelihood Action Plans (LAP) at the local government level are priorities to be pursued.
- Providing an additional 50 days of paid wage labour under MGNREGS & Ayyankali EGS to the rural and urban poor, supporting unorganized/informal sector workers recover lost capital and compensating them for income lost, testing out a livelihood start-up programme for nano-enterprises along the lines of Start-up Village Entreprenuership Programme, establishing a Crisis Management Fund (CMF) for micro-entrepreneurs and women JLGs engaged in leased land farming, and piloting a micro-insurance programme that would insure livelihood ventures from various hazards and calamities are among the investment proposals in the livelihoods sector.

Land -

- Secure tenure is the key for reducing vulnerability and risks. Comprehensive and secure land records offer critical protection of rights when population is displaced by a disaster. The main focus of securing land records in the State would be by unifying and completing its land records and maps. Kerala has made a good effort in implementing the land records modernization with constrained resources under the Bhoomikeralam project and now through the Kerala Land Records Modernization Mission. These efforts would now be amplified through concerted policy and institutional measures.
- Key priorities in strengthening land records and securing tenure would be adopting the Kerala Land Administration and Management Act and operationalizing and strengthening the Kerala Land Records Mission to allow unification of the land records and registry map work of the Department of Revenue, Department of Land Records and Surveys, and the Department of Registration. The Mission would involve a costed and timed programme for completing land records modernization in Kerala with components for (1) Computerization of Land Records, (2) Survey/ Re-Survey, (3) Computerization of Registration, (4) Modern Record rooms.

This document is divided into six chapters that present the above storyline. Chapter 1 focuses on the flood event, looking at Kerala's inherent vulnerability to disasters, the progression of the 2018 floods from the start of rainfall in June to the abatement of the floods in the end of August, the immediate response of the Government and its people and the quantification of the impacts and damages from the floods.

Chapter 2 presents the argument for a paradigm shift in the response to the floods through a comprehensive, well-coordinated and multisectoral approach to resilient recovery of Kerala. The Chapter introduces the RKI and the RKDP. The RKI has been created in response to the floods to *"enable Kerala's resilient recovery and catalyse transformational shift towards risk-informed socio-economic development through supporting sustainable communities, institutions, livelihoods and putting in place major infrastructure"* (G.O.(P)No.16/2018/P&EA). The RKI provides the institutional framework for the rebuilding process of post-flood Kerala and acts as a vehicle to operationalize the RKDP roadmap which presents the policy shifts, institutional actions and investments required for resilient rebuilding of Kerala. This chapter outlines the aim, principles, structure and processes of RKI as well as the sectoral, geographical and temporal scope of RKDP.

Chapter 3 details the cross-cutting foundational elements RKDP. These are elements are cross-sectoral, i.e. they are priorities that are ingrained across sector specific roadmaps, and thus deserve special focus. These foundational elements include Disaster Risk Management and Resilience, Environment and Climate Change, Strengthening Institutional Efficiency and Resilience, and Open Data.

Chapter 4 investigates key sectors that were impacted by the floods and have a role in enhancing resilience to future floods and disasters. It examines how each sector was impacted by the floods, analyses legacy and current issues that hampered its rapid recovery, outlines proposed sector-specific approach to resilient rebuilding, identifies specific interventions to support this approach, along with supplementary technical studies and assessments. The key sectors covered by RKDP are Integrated Water Resource Management, Water Supply, Sanitation, Urban, Roads and Bridges, Transportation, Forestry, Agriculture, Animal Husbandry and Dairy Development, Fisheries, Livelihoods and Land. While this approach comprehensively responds to the various drivers of the floods, the multi-sectoral nature of the programme affords the opportunity to maximize the Programme's goals, through capitalizing on mutual gains between sectoral interventions. The multi-sectoral nature of the RKDP means there may be challenges in execution, and to mitigate this the RKI will structure, coordinate, execute and monitor progress to programme goals.

Chapter 5 delves into the details of the financing, institutional and implementation arrangements of RKDP. Using the Joint Rapid Damage Needs Assessment (JRDNA) and the Post disaster Needs Assessment (PDNA) estimates as a baseline, this chapter quantifies the investments required for rebuilding Kerala as per the RKDP roadmap. This analysis along with a macroeconomic outlook and debt sustainability study of Kerala State is used to determine the funds necessary for implementing RKDP and identify the potential public and private sources of financing the RKDP. These include the State budget, the Central government natural disaster assistance, the Kerala Flood Cess, assistance from multilateral and bilateral development partners, loans from HUDCO, NABARD and other sources, crowdfunding, and private/non-traditional sources of financing including Masala and Diaspora Bonds. There are numerous active partnerships with national and international development agencies.

Given the multi-disciplinary and often complex nature of RKDP policy, institutional and investment interventions, it is essential that there is a clear process and arrangement for implementation. The scale of the disaster, planning required, implementation complexities, financial management and service delivery calls for a dedicated institutional framework, which is further explained in Chapter 5. This framework additionally includes clear processes and distribution of responsibilities for project identification and selection within RKDP. Chapter 5 wraps up with details on the timeline and phasing of RKDP, along with details on the institutional support framework required to facilitate project implementation, such as through instituting singular contracted procurement management services and third-party auditing for RKDP.

Chapter 6 presents the need for instituting a comprehensive and effective monitoring and evaluation (M&E) system from an early stage, especially given the multitude of interventions and sectors involved in the RKDP. An M&E framework is introduced along with the supplementary M&E institutional arrangement and implementation mechanism. The chapter comes to an end with a preliminary results framework, that uses key performance indicators to regularly measure RKDP progress made in achieving outputs, outcomes, and processes goals.

Chapter 1: All about the 2018 Kerala Floods

1.1 How Vulnerable is Kerala to Disasters?

Kerala is highly vulnerable to natural disasters and the changing climatic dynamics given its location along the sea coast and steep gradient along the slopes of the Western Ghats. It is prone to a host of natural hazards such as cyclone, monsoon storm surge, coastal erosion, sea level rise, tsunami, flood, drought, lightning, landslide (debris flows), land subsidence (due to tunnel erosion or soil piping) and earthquake. Kerala's State Disaster Management Plan assesses 39 types of known and reported hazard types in the State that may turn disastrous in the event of lack of proper preparedness and risk reduction planning[1].

Kerala has a humid tropical climate, the dominant climatic phenomena being the South-West (June to September) and the North-East (October to December) monsoons. The former is more significant producing 80% of the total annual rainfall. Kerala has an average annual precipitation of 3000 mm, with about 90% of the rainfall occurring during the six monsoon months. The high intensity monsoon storms heavy discharges in all the rivers and result in severe floods, making floods the most common of natural hazards that affects the State. Nearly 14.8% of the State is prone to flooding[2], and the proportion is as high as 50% for certain districts. Landslides are a major hazard along the Western Ghats in Wayanad, Kozhikode, Idukki and Kottayam districts (as seen in the weather led disaster that occurred in 2018). More than 50% of Kerala's land area is moderately to severely drought susceptible.

Kerala anticipates the effects of global climate change to bring an increase in extreme rainfall and with it the probability of urban flooding during the north-east monsoon period, a water shortage during peak summer months, along with a subsequent increase in urban temperature, and a potential increase in coastal erosion along the highly populated coastline due to rising sea-levels.

The impacts of climate change are aggravated by lack of adaptive capacity of the State to floods, droughts, and mudflows are expected to increase in both frequency and severity because of climate change. Another impact being witnessed is progressive coastal erosion affecting nearly 63%[3] of the State's 580 km of coastline.

Table 1: Kerala's exposure to climate and geophysical hazards

Hazard	Time Frame	Description of hazards
Extreme Precipitation and Flooding	Current	Observed decreasing trend based on rainfall data for the last 100 years; extreme events expected to increase in frequency
	Future	Rainfall trends in Kerala over the past decade exhibit sporadic long spells of heavy rains, leading to an increasing likelihood of the of extreme rainfalls and flooding

[1] Kerala State Disaster Management Authority: Government of Kerala, State Disaster Management Plan 2016, http://sdma.kerala.gov.in/publications/DMP/Kerala%20State%20Disaster%20Management%20Plan%202016.pdf
Kerala State Disaster Management Authority: Government of Kerala, Kerala State Disaster Management Plan Profile, http://documents.gov.in/KL/16344.pdf

[2] CESS, 2010

[3] Shoreline Change Assessment of Kerala, National Centre for Sustainable Coastal Management, Kerala, June 2018

Drought	Current	The State of Kerala experiences seasonal drought conditions every year during the summer months. The State of Kerala experiences seasonal drought conditions every year during the summer months. The trend analysis on rainfall data over the last 100 years reveals that there is significant (99%) decreasing trend in most of the regions of Kerala especially in the month of January, July and November.
	Future	Based on State's DRM analysis, it is evident that more than 50% of the land area of the State is moderately to severely drought susceptible, majorly on the drinking water side.
Sea Level Rise	Current	The historic sea level rise for Cochin is estimated to have been 2 cm in the last one century.
	Future	Sea level is on the rise due to global warming and the projected Sea Level Rise (SLR) along Kerala coast on a conservative estimation is about 100 to 200 mm over the next 100 years. Vulnerability to Sea Level Rise would be of alarming to the majority coastal communities which live on sandy coasts, most of which are barrier beaches or spits. Backwater banks, islands and filtration ponds/paddy fields are other sections of the coastal zone which are highly susceptible to Sea Level Rise.
Strong Winds	Current	The State has identified strong winds as a state specific disaster calamity, that has been experienced often in the last decade.
	Future	The maximum wind speed from tropical cyclones is expected to increase, but estimates are highly uncertain
Tsunami	Current	The 590 km coast of Kerala is one of the most densely populated land areas in the country. This coastline is exposed to high waves, storm surges and Tsunami. Indian Ocean Tsunami on 26 Dec 2004 affected the 250 km coastline with sea water entering up-to 1.5 km inland.
Landslide	Current	Apart from floods the mountain regions of the State experience several landslides during the monsoon season. It is known that a total of 65 fatal landslides occurred between 1961 and 2009 causing the death of 257 individuals. In the recent floods in 2018, the State has suffered more than 5,000 small and big landslides and landslips, that emerged as a major cause of economic and life loss in the floods.

Not exposed. No potential impact. No risk	Slightly exposed. Low potential impact. Low risk	Moderately exposed. Moderate potential impact. Moderate risk	Highly exposed. High potential impact. High risk

The Table[4] below shows the susceptible/vulnerable areas and population exposure to major hazardous phenomena in the State:

[4] KSDMA

Table 2: Area vulnerable to hazards

Hazard	Number of taluks prone	Susceptible area (km^2)	Population exposed
Landslides	50	5,619.7	2,799,482
Floods	75	6,789.5	7,795,816
Coastal Hazards	24	289.7	313205

Underlying Risk Drivers: Floods are the most common of natural hazards that affect the people, infrastructure and natural environment in Kerala, and incidence of floods in the State is becoming more frequent and severe. Other than floods, the State is also vulnerable to droughts, landslides, storm surges and Tsunamis. Some contributors that exacerbate the disaster risks in the State are:

- **Unsustainable and weak management of natural resources and poor awareness of the changing climatic conditions.** Degrading environment due to extensive exploitation of the natural resources and deforestation, coastal erosion, monsoon storm surges, sea level rise and land subsidence due to tunnel erosion or soil piping (a creeping slow hazard that emerged from analysis of landslides).
- **Lack of awareness and anticipation of disaster risks**, including weak institutional capacity to deal with high-intensity disasters, inadequate early warning systems and protocols respectively, limited Disaster Risk Management (DRM) and slow roll out of community-based DRM activities. Additionally, there is limited consideration of disaster risk within social and economic sectors, partly because of competing demands on limited financial resources and inadequate capacity.
- **Poor maintenance of existing assets**, which accentuates risk and increases the State's vulnerability to natural disasters. Examples are: deteriorating, aging and poorly maintained infrastructure (including irrigation channels); minor major and irrigation dams managed by too many agencies; erosion of river embankments, roads, bridges, and encroachments into water bodies and sand mining from rivers, water channels and canals leading to narrowing carriage capacity of water channels; and poor solid waste management and sanitation disposal/treatment facilities.
- **Inadequate storm water drainage and filling of traditional water storage reservoirs,** which increases the pluvial flood risks. An increase in flood plain occupancy and reclamation of water bodies and wetlands results is also increasing flood damages. Riverine flooding is a recurring event consequent to heavy or continuous rainfall exceeding the absorptive capacity of soil and flow capacity of streams and rivers. This causes a water course to overflow its banks onto flood plains.
- **High density of urban areas**. This density includes a population of 860 people/km^2 (2011 Census), narrow roads, dense and intrinsic road network and density of coastal population in vulnerable areas. Rapid urbanization influenced habitations into uncontrolled expansion on both banks of the rivers/water bodies thereby encroaching into water channels/bodies and constricting the floodplains.
- **Absence of risk-informed urban planning**. Non-compliance to design standards and non-incorporation of resilient features in urban infrastructure was reaffirmed by the widespread flooding in urban and semi-urban areas of Kerala. Master plans prepared by the Chief Town Planner (CTP) are still awaiting feedback from the Local Self Government Institutions (LSGIs) to enable appropriate rectification and issue of notification of approval of the masterplans for the respective LSGIs. Till date, master plans of only 19 local bodies have been notified and there is little evidence of hazard risk

informed planning process in the State. Lack of notification has resulted in unplanned development/expansion in urban areas.

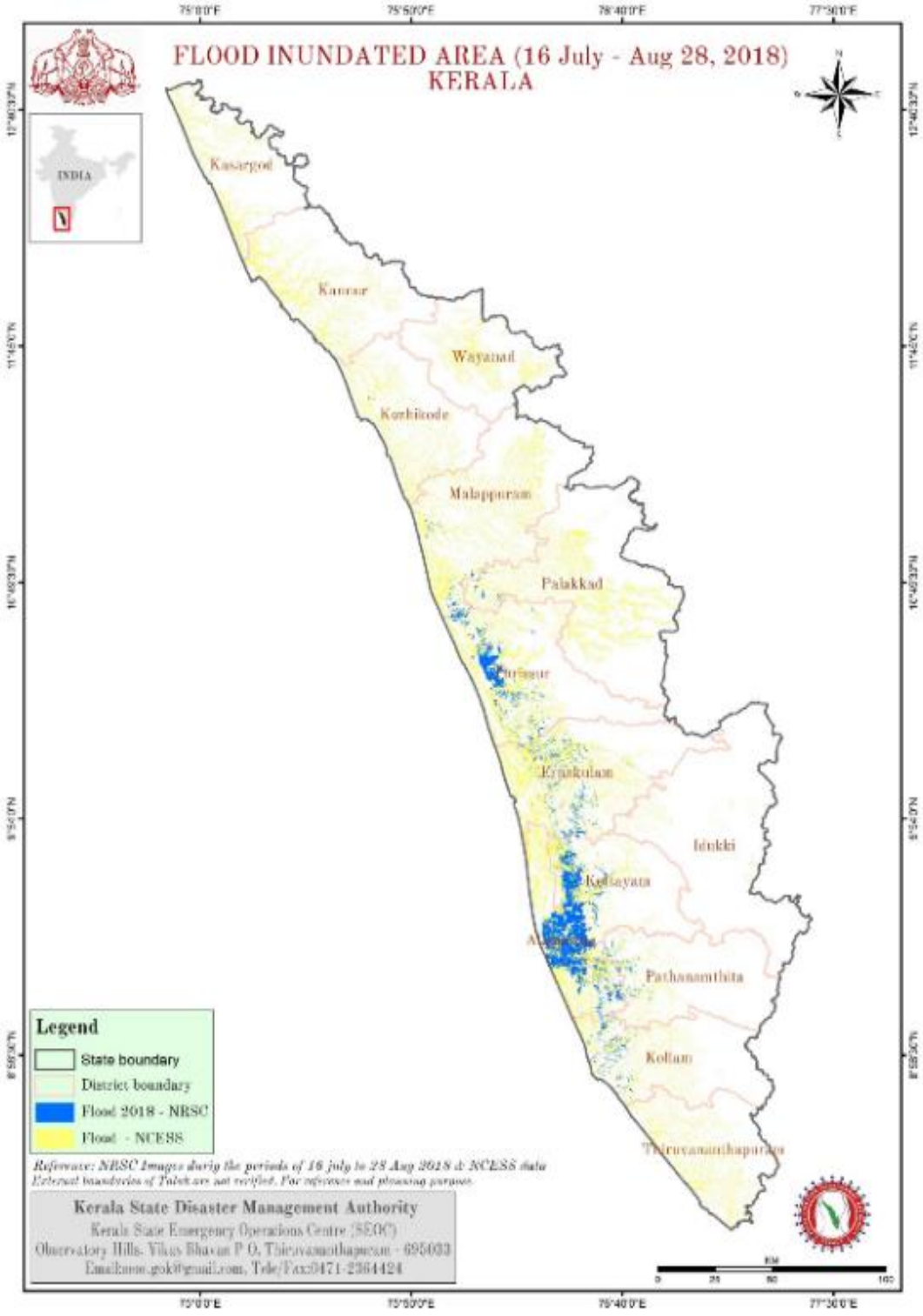
- **Poorly enforced land use pattern and practices:** Current land use regulations are in the State are based on (a) the Paddy and Wetland Act, (b) the River Management Act; and (c) the Kerala Municipal Building Rules (KMBR) and the Kerala Panchayat Building Rules (KPBR). These orders do not ideate into a single land management policy/regulation for enforcement agencies to pursue due to the regulatory and not restricting nature of these orders. A commonality of law for land use is absent, due to which business and habitation zones has overlapped over the years.

1.2 What Happened during the 2018 Floods?

Between June 1 and August 19, 2018, Kerala received abnormally high rainfall, (about 42% above normal), resulting in the worst ever floods since 1924, impacting almost 5.4 million people - one-sixth of the State's population. Kerala received 2346.6 mm of rainfall from 1 June 2018 to 19 August 2018 in contrast to an expected 1649.5 mm of rainfall (IMD data). This rainfall was about 42% above the normal. Further, the rainfall over Kerala during June, July and 1st to the 19th of August was 15%, 18% and 164% respectively, above normal. The heavy monsoon brought widespread flooding to several districts of Kerala State and triggered thousands of small to big landslides. Around 1,259 out of 1,664 villages spread across its 14 districts were affected. Seven districts were worst hit, where the whole district was notified as flood affected: Alappuzha, Ernakulam, Idukki, Kottayam, Pathanamthitha, Thrissur and Wayanad. Water levels in several reservoirs were almost near their capacity due to continuous rainfall. Due to heavy rainfall, the first onset of flooding occurred towards the end of July. Thirty-five dams across the State were opened to release flood runoff. All five overflow gates of the Idukki Dam were opened for the first time in 26 years. Heavy rains in Wayanad and Idukki caused severe landslides.

Several districts were inundated for more than two weeks due to heavy rains induced floods. The limited capacity of Vembanad Lake and Thottappally spillway worsened the flooding in the Kuttanad region and the backwaters. The worst affected districts were Wayanad (Kabini sub-basin), Idukki (Periyar sub-basin), Aluva & Chalakudy (Periyar and Chalakudi sub-basins), Chengannur and Pathanamthitta (Pamba sub-basin). According to flood-affected area maps provided by the National Remote Sensing Centre (NRSC), between 16th July to 28th August, 65,188 hectares of the land area was inundated. Figure 1, on the next page, shows the flood affected areas in this time span. Many areas were under water for more than two weeks. Nearly 341 landslides were reported from 10 districts. Idukki district was ravaged by 143 landslides. The devastating incident resulted in a total of 498 casualties, with over 5.4 million people affected with loss of assets and property and 1.4 million people displaced, forcing them to temporarily move to relief camps during the peak of the disaster. Many of the displaced were women and children.

Figure 1: Flood affected areas plotted against the flood prone areas of Kerala



Source: IMD, State Relief Commissioner, Disaster Management, Additional Memorandum, Kerala Floods 201

Table 3: District wise rainfall during 1 June 2018 to 22 August 2018

District	Normal Rainfall (mm)	Actual Rainfall (mm)	Departure from Normal (%)	
Kerala State	1701.4	2394.1	41	Excess
Alappuzha	1380.6	1784	29	Excess
Kannur	2333.2	2573.3	10	Normal
Ernakulam	1680.4	2477.8	47	Excess
Idukki	1851.7	3555.5	92	Large Excess
Kasaragod	2609.8	2287.1	-12	Normal
Kollam	1038.9	1579.3	52	Excess
Kottayam	1531.1	2307	51	Excess
Kozhikode	2250.4	2898	29	Excess
Malappuram	1761.9	2637.2	50	Excess
Palakkad	1321.7	2285.6	73	Large Excess
Pathinamthitta	1357.5	1968	45	Excess
Thiruvananthapuram	672.1	966.7	44	Excess
Thrissur	1824.2	2077.6	14	Normal
Wayanad	2281.3	2884.5	26	Excess

*S*ources: Study Report Kerala Floods of August 2018, Government of India: Central Water Commission Hydrological Studies Organization, September 2018

1.3 How did the Government of Kerala Respond?

The Government of Kerala conducted timely and efficient rescue and relief operations with heavy support of communities mobilizing on their own, and effective application of information technology and social media by voluntary youth groups. The people of Kerala also showed remarkable resilience in the face of the adversity to the extent that within one week of flood waters receding, most people returned to their homes to rebuild their lives. The administrative machinery of the government was in full force during relief operations despite many of their own families and property being adversely impacted in floods. The Kerala State Disaster Management Authority (KSDMA) played a critical role in coordinating emergency response, rescue and relief operations during and after the floods. Relief assistance was provided to people in camps including immediate food supplies (rice, wheat and pulses), drinking water, kerosene and other life-saving items. Food packets and assistance of Rs. 10,000 per family to clean inundated houses were also disbursed. The State's well-known poverty eradication and women's empowerment programme, Kudumbashree, played an extensive role in these efforts. Kudumbashree members cleaned houses and public offices, provided counselling to families, managed community kitchens in affected areas, collected relief material and distributed it in camps, provided assistance for packing of take-home kits, supplied volunteers for various activities, housed flood victims in their homes, and conducted mass cleaning activities in some districts. They also raised funds and contributed nearly Rs. 11.2 crores to the Chief Minister's Disaster Relief Fund.

The Central Government and several other states also provided support to GoK's response and relief efforts. Fifty-seven teams of National Disaster Response Force (NDRF) and 435 boats were deployed for search and rescue in addition to five companies of paramilitary forces, armed forces and coast guards with 40 helicopters, 20 aircrafts, 2 ships, 10 columns and 10 teams of Engineering Task Force. In addition, the fishing community of the State rendered voluntary assistance towards search and rescue. Nearly 669 boats that went out with 4357 fishermen are estimated to have saved at least 65000 lives.

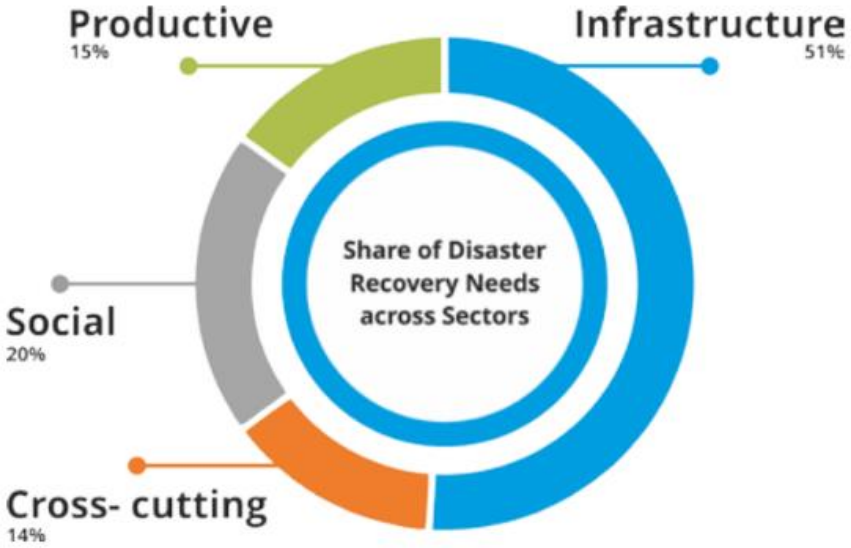
The Prime Minister announced financial assistance package of Rs. 600 crore. Villages with destroyed mud brick houses were to be provided houses under the Pradhan Mantri Awas Yojana (PMAY). The Ministry of Rural Development sanctioned Rs. 1,800 crore under Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA) for 2018-19 for 5.5 crore person days of work. Directions were issued to insurance companies to hold special camps for assessments and timely release of compensation to the affected families/beneficiaries under social security schemes, to Fasal Bima Yojana for fast clearance to agriculturists/farmers, and to National Highway Authority of India to repair national highways damaged due to floods on priority. Approximately Rs. 1,400 crores from millions of individuals and organizations across India and overseas were credited into the Chief Minister's Disaster Relief Fund (CMDRF), in addition to contributions in kind (medical and relief supplies).

1.4 What were the Impacts of the Flood?

In September-October 2018, the GoK conducted a series of assessments to estimate the damage, loss and needs to critical sectors and districts from the floods. A Joint Rapid Damage and Needs Assessment (JRDNA) was conducted by GoK, supported by the ADB and the World Bank covering 12 sectors and all 14 districts in the State which were affected by the floods and landslides to varying extents. The JRDNA was complemented by a detailed Post-Disaster Needs Assessment (PDNA), led by GoK and supported by the United Nations. The assessments estimated that total damages and losses to be around Rs. 26,718 crore and total recovery needs at around Rs. 31,000 crore. Infrastructure sectors like transportation, water,

sanitation and hygiene, power and irrigation were the most affected and have the largest recovery needs, followed by social sectors[5], productive sectors and cross cutting sectors.

Figure 2: Share of disaster effects across sectors



The losses accrued by the State were amplified owing to several factors including inadequate reservoir storage and limited capacity for dam operation, reduced carrying capacities of surface water bodies, unplanned development in disaster-prone areas and due to the poor quality of the built infrastructure. The floods and landslides disproportionately affected vulnerable groups in the State including women, the elderly, children, persons with disabilities (PWDs), Scheduled Tribes, Scheduled Castes and the fisher folk especially in rebuilding their livelihoods in agriculture and other ancillary activities (fishing and animal husbandry for instance) and in the Micro, Small and Medium Enterprise (MSME) sector. There have been both immediate and long-term losses in wages and work prospects given extensive damage to livelihood related assets. These are reflected in the aggregate economic losses reported: it is estimated that close to 2.6% of Kerala's gross state domestic product (GSDP) was washed away by the floods.

[5] Social sectors include Housing, Land and Settlements, health and nutrition, education and child protection, cultural heritage. Productive sectors include agriculture, fisheries and livestock.

Table 4: Overview of Disaster Effects and Recovery Needs

Sector	Damage	Loss	Total Effect (D+L)	Total Recovery Needs
	Rs. crore	Rs. crore	Rs. crore	Rs. crore
Housing, Land and settlements	5027	1383	6410	5443
Irrigation & Water Resources				1483
Water, Sanitation and Hygiene	890	471	1361	1331
Integrated Water Resources Management				24
Power				353
Transport				10046
Health and Nutrition	499	28	527	600
Agriculture, Fisheries and livestock	2975	4180	7155	4498
Livelihoods	881	9477	10358	3896
Education and Child Protection	175	4	179	214
Disaster Risk Reduction	17	583	599	110
Natural Environment & Biodiversity	26	0.04	26	148
Cultural Heritage	38	37	75	80
Other Infrastructure				2446
Gender and Social Inclusion	0.9	0	0.9	35
Local Governments	28	0	28	32
Total				

Source: Kerala Floods 2018 PDNA

Note: (i) The values have been rounded so the totals may not match. (ii) Damage, loss, and total effect have not been given for Power, Irrigation, Other Infrastructure and Transportation (Roads and Bridges)

Chapter 2: How does the 'Rebuild Kerala Development Programme' Differ from the Standard Recovery Approach?

2.1 Rebuilding Post-flood and Protecting Our Future

The 2018 flood disaster was unprecedented in its extent and impacts. The floods highlighted a number of structural constraints associated with institutional capacity, policy and planning, financing, standards, access to data and public services, that left Kerala unprepared for major natural disasters or climate change shocks. To recover from the floods in a resilient and sustainable manner, it was felt that a traditional approach to recovery and reconstruction would be insufficient — it was not enough that the State merely undertake a rehabilitation and restoration programme in the aftermath of this natural disaster. Kerala had to address the fundamental drivers of floods as well as better prepare better for future disasters. The floods had to be taken as "*a challenge and an opportunity to rebuild the State to ensure better standards of living to all sections of the society"*[6]. A comprehensive and well-coordinated multi-sectoral programme is required to address this challenge in order to ensure a resilient recovery and a sustainable development pathway for Kerala.

2.2 Structural Constraints to Disaster Risk Reduction and Resilience

Institutional and capacity: Inadequate institutional capacity limits the State's ability to anticipate and respond to extreme events which leads to sub-optimal and ad hoc response, from one emergency to another. Multiple government agencies are engaged in the sectors of agriculture, water, roads and waste management, but they often operate in a fragmented and isolated manner, instead of taking a multisectoral and cross-institutional approach to planning, development and management of natural resources, infrastructure and public service delivery. To encourage this holistic approach there is a need for institutional consolidation, coordination and capacity building. An enabling institutional and policy framework with a supporting regulatory regime and adequate enforcement is required, especially for critical sectors like integrated management of agriculture, water resources, transportation, disaster risk management, urban services, etc. A comprehensive assessment of the institutions, re-engineering when required for more effective delivery through redefining of roles and responsibilities, strengthening staffing, and capacity building would be required. Additionally, it is important to build partnerships with the private sector on climate proofing and adaptation, green and resilient designing and value engineering techniques to reduce overall impact on environment and ecology during recovery and rebuilding.

Policy and planning: One of the key gaps identified during the floods was inadequate urban spatial and sectoral planning and a lack of mainstreaming of risk mitigation measures. There is little evidence of hazard risk informed planning process in the State. Poor enforcement of master plans has led to extensive urban sprawl and unmanaged construction in hazard prone areas. During the floods, many such unauthorized constructions in vulnerable areas suffered severe damages. Land use regulations are currently based on multiple divergent acts, orders and rules. These do not align into a single land management policy and regulation for enforcement agencies to follow. This is not conducive to facilitate systematic planning and investments, enforcement of DRR regulations, or implementation and

[6] The policy statement of GoK as per Government Order G.O.(P)No.16/2018/P&EA, dated November 9, 2018.

compliance of DRM measures. In order to achieve resilient recovery, it is important to introduce flexibility in planning guidelines, ensure synergies between urban master plans and district development plans, enable multi-year infrastructure planning, etc. The Government has an institutional and legal framework in place to manage disaster response, however it is imperative to additionally mainstream and integrate DRM into various sector development strategies.

Financing: Currently, disaster risk financing is characterized mostly by ex-post mechanisms (e.g. budget reallocations) rather than ex ante (e.g. insurance of public assets, market-based risk transfer, etc.). The State draws finances for DRM activities primarily from its own budget, resources provided by the GoI, external financing institutions and voluntary contributions. Kerala needs to explore sustainable financing options for DRM and DRR, for example, catastrophe insurance, insurance linked-safety net programs, and other innovative insurance products to reduce the fiscal burden of disasters on State resources. While most better performing states in terms of infrastructure[7] have Capex to GSDP ratio more than five, Kerala managed only 1.79. In critical infrastructure sectors, there is a need to explore innovative financing structures and alternate revenue models for raising funds to support resilience.

Building Standards: Widespread flooding in urban and semi-urban areas of Kerala has reaffirmed the absence of risk-informed urban planning, non-compliance to building design standards, and non-inclusion of resilient features in urban infrastructure. Aging and poorly maintained infrastructure accentuates this risk. Inadequate investments in building resilient infrastructure and the poor operation and maintenance (O&M) of assets also contributed to losses across sectors during extreme events. There is a need to strengthen technical design guidelines, enforcement, service standards and codes for infrastructure and buildings to incorporate climate and disaster risks.

Data: An inadequate hydrological database, poor information systems and tools prevent forecasting, early warning and rapid response. There is limited availability of data due to an inadequate hydro-met system, a lack of sampling stations, low density of gauges, broken equipment, etc. This leads to poor quality data that does not support sound decision making. Additionally, limited accessibility of data does not allow agencies to readily access information for planning and management. There is a lack of detailed systematic information on hazards, and sector-specific asset health that is required for scientific analysis to properly manage water resources, construct roads, and undertake various urban services and planning measures.

Infrastructure and service delivery quality: Kerala has made great progress in ensuring that services such as education, health or connectivity reach its citizens. This progress has provided a strong foundation to the State's development. However, as the floods highlighted, Kerala's challenges today are increasingly about the quality and resilience of infrastructure and public services. Thus, there is a need to maximize the efficiency of scarce public investments in the development of infrastructure and delivery of services. This requires a paradigm shift in public investment and expenditure management systems and approach.

[7] As per white paper on State Finance, June 2016

2.3 A Paradigm Shift through Rebuild Kerala Development Programme

The Rebuild Kerala Development Programme (RKDP) is a thus a direct response to the 2018 floods, designed to serve as a resilient recovery programme which aims to build resilience during recovery and promotes resilience in regular development[8]. The Rebuild Kerala Initiative (RKI) is the institutional modality or framework for the entire rebuilding process andUacts as a vehicle to operationalize the RKDP by coordinating, facilitating and driving policy shifts, institutional renewal and investment on-the-ground required for a resilient rebuilding of Kerala. Through establishing RKI, the Government aims to put in place a streamlined and transparent process of decision making for comprehensive and resilient recovery and rebuilding from the 2018 floods. The RKI aims to catalyse the State's transformational shift towards risk-informed sustainable development[9] by putting in place policies, institutions and systems for enhancing resilience to disasters and impacts of climate change, by ensuring higher standards of infrastructure, assets and livelihoods for resilience, and by fostering equitable, inclusive and participatory reconstruction for building back better.

The RKDP response aims to address the underlying multi-sectoral drivers and challenges highlighted by the 2018, as outlined above, through a multi-sectoral response. Without smart and resilient recovery, reconstruction, and long-term resilience building efforts, the recent floods and landslides may undermine the investments and progress that successive Governments have made in reducing poverty and promoting prosperity.

2.4 Purpose of 'Rebuild Kerala Initiative'

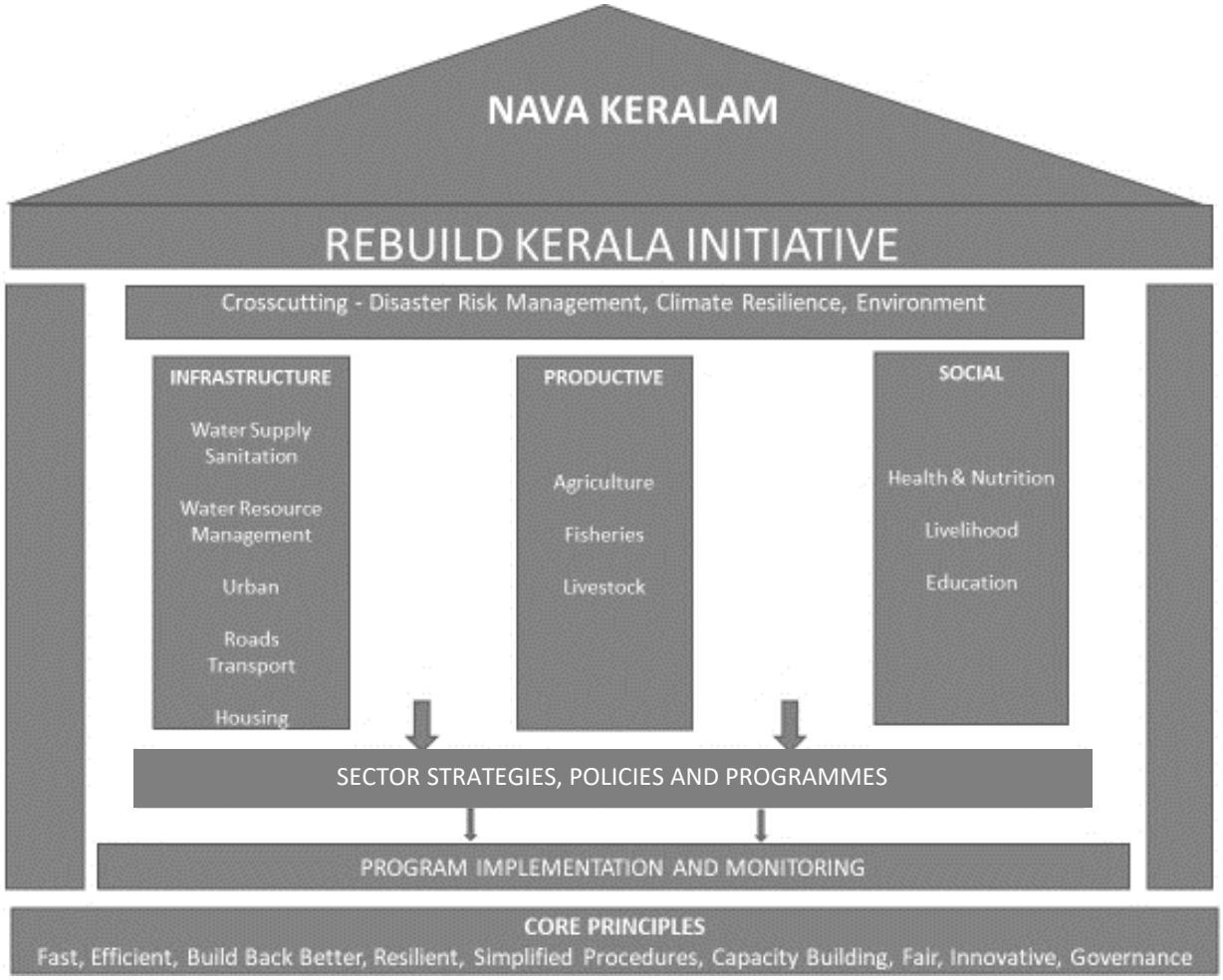
"Rebuild Kerala Initiative is guided by GoK's vision for recovery and move towards Nava Keralam. RKI envisions a green and resilient Kerala where higher and ecologically safe standards of infrastructure, improved conditions of living and new major development projects ensure that people and assets are able to withstand the onslaught of future disasters. " – G.O.(P)No.16/2018/P&EA

This vision sets the stage for resilient recovery in Kerala followed by a streamlined process of decision making for identifying the priorities, investment needs, and sources of funding.

[8] "Resilient recovery"

[9] Government Order; G.O.(P)No.16/2018P&EA dated November 11, 2018

Figure 3: Position and purpose of Rebuild Kerala Initiative



Objective of RKDP

"To enable Kerala's resilient recovery and catalyse transformational shift towards risk-informed socio-economic development through supporting sustainable communities, institutions, livelihoods and putting in place major infrastructure. "– G.O.(P)No.16/2018/P&EA

The RKDP aims to rebuild Kerala in a speedy and effective manner. The goal is to rebuild Kerala in a way that ensures (i) higher standards of infrastructure, assets and livelihoods for resilience against future disasters and (ii) build individual, community and institutional resilience to natural hazards while fostering equitable, inclusive and participatory reconstruction that builds back better. Ecological safeguards and standards would be built into the structures that will be constructed to equip new and restored assets to better withstand the onslaught of floods and other natural hazards in the future. The RKDPP also emphasizes the necessity to improve sectoral mainstreaming of disaster risk reduction measures and strengthen disaster risk management capabilities across the state machinery. The aim is to rebuild a resilient Kerala, wherein state institutions, infrastructure, citizens and their livelihoods are safely protected from extreme weather events.

Mandate

The RKI will act as the coordinating entity for Kerala's reconstruction efforts to bring about a perceptible change in the lives and livelihoods of its citizens by adopting higher standards of infrastructure for recovery and reconstruction, and by building ecological and technical safeguards so that the restructured assets could better withstand floods in the future.[10] In this regard, the RKI's primary mandate is to develop, coordinate and implement the RKDP.

Key responsibilities of RKI would include:

1. Developing and coordinating the implementation of the RKDP;
2. Facilitating transformative policy and institutional shifts and critical programme investments that address the fundamental drivers of floods and other natural disaster and better prepare Kerala for future disasters and climate change risks;
3. Mobilizing public, private and community-based resources for the implementation of the RKDP;
4. Supporting Government departments and agencies in effecting agreed policy and institutional changes, project preparation and implementation and, in select cases, directly undertake activities and projects that are critical for recovery and resilience;
5. Entering into and enabling partnerships with nongovernmental and civil society entities, development partners, financing partners, the private sector, academia and thinktanks for the implementation of the RKDP;
6. Ensuring an inclusive, participatory and consultative process of implementation of the RKDP;
7. Undertaking M&E and conducting performance review of RKDP; and
8. Reporting to the High-level Empowered Committee (HLEC), the Advisory Council, the Chief Minister and the Council of Ministers on all matters pertaining to the RKDP, including Programme progress and results on a regular basis.

2.5 A Unique Approach to Rebuilding

The RKDP through RKI will adopt a multi-hazard, multi-sectoral programmatic approach, recognizing the interdependencies between sectors and aim to enhance institutional and regulatory capacity for resilient recovery. This holistic approach will allow the programme to maximize the programme's goals, as it will be able to incrementally take advantage of the gains in one sector to support the opportunity of progress in other sectors. In addition to the ability to capitalize on potential mutual gain between sectoral interventions, such a programmatic approach will respond more holistically, minimize redundancies and increase opportunities to ingrain resilience across the system.

Differentiated, tiered and multi-sectoral: Building resilience and reducing vulnerabilities to disaster in Kerala requires a multi-pronged approach. The RKDP through RKI is anchored in a common but differentiated approach that recognizes common vulnerabilities and threats to communities and assets from disasters and climate change but also takes into account different levels of vulnerability,

[10] Government Order; G.O.(P)No.16/2018P&EA dated November 11, 2018

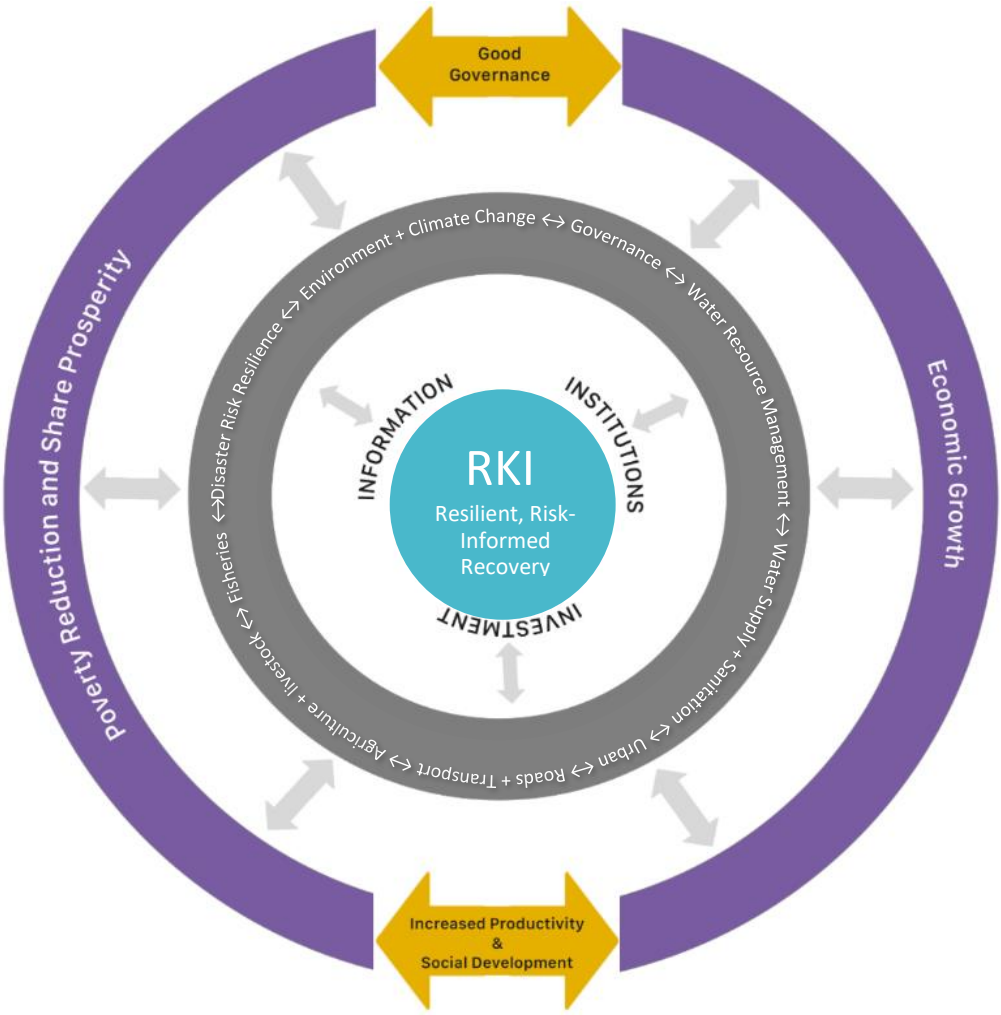
development, coping capacities across the various sectors and districts. The needs for housing reconstruction in the low-lying lands of Kuttanad area, for example, are very different from those of the high. There must be region specific menu of options including, but not limited to, norms, planning, design, implementation arrangements and enabling mechanisms. The multi-pronged approach would thus encompass (i) tiered engagement – state, district, and local level; (ii) multi-sectoral engagement – policy and institutional reforms, resilient strategies, capacity building, across the various sectors; and (iii) horizontal and vertical investments – synchronized resilience mainstreaming across departments and agencies and at State and local levels.

Systems resilience approach: Rather than sector approach, a systems approach is key to an integrated resilient recovery programme. Each sector depends on other sectors for increased resilience, and while interdependencies can help to build resilience, these dependencies give rise to vulnerabilities. If one sector is resilient to a certain degree whilst being dependent on a sector that is less resilient, then the systems put in place for resilience are wasted. For e.g. flood defence failures could lead to flooding of power stations, resulting in power cuts and disruption of telecommunications. There is currently a lack of coordination of the various adaptation investments, research and other activities, both within and across sectors. There should be means to share information and best practices across sectors to enable a systems approach to resilience. Local and regional resilience platforms are needed.

Transformational shift: To achieve resilient recovery and catalyse a resilient development pathway, there is a need for a transformational shift towards policies and institutions that enable climate resilient recovery and development. The resilience deficit in Kerala that contributed to a hazard turning into a disaster is anchored in lack of adequate planning and inter-sectoral coordination, increased land vulnerability due to urbanization, unplanned development along rivers, inadequate reservoir storage and dam management, poorly maintained infrastructure, inadequate early warning systems and protocols, high density of coastal population, degrading environment combined with limited consideration of disaster risk within social and economic sectors and limited institutional capacity. There is need to adopt a suite of non-structural and structural investments to build resilience to climate change. Policy reforms are expected to lead to transformations towards climate-smart planning, skills, institutional capacity building and investments. To achieve these reforms, an incentive structure must be created providing cutting-edge information, expertise, and incremental financing to support climate and disaster resilient investments.

Programmatic approach: The RKI will help the Government develop a framework that takes a programmatic approach to identify priority sectors that are critical for rebuilding a resilient Kerala. Such a framework would enable the use of holistic recovery management. In it, the activities of government agencies, communities, and nongovernmental entities complement one another under a government-led framework. The RKI programme translates the GoK's vision for recovery, Nava Keralam, into a strategy; prioritizing actions; fine-tuning planning; and providing guidance on financing, implementing, and monitoring the recovery.

Figure 4: Programmatic Approach of Rebuild Kerala Initiative



Pooled financing: The resources would be pooled through several windows of funding: own resource mobilization including budgetary reallocations, loans and grants from multilateral and bilateral agencies, masala and diaspora bonds, contributions from the private sector and citizens, new sources of philanthropy, and reallocations from ongoing programs and projects, among others. The resources would be pooled for the greatest degree of financial sustainability.

Simplified procurement – Within Government rules, expedited models of procurement procedures would be adopted, where required, to provide a robust mechanism for the timely purchase of goods and services. RKI's mandate would include invoking and promoting use of simplified measures.

Risk management framework: The RKDP is designed with a risk management approach which ensures that the system can be updated over time as conditions change. This includes a monitoring programme to evaluate system performance over time and flexibility to make needed changes. A climate-change risk management programme will be incorporated into asset management programmes of select sectors. An

asset management system is a "strategic and systematic process of operating, maintaining, upgrading, and expanding physical asset effectively throughout their life cycle[11]". The programme endeavours to creatively aligns incentives, including the sharing of risks and rewards of new and robust design approaches to maximize life-cycle cost effectiveness.

2.6 Key Principles of Resilience

A resilient rebuilding and development pathway, as envisaged by RKDP, would require applying the following key principles of resilience, especially in the affected infrastructure sectors, as per international best practices:[12]

- **Flexible, adaptive engineering.** While modelling and vulnerability assessment can provide some insights, it is not possible to predict every potential condition for future infrastructure and systems. Hence, anticipating a range of possible future conditions, designs should be flexible. Flexible design includes the ability to change size and/or functions in the future. Flexible designs would also include redundant systems to protect against failures.[13]
- **Stronger standards for design and implementation.** Engineering standards will need to be revised to account for the hazard risks and future climatic conditions. The development of engineering standards can follow a risk management approach and balance the potential consequences of failure with the cost of risk reduction measures.
- **Apply risk management methods and tools***:* Risk informed planning should incorporate risk management methods and tools to help identify, assess and prioritize options to reduce vulnerability to potential environmental, social and economic implications of climate change.
- **Adopt integrated approaches:** Adaptation should be incorporated into core policies, planning, practices and programs whenever possible.
- **Prioritize the most vulnerable:** Adaptation plans should prioritize helping people, places and infrastructure that are most vulnerable to climate impacts and be designed and implemented with meaningful involvement from all parts of society.
- **Build strong partnerships**: Coordination across multiple sectors and scales is critical and should build on the existing efforts and knowledge of a wide range of public and private stakeholders.
- **Apply ecosystem-based approaches:** Resilient recovery and development should, where relevant, take into account strategies to increase ecosystem resilience and protect critical ecosystem services, thereby minimizing vulnerability of human and natural systems to climate change.
- **Maximize mutual benefits:** Where possible, use strategies that complement or directly support other related climate or environmental initiatives, such an effort to improve disaster preparedness, promote sustainable resource management and reduce greenhouse gas emissions, including the development of cost-effective technologies.

[11] Federal Highway Administration (FHWA), (2012). *Transportation Asset Management Guide: A Focus on Implementation*. http://www.fhwa.dot.gov/asset/hif10023.pdf.

[12] White House (2011). "Federal Actions for a Climate Resilient Nation; Progress Report of the Interagency Climate Change Adaptation Task Force"

[13] De Neufville, Richard, and Stefan Scholtes, (2011). *Flexibility in engineering design*. The MIT Press, Cambridge, MA.

Rebuild Kerala Development Programme aims to achieve resilient recovery and development in critical sectors like roads, water resources management, with differentiated vulnerabilities in the hinterland and coastal areas. The high intensity rainfall in 2018, ranging from 50 – 500-year return period shows the wide range of intense precipitation sectors may need to be prepared for.

2.7 'Rebuild Kerala Initiative' Core Guiding Principles[14]

Planning and implementing the various projects under RKI would be guided by eight core principles - (i) Fast, Efficient, and Inclusive (ii) improving resilience (iii) build-back-better philosophy (iv) Innovative and Modern Technologies (v) Fair and Equitable Rehabilitation Practices (vi) Capacity building (vii) Building Asset Management Frameworks (viii) Simplification of processes and procedures

Fast, efficient and inclusive, covering vulnerable populations: Reconstruction needs to be strong, so that assets and livelihoods become less vulnerable to future shocks; efficient, so that both men and women can get back to their normal life fast; and inclusive, so that all citizens, including members of disadvantaged communities such as women, the elderly, PWDs, the Scheduled Castes and Scheduled Tribes, migrant workers and fisher folk, participate fully in the efforts and are not left behind in any way.

Women bear a disproportionate burden of losses in natural disasters. Often, they are at the forefront of a disaster looking after the elderly, children and animals and assisting in rescue efforts. This risk is aggravated in Kerala because many households are headed by women, with their husbands working as migrants in foreign shores. To integrate women's needs and their knowledge as resilience champions, it will be ensured that the Resilient Recovery Plan being developed by the GoK is gender informed and specific needs of women for shelter, safety, sanitation etc. in times of disasters are addressed in these plans. The last mile connectivity of information about disasters for the women residing in hard to reach areas will also be ensured. The sectoral engagements will also focus on integrating gender concerns (e.g. ensuring that there is last mile delivery of drinking water supply, so women are not burdened with fetching water; collecting gender disaggregated data for all programme beneficiaries and so on). To ensure that women's interests are effectively addressed by the LSGIs, capacity building of the office bearers in the Panchayats, including women and men will also be taken up in RKI.

In addition to women, the RKI will also focus on addressing the concerns of other vulnerable groups such as the elderly, people with disabilities (PWDs), Scheduled Castes (SCs), Scheduled Tribes (STs), the fisherfolk, and migrants who come from other states. The elderly and PWDs are at greater risk of being affected by natural disasters because early warning systems are not always able to reach them on time. Similarly, while there were a number of State Government schemes to ensure relief to migrant workers during the 2018 floods, several of them were unable to access such schemes because of lack of access to information, loss of identity cards in the floods, and lack of social support. The concerns of these groups will have to be addressed in recovery plans going forward. The fisherfolk, the 'heroes' in the 2018 rescue efforts, face the maximum risk to natural disasters as they live in hazardous conditions in coastal areas. They are highly vulnerable to losing their assets such as boats, and their livelihood with a depleting fish stock when aquaculture farms overflow. Similarly, the 2018 floods have been particularly disastrous for the ST families living in highland areas of Wayanad and Idduki where landslides caused extensive damage to plantations and paddy fields. Through an inclusive process, tribal communities can be integral to resilience planning in vulnerable areas given their deep relationship with forests and natural resources.

[14] From the GO

Improving resilience: RKI will focus on building assets that are more resilient to natural calamities like floods. Approaches in this direction will comprise of elevating flood-prone road sections, drainage improvement, slope stabilization, landslide protection, and bio-engineering techniques. Incorporating cost-effective disaster-resilient principles will improve the long-term sustainability of the reconstructed critical public infrastructure. The efforts under RKI for rehabilitation will be based upon structural assessments, geological and hydrological surveys, and a range of improved technical measures. Modifications to current designs and structures will be encouraged if these will lead to enhanced resilience and durability. Efforts will be made to use methodologies based on organic architecture to foster harmony between the human habitation being settled and the natural world.

Build-back-better philosophy: The RKDP will adopt a 'build-back-better' approach, backed by sound engineering designs, adequate drainage, and greening approaches to enhance resilience. Build-back-better principles will, in general, include improved designs, sizing, siting, and orientation, with due recognition of affordability and technical viability constraints. Where relevant, poor existing geometrics of roads and canals must be improved, and new / additional cross-drainage structures as well as arrangements for surface drainage and wider waterways at selected vulnerable locations must be provided.

Innovative and modern technologies: The RKDP should be used as an opportunity to adopt or switch to practices that are more efficient, less resource intensive and more environment friendly. For instance, road rehabilitation should choose between a variety of pavement designs. RKI will have to weigh between several available options in a range of alternative surfacing and paving technologies based upon availability of local resources, geography (flood and landslide risk, steep terrain) and traffic volumes. Some of these options may have a higher initial investment cost, but over the whole life cycle of the road, they will prove more durable and will need less maintenance and repair. Resilience will be potentially improved through innovative technologies, which will extend road durability and reduce life cycle costs.

Adoption of new technologies shall be a key driver of the process and this will ensure that the new projects undertaken are state-of-the-art. The implementation of smart technologies in utilities, early warning systems, setting up predictive tools for disaster management, improved technology solutions for relief work, designing evacuation plans etc. will improve the overall responsiveness of the State to tackle any such disaster in future and improve the efficiency of delivery of civic services during such catastrophes.

Specific focus should be given for building vast depositories of data both local, regional relating to weather, rainwater analysis, soil data for designing robust and sustainable systems for disaster management. Use of data analytics in systems planning and implementation and induction of modern technologies (e.g. IoT) will be a common thread in the establishing improved disaster management and surveillance mechanisms.

Fair and equitable rehabilitation practices: Resettlement and Rehabilitation plans should be based on the best and fair practices. In each case where resettlement/rehabilitation must be done, a Resettlement & Rehabilitation Plan must be drawn up for the Project Affected People (PAP) and the Project Affected Household (PAH) after assessing the category of impacts together with socioeconomic conditions on the PAP and PAH, and host communities, estimated cost of resettlement and draw up a time-bound action plan for implementation.

Capacity building: Durability and resilience can be increased only if technical and operational capacity of implementing agencies is adequate. Under RKI, planned programmes will be undertaken to enhance capacity of institutions and agencies under Government through training and support of technical laboratories and quality control, based on adoption of international good practice.

Building asset maintenance frameworks: Ensuring the sustainability of public investment through sound public asset maintenance practice is challenging across countries. Road maintenance is a common challenge for most governments because of limited resources. The possibility of creating local responsibility for asset maintenance, by adopting a community-based approach to routine maintenance of public assets which has been successfully implemented in other countries, will be explored.

Simplification of processes and procedures: A rebuilding exercise of this magnitude requires nimbleness in decision making. At the same checks and balances are to be in place to ensure transparency and prudence in spending. The clearances and permissions that are required for the project may be given at the appropriate levels as explained in the institutional arrangements discussed below in this proposal. Improved practices may be incorporated into the procurement guidelines in RKI. Reconstruction of infrastructure systems, consequent to disasters and post war like situations needs strategies different from conventional public work execution methodologies. In such circumstances, it may be difficult to wait for the completion of entire planning and design for initiating the actual construction activities considering the limited time frame available for completion of such projects. Mode of procurement and contracting systems are also to be suitably modified to meet the specific requirements like faster construction, least disturbance to the damaged environment, and efficient utilisation of natural resources, while ensuring transparency and efficiency.

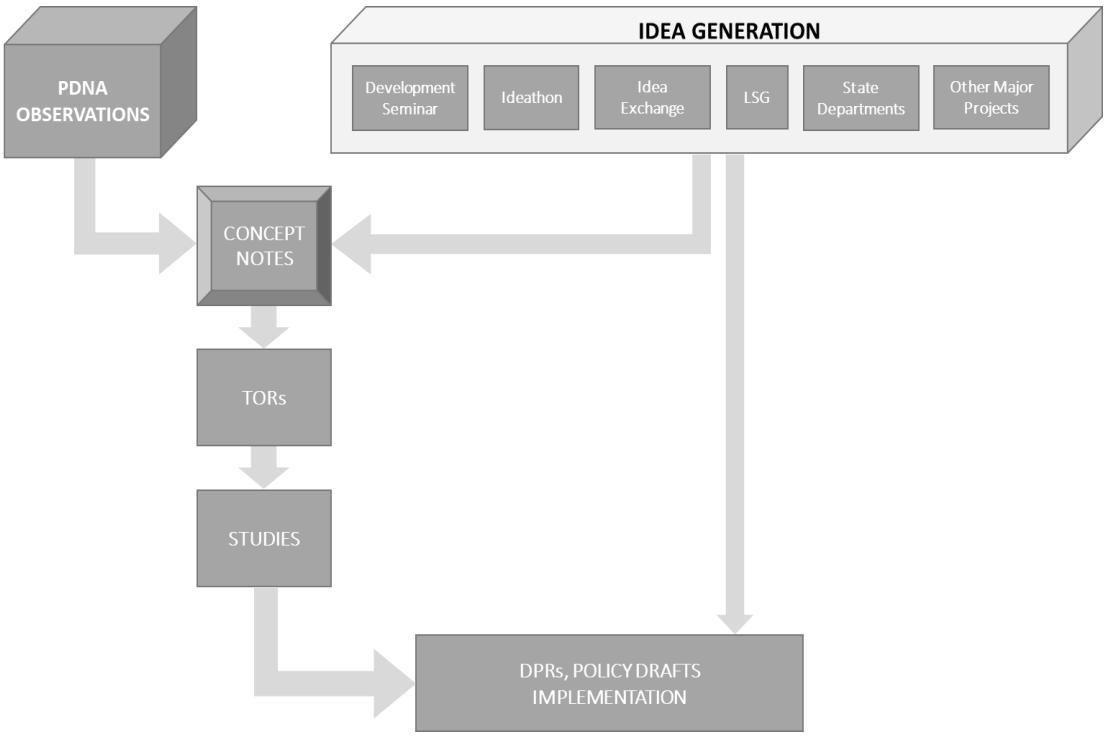
Integrated Concurrent Engineering (ICE) and Execution methodologies as being followed by EPC organizations are among various options to meet the above objective. The agencies awarded with such works shall be permitted to adopt techniques and methodologies in planning and design based on acceptable national/international standards /specifications suited to Kerala conditions. They may choose appropriate designs, technologies and practices from basket of acceptable options (which may be short listed with the help of experts in related fields).

Eventually as the RKI progresses, good models will evolve and be a legacy for improving the process of governance specially for infrastructure construction and disaster management. Processes and Procedures which have been tried out successfully under RKI can be subsequently incorporated into Government practices, rules and procedures.

2.8 Structure, Framework, and Process

In addition to its core guiding principles and approaches, the inclusion of projects under RKDP would done after considering the ideas, suggestions and proposals from the widest possible spectrum of stakeholders. Stakeholders will be diverse in composition, capacity and responsiveness – and may range from persons who have a promising idea to those who might even have fully or partially developed project proposals. So also, such ideas or proposals can emanate from individuals to institutions. The success of RKDP will substantially hinge on how well it can accommodate and reflect the true aspirations of all stakeholders in its design. To achieve the above objective, the following process of collecting and developing ideas are envisaged under RKI.

Figure 5: Process for idea generation under Rebuild Kerala Initiative



Development seminars: Development Seminars with the support of print and electronic media groups at regional and sub-regional levels will be organized. Members of Parliament and Members of Legislative Assemblies of the affected districts would play a significant role in fostering meaningful discussions for generating ideas. The feasibility of translating ideas that emerge from these seminars into projects will be thoroughly examined by the RKI Secretariat with the help of experts in the field. These will be then worked on to develop full-fledged projects. Where an idea looks promising but cannot be converted into a project directly, a feasibility study may have to first be undertaken to establish the workability of the idea itself.

Idea generation: Focused hackathons conducted on specific themes and on possible rebuild ideas will be held. This approach would more specifically focus on tapping the suggestions from the non-resident population of the State.

Idea exchanges: Colleges and schools will be encouraged to work on college/school level projects for their ideas on rebuilding the locality or region in which the institution is located.

Identification by LSGs: The District Panchayats and Municipal Corporations will formulate two or three major infrastructure investments addressing regional issues for inclusion in RKI viz. those whose scope extends beyond one or very few LSGs.

Identification by Government Department: Departments like PWD, Irrigation, Water Authority will be invited to submit critical proposals that go beyond the scope of their annual budget operations but which in their opinion will have significant beneficial impact for the State in the future in terms of improving resilience of regions likely to be affected by floods.

Major infrastructure projects: Primarily driven by a project proponent (could be a sponsor, company, regional groups etc.) these would be iconic projects or large projects with well-marked boundaries that are viable on its own revenue streams or could be made economically viable through a gap funding by Government which is not excessive in relation to the total project size.

Online platforms: Necessary online platforms for the purpose viz. conducting hackathons, hosting idea exchange platform, uploading project proposals, processing and issuing sanctions will be developed and commissioned without delay.

Stakeholder acceptance: A system of e-polling will be introduced to ascertain user acceptance of tested solutions as part of this online platform. All the project profiles of RKI will be uploaded in the online portal for a week to a fortnight for gathering views of stakeholders, prior to placing before the Advisory Council and the Council of Ministers for approval. Stakeholders' acceptance of the projects listed in the portal will be elicited to give the selection more validity and robustness.

2.9 Regions and Sectors Addressed

The RKI has a comprehensive scope of engagement, including key sectors affected by the August 2018 floods, and assessed in the PDNA viz. Housing, Land, and Settlements, Roads, other public transport, water supply, water resources, sanitation, sewerage, urban waste, agriculture and fisheries, health and nutrition, education, cultural heritage, and cross cutting sectors - disaster risk management, Environment, livelihoods, gender equality and social inclusion, local governance.

Geographical scope: all 14 districts (with special emphasis on the worst affected - Alappuzha, Ernakulam, Idukki, Kottayam, Pathanamthitha, Thrissur and Wayanad.

Sectoral Scope: Cross-cutting sectors – Disaster Risk Management, Climate Change, Environment, Governance. Critical sectors: Water Supply and Sanitation, Integrated Water Resource Management, Urban, Roads and bridges, other Transportation, Forestry, Agriculture, Livelihood, Animal Husbandry and Dairy, Fisheries and Land.

Temporal scope: RKI will be a multi-sector programme involving several government departments and agencies over a period of five years. In the medium-term, interventions aim at rebuilding shelter, infrastructure, and livelihoods; and in the long-term interventions work toward building government capacities and reducing the risk of future disasters. The majority of medium-term recovery and reconstruction measures are expected to be completed within two to three years. Given the multi-agency, inter-disciplinary nature of the reforms, long-term interventions could take more than five years. For further detail on the short, medium, and long-term interventions please refer to the sector specific concept notes under Chapter 3 'Cross-cutting Foundational Elements' and Chapter 4 'Critical Sector Priorities'.

Chapter 3: Cross-cutting Foundational Elements under RKDP

The unprecedented flood event highlighted some challenges that are cross-sectoral in nature. These common priorities are ingrained across all interventions of the RKDP and especially within the various key sectors in Chapter 4. Therefore, they take on the role of foundational elements, requiring special attention. Additionally, interventions to improve the elements discussed in this chapter all require cross-sectoral coordination and collaboration across central, regional and local levels of the Government; another reason why they are treated differently from the key sectors in the following Chapter 4. Besides comprehensively responding to the driver of the floods, this multi-sectoral nature affords the great ability to maximize the programme's goals, through capitalizing on potential mutual gain between sectoral interventions. The cross-cutting overarching themes in RKDP discussed in this chapter are Disaster Risk Management and Resilience, Environment and Climate Change, Strengthening Institutional Efficiency and Resilience and Open Data.

3.1 Disaster Risk Management and Resilience

3.1.1 Introduction

Following the devastating floods and landslides in August 2018, the PDNA was carried out by the Government of Kerala jointly with United Nations, World Bank, Asian Development Bank and European Union. The assessment team held consultations with the relevant departments, district administrations, panchayats and various other stakeholders. The assessment covers a review of the existing disaster management system in the State covering all phases of the disaster management continuum—preparedness, response, relief, mitigation, and prevention. The vision set out for *Nava Keralam* is to ensure zero mortality due to disasters with minimum economic losses and disruption of services. To achieve it, the principles of risk-informed programming will be embedded across all the sector recovery plans with additional investments for disaster preparedness and response. The DRR sector accounted for Rs. 16.5 crore in damages and Rs. 582.52 crore in losses, that is, a net value of Rs. 599 crore due to floods of 2018. The estimated recovery cost is Rs. 109.7 crore[15].

3.1.2 Immediate Recovery Efforts

An amount of Rs. 1,501 crore has been allocated under various heads, out of which Rs. 1,007 crore has been spent from the State Disaster Response Fund (SDRF). The State Disaster Management Authority (SDMA) has acquired the technology of 'Location-Based Messaging System' to disseminate information on localized tragedy prediction. Measures to renew the state and district disaster management programs have already started. The hotspots that are vulnerable to disaster and prone to landslides, but had residential construction before the flood, are mapped with the help of Geological Survey of India to prevent housing development in those regions. In order to provide information for future reference, the government has ordered all government and public sector enterprises, affected by floods, to mark the maximum height of the water level reached in the recent flood. The Centre for Water Resources Development and Management (CWRDM), Kerala Forest Research Institute, MG University and Kerala

[15] Kerala 2018 Floods PDNA

State Remote Sensing and Environment Centre have been entrusted to provide accurate map of flood affected areas including information on height of flood water. A mobile app was developed to ensure people participation in the process. Information collected in this regard has been given to the Central Water Commission to produce and accurate map.

3.1.3 Hazard Profile of Kerala

Kerala is highly vulnerable to multiple natural and anthropogenic hazards and a changing climate, given its mountainous topography and geo-hydrological features. Communities regularly face low-severity but high-frequency disasters such as floods, rains, landslides, heat wave, lightning and thunderstorms. More broadly, the State is prone to cyclones, storm surge, coastal erosion, tsunami, drought, soil piping and earthquake. Kerala is also one of the most densely populated Indian states (860 persons per square kilometer) which makes it even more vulnerable to damages and losses because of disasters. Floods are the most common of natural hazards that affects the State. As per the State Disaster Management Plan 2016 of Kerala, 5642.68 km^2 or 14.52% of the total area of the State is prone to floods. In Alappuzha district more than 50 % of area is identified as flood prone.[16] The State lies in seismic zone III which corresponds to Moderate Damage Risk Zone (MSK VII). The State falls under Moderate Damage Risk Zone for Wind and Cyclone (Vb=39 m/s). As per IMD data for the period 1877-2005, the State witnessed six cyclonic storms and five severe cyclonic storms. The State also witnesses high incidence of lightning, especially in the months of April, May, October and November. Lightning strikes cause heavy loss of lives in the State.

Landslides are a major hazard along the Western Ghats in Wayanad, Kozhikode, Idukki and Kottayam districts (as seen in the weather led disaster that occurred in 2018). The western flank of the Western Ghats covering the eastern part of Kerala is one of the major landslide prone areas of the country. 1500 sq.km. in the Western Ghats is vulnerable and every year with the onset of monsoon, landslides are reported. The mountain regions experience several landslides during the monsoon season (Kuriakose, 2010) leading to road collapse, silting of river beds and creating heavy damages on public and private assets. The coastline is prone to erosion, monsoon storm surges and sea level rise. Land subsidence due to tunnel erosion or soil piping is a slow hazard that has recently been affecting hilly areas.

Kerala experienced 66 drought years between 1881 and 2000. More than 50 % of Kerala's land area is susceptible to moderately-to-severe drought. After the drought years of 2002-2004, 2010, and 2012, Kerala State was officially mapped as mild to moderately arid by the Indian Meteorological Department (IMD). In 2017, the IMD stated that the year brought the worst drought in 115 years. Increasing incidence of drought is mainly due to weather anomalies, change in land use, traditional practices and lifestyle of people. Other natural hazards faced by the states include forest fires, swell waves and tsunami. In 2019, heat waves were declared as a state specific disaster in the State.

3.1.4 Key Drivers of Kerala's Disaster Vulnerability

3.1.4.1 *Multi-sectoral drivers*

The impact of heavy rainfall and associated floods in August 2018 was exacerbated by a number of factors. These include changes in land use and cover, antecedent hydrologic conditions, reservoir storage and operations, encroachment of flood plains, poor agriculture practices adversely impacting downstream

[16] Kerala State Disaster Management Plan

riverine ecosystems, shrinkage of carrying capacity of lakes and rivers, inadequate early warning and protocols, lower community preparedness, partial activation of disaster response SOPs etc.[17].

In addition to the direct factors, there were several underlying multi-sector issues that contributed to the heavy impact of floods and have exacerbated the vulnerability of state to disasters. These include unsustainable and inadequate management of natural resources, climate change. limited/ restricted/restrained dissemination of disaster risk information, lack of awareness of disaster risks, inadequate capacity to deal with high intensity disasters, degrading environment due to extensive exploitation of the natural resources and deforestation, and slow roll out of community-based disaster risk management (DRM) activities. Some of the key factors contributing to the vulnerability to disasters are:

1. **Deteriorating infrastructure and encroachments:** Deteriorating, aging and poorly maintained infrastructure including irrigation channels, minor major and irrigation dams, eroding river embankments, roads, bridges, have accentuated the disaster risks. Encroachments into water bodies and sand mining from rivers, water channels and canals, leading to narrowing carriage capacity of these water channels, poor or nil solid waste management and sanitation disposal /treatment facilities have also contributed to the State's increasing vulnerability to natural hazards.
2. **Poor land use planning:** Current land use pattern and practices in the State have also contributed to the increase in disaster risk. Changes in land use and cover also affected the hydrological conditions, which, in turn can affect flood peaks and inundation. On the policy side, land use regulations are spread across multiple, incongruent legislations, orders and rules. Lack of streamlined and singular land management Act/policy/regulation and weak enforcement has led to an overlap of business and habitation zones and establishment of associated public infrastructure. This is further compounded by high population density of 860 people/km^2 (2011 Census), narrow, dense and intrinsic road network, dense coastal populations and general higher standard of living of the public as compared to the rest of the country.
3. **Unplanned urbanisation:** The widespread flooding in urban and semi-urban areas of Kerala has reaffirmed absence of risk-informed urban planning, non-compliance to design standards, and non-incorporation of resilient features in urban infrastructure. Rapid urbanization influenced habitations into uncontrolled expansion on both banks of the rivers/water bodies thereby encroaching into water channels/bodies and constricting the floodplains. Inadequate storm water drainage and silting of minor storage ponds and flood plains in urban and urban sprawl areas have increased flood risks. Only 1/3rd of Urban Local Bodies (ULB) have approved master plans and there is very little evidence of hazard risk informed planning process in the State.
4. **Climate change:** During June 1st to August 18, 2018 the State received cumulative rainfall that was 42% in excess of normal average rainfall. Extreme precipitation and runoff conditions that caused the 2018 flooding were unprecedented. However, despite the significant warming observed between 1951 - 2017, the mean and extreme precipitation and total runoff have not increased and hence

[17] Kerala 2018 Floods PDNA

attributing 2018 floods in Kerala to climate change can be difficult[18]. The 2018 floods are more likely to be driven by anomalous atmospheric conditions due to climate variability than anthropogenic climate warming. The frequency of precipitation extremes is projected to rise more prominently in southern and central India in the mid and end of the 21st century under the representative concentration pathway (RCP) 8.5.[19] (Mukherjee et al., 2018). Extreme rainfall at 1-15 days duration in August 2018 in the catchments upstream 15 of the three major reservoirs (Idukki, Kakki, and Periyar) had the return period of more than 500 years. In January 2019, the State, for first time witnessed sub-zero temperatures in the hilly areas of Idukki, Munnar and Wayanad, for over 4 days leading to frost and formation of snow in many areas. The State has also had its share of droughts with critical droughts in the years of 2013, and winters of 2017. Lack of adaptive capacity of the State to floods, droughts, and mudflows, that are expected to increase in both frequency and severity because of climate change, could worsen their impact. Another impact being witnessed is progressive coastal erosion affecting nearly 63% of the State's 580 km coastline[20].

5. **Other factors**: Some of the other factors that have increased the vulnerability of the population in the State to disasters include - coastal erosion, land subsidence due to tunnel erosion or soil piping and unsustainable exploitation of natural resources These factors, combined with limited consideration of disaster risk within social and economic sectors, partly because of competing demands on limited financial resources and inadequate capacity, underpin the high disaster risk levels in Kerala.

3.1.4.2 *Challenges specific to the DRM sector*

The increasing vulnerabilities due to a variety of factors such as rapid urbanization, environmental degradation, growing population and climate change compounded the disaster risks in the State and this mandated a paradigm shift from a relief centric approach to a proactive and comprehensive mindset towards disaster management covering all aspects from prevention, mitigation, preparedness to response and recovery[21].

1. **Response-oriented disaster risk management:** The existing disaster management system in the State is largely response-centric. The disaster management plans prepared at the state and district levels provide a lot of information on hazards but are weak in vulnerability and capacity assessment. The plans are also weak on mitigation and do not provide strategies for mainstreaming disaster risk reduction (DRR) across key sectors. Although the SDMP has mandated departments to allocate 10% of their budget for integrating DRR in their sectors, no such allocation has happened in practice.
2. **Inadequate risk information mechanisms**: The collection and availability of disaster risk information, including hydro-meteorological data, is limited and scattered across multiple agencies, which, is often not shared between agencies. This reduces the scope of terrain, weather and hydrology and disaster risk informed planning. For example, there are 422 meteorological stations managed by 16 agencies

[18] Mishra V, Shah H: Hydro climatological Perspective of the Kerala Flood 2018, Journal of Geological Society of India, Volume 92, Issue 5, 511-650, doi:10.1007/s12594-0018-1079-3

[19] Mukherjee, S., Aadhar, S., Stone, D. and Mishra, V.: Increase in extreme precipitation events under anthropogenic warming
in India, Weather Climate. Extreme., 20(July 2017), 45–53, doi: 10.1016/j.wace.2018.03.005, 2018.

[20] Shoreline Change Assessment of Kerala, National Centre for Sustainable Coastal Management, Kerala, June 2018

[21] Kerala State Disaster Management Plan Profile, KSDMA

comprising of various research institutes, weather monitoring institutions both government and private, commercial entities, and state line departments. River morphological studies and related data is now out dated, and custodians of this data are reluctant to share the same. Data from 143 river gauges, 422 meteorological, and 7 observatory stations are not even automated. Kerala has failed to ensemble these data into a single platform to routinely monitor and provide accurate forecasts and flood warnings. The underlying issue is the prevalent protocol of information sharing is subjected to receipt of forecast data from a single source – Indian Meteorological Department (IMD), leading to lower scale of accuracies, and shorter lead time to undertake emergency response measures. Inadequate regulatory arrangements with non-IMD weather data sources prevent the State from utilizing multi-model super-ensemble forecasting, which can significantly reduce errors in model output and provide more accurate forecasting.

Further, data captured by different agencies are not systematically analysed and shared with the line departments to factor the same into planning and investment decisions. The KSDMA, in the KSDMP profile stipulates plans to add medium and long term structural and non-structural prevention and mitigation plans based on micro-level, hazard, vulnerability and risk analysis. However, this analysis is yet to be undertaken. There is a need to ensure free flow of information to and from all relevant entities to facilitate their systematic planning and investments, enforcement of DRR regulations, monitor implementation and compliance of DRM measures. The State should consider options to develop a data analyzing and clearing house function in the State, preferably under the Kerala Spatial Data Infrastructure (KSDI).

The State Disaster Management Plan stipulates restrictions in hazard zones and has laid checklists for risk assessment, to be followed by the implementing department prior to approving any infrastructure development projects. However, there's sub-optimal application of risk-information by agencies, partly due to unavailability of downscaled multi-hazard vulnerability maps (up to 1:5000).

3. **Legal and policy framework for disaster risk management**: The Kerala State Disaster Management Authority (KSDMA) established under the Disaster Management Act 2005 (Central Act 53 of 2005), in the aftermath of December 2004 Indian Ocean Tsunami, identifies disaster risks as one of the main challenges to Kerala's development aspirations. Although prevention is clearly articulated as a role to be performed by the KSDMA, its facilitating role in pre-disaster risk management and its relationship with sector departments and other related agencies, are not clearly articulated and enforced. The Kerala State Disaster Management Policy of 2010 needs an urgent relook to fit to the newly emerged disaster risks.
4. **Weak Coordination between the institutions:** Due to the interdisciplinary nature of DRM, multiple government agencies and departments deal with DRM directly or indirectly. The KSDMA is responsible for both risk monitoring, developing and recommending mitigation/DRR measures and providing early warning. However, weather forecasting is done by the IMD, the Central Water Commission (CWC) is responsible for water level in rivers and reservoirs~~,~~ Minister of Earth Sciences for monitoring earthquakes, amongst others, without an integrated system linking them to KSDMA. Under the existing governance structure, KSDMA and DDMAs are placed to support DRM across various government departments and agencies in the State through its coordination and facilitation mandate. However, to play its role in DRM, protocols for relationships and links between the KSDMA and other agencies that produce and analyse DRM related data and information, the sector departments and

agencies, need to be developed with clearly defined roles for each institution. Risk governance, capacity, and funding limitations indicate that DRM mainstreaming efforts have not been fully embedded in core sector activities in the State.

5. **Inadequate disaster risk financing mechanism:** Current system is characterized mostly by ex-post financing mechanisms (*e.g*., budget reallocations) rather than ex ante (*e.g*. insurance of public assets, market-based risk transfer etc.). The State draws its finances for DRM activities from Government of India, and multilateral financing institutions like ADB and World Bank which are largely focused on pre and post-disaster response activities and related policy support.

   The Disaster Management Act, 2005 provides an enabling environment for the creation/establishment of disaster risk funds– a) disaster response fund and, b) disaster mitigation fund at the National, State, and District-level[22]. Presently only the National and State Disaster Response Funds (NDRF and SDRF) are constituted and these funds are primarily aimed at financing expenses for emergency response, relief and rehabilitation only. Both NDRF and SDRF cannot be used for financing either mitigation and/or post-disaster reconstruction activities. Strong financial management of disaster risks supports –

a) **Disaster Risk Management:** By putting a 'price' on the risk, disaster risk finance & insurance (DRFI) provides cost-benefit trade-offs in investment in climate and disaster risk reduction, risk retention, and risk transfer and ensures that the government is financially prepared to enact a swift post-disaster response and reconstruction; and

b) **Public Financial Management:** By strengthening fiscal risk and public debt management agendas helps the government to identify, clarify, and manage its contingent liability to disasters, and to ensure that disasters do not negatively impact the debt profile and budget objectives for a country's development.

3.1.5 Proposed Transformational Approach for Rebuilding Resilient Kerala

3.1.5.1 *Disaster risk management as a cross-cutting theme*

In order to achieve resilient recovery and development of Kerala, mainstreaming disaster risk reduction and resilience across sectors is key. Resilience is required in all sectors to protect against cascade failure and to adapt the infrastructure against a slowly changing climate over the longer term. The August 2018 floods had a multi-sectoral impact, not just within sectors but also among. The floods highlighted the interdependencies among various sectors and the 'cascade failure' where the failure of one aspect of infrastructure, such as flood defences and reservoir, can lead to other failures, submerged roads, damaged power infrastructure, leading to power cuts which thereby affect telecommunications networks. The interdependencies in sectors therefore need to be managed well, especially as infrastructure is becoming more interdependent. Mainstreaming resilience across sectors is a systems issue, requiring collaboration, planning and sharing of information between sectors, anchored in the Rebuild Kerala Development Programme.

[22] National Disaster Response Fund (NDRF), State Disaster Response Fund (SDRF), District Disaster Response Fund (DDRF), and National Disaster Mitigation Fund (NDFM), State Disaster Mitigation Fund (SDMF), District Disaster Mitigation Fund (DDMF).

The RKDP takes a systems approach, rather than sector approach, to prepare for next extreme event and adapt to climate change. Resilience in one sector is dependent on resilience in another, so modelling infrastructure systems and scenario planning is essential to ensure that vulnerabilities in one sector do not compromise others. Sharing of data and collaboration across the supply chain will be requisite for such systems-level planning. System oriented resilient recovery and development requires medium-long term planning for adapting and maintaining infrastructure and mainstreaming of resilience in regulatory and policy framework. Regulations and design standards across sectors need to be revised to reflect the multi-hazard exposure, vulnerability and uncertainty due to climate change. Regulation must also be adapted to allow greater information sharing and collaboration across the supply chain to facilitate Kerala's resilient recovery and development as a whole.

In the aftermath of the floods, both structural and non-structural measures need to be undertaken to build resilience and build-back-better. Across sectors like water, roads, transport, infrastructure designs and plans, as well as institutions, regulations and standards need to be adapted and even be adaptable to accommodate a range of future climate conditions. Changes in land cover and use, resource availability and demographics in population will require flexibility in infrastructure location and design. RKDP's multi-sectoral risk-informed recovery and development planning is anchored in the following key questions:

1. What can happen? (i.e., what can go wrong?)
2. Why did it happen?
3. How likely is it to happen?
4. What can be done to prevent the happening and reduce the damages?
5. If it does happen, what are the consequences?[23]

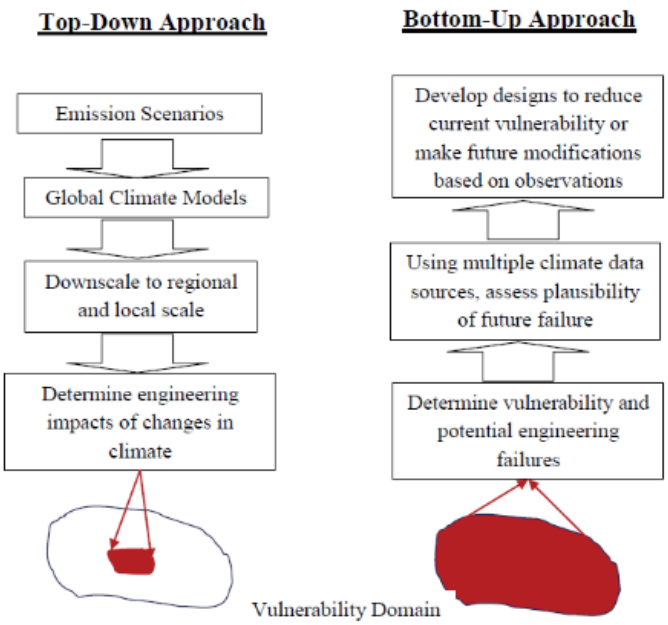
Answering these questions would require conducting comprehensive multi-hazard risk assessment, that will be key to systematically identify potential hazards, estimate its likelihood of occurrence and its consequences, using appropriate downscaling techniques. All relevant sectors would require vulnerability assessments to determine the design and planning changes required to make their infrastructure and services resilient. Depending on the level of downscaled projections available, sectors can choose to take a top-down or bottom up approach (see figure below). The bottom-up approach is more akin to traditional engineering failure analysis in that modes of failure and the consequences are first assessed. This risk *or climate-informed decision analysis*[24] *would then help* evaluate the plausibility of these conditions occurring in the future.

While conducting resilient recovery planning, sectors should consider incremental cost of additional actions, to make cost effective decisions. Disaster risk reduction and embedding resilience would require adding incremental features to reduce failure risks as long as the incremental benefits are perceived to exceed the incremental costs.

[23] Rolf Olsen, Ph.D., American Society of Civil Engineers. (2015). *Adapting infrastructure and civil engineering practice to a changing climate*. Reston, VA, Committee on Adaptation to a Changing Climate.

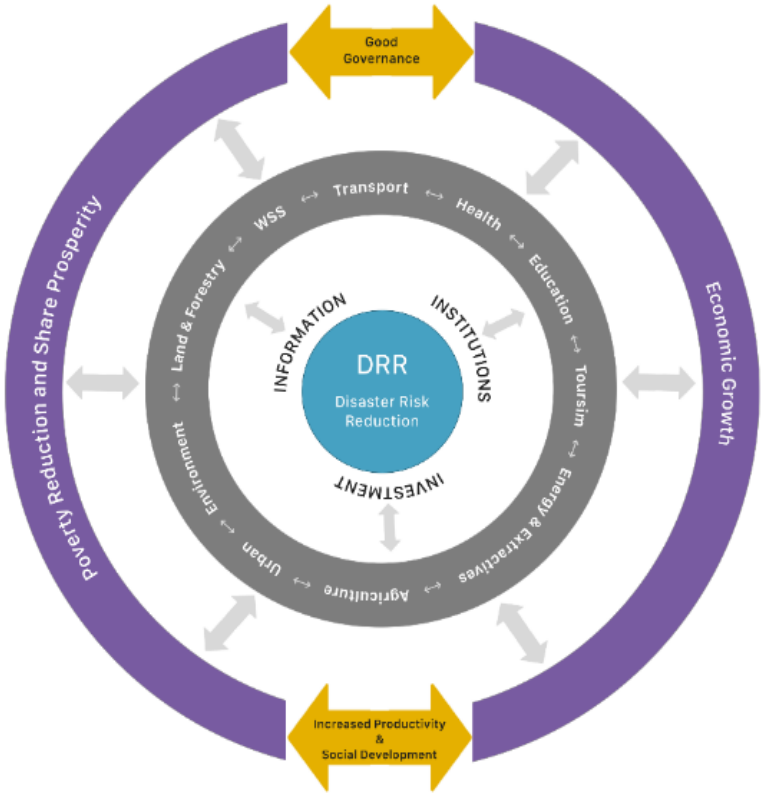
[24] Hallegatte, Stéphane, Ankur Shah, Robert Lempert, Casey Brown, and Stuart Gill. (2012). *Investment Decision Making Under Deep Uncertainty – Application to Climate Change*, World Bank Policy Research Working Paper 6193, The World Bank. Sustainable Development Network, Office of the Chief Economist.

Figure 6: Top-down versus bottom-up approach to climate proofing and adaptation



Source: Adapting Infrastructure and Civil Engineering Practice to a Changing Climate, 2015

Figure 7: An illustration of the cross-sectoral linkages and disaster risk reduction



3.1.5.2 *Sendai Framework for Disaster Risk Reduction and Sustainable Development Goals as a guiding principle*

A resilient rebuilding and development pathway, as envisaged by RKDP, will adopt the Sendai Framework for Disaster Risk Reduction 2015-2030[25] and Sustainable Development Goals as guiding principle for developing and prioritizing actions and investments. India adopted the Sendai Framework at the Third UN World Conference for Disaster Risk Reduction in March 2015. There are overlapping indicators for SFDRR and SDGs. Under the Sendai Framework, four priorities for action are identified:

1. **Understanding disaster risk:** DRM should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be used for risk assessment, prevention, mitigation, preparedness and response.
2. **Strengthening disaster risk governance to manage disaster risk**. Disaster risk governance at the national, regional and global levels is very important for prevention, mitigation, preparedness, response, recovery, and rehabilitation. It fosters collaboration and partnership. Creation and operationalization of national platforms are a critical part of this process, bringing together stakeholders with a role to play in risk reduction and management.
3. **Investing in disaster risk reduction for resilience.** Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment.
4. **Enhancing disaster preparedness for effective response and to 'Build Back Better' in recovery, rehabilitation, and reconstruction.** The growth of disaster risk means there is a need to strengthen disaster preparedness for response, act in anticipation of events, and ensure capacities are in place for effective response and recovery at all levels. The recovery, rehabilitation and reconstruction phases present a critical opportunity to build back better, including through integrating disaster risk reduction into development measures.

Besides Sendai Framework for DRR the sustainable development Goals will be taken into consideration for rebuilding a disaster resilient Kerala.

3.1.5.3 *Inclusive resilience*

As highlighted in Sendai Framework, the State will integrate gender, age, and disability considerations in policies and practices to ensure inclusive and resilient development. Disability inclusive DRR efforts will be strengthened across the State, including disability sensitive training, appropriate equipment and design and construction of infrastructure for DRR purposes. Understanding the different needs and capacities of women and men is critical to effective DRM, including enhancing women's role in building broader resilience. Efforts will be made to ensure compliance with the 15th Finance Commission's recommendations on gender budgeting in DRR through allocation of seed funds to ensure equitable facilities are made available for both men and women in relief camps and shelters. Further, to ensure gender sensitivity at grass root levels, grant in aid as part of the central allocations to the State may also be allotted to advertise gender sensitivity in disaster risk reduction, thereby augmenting State resources for LSGs. Kerala has 12.6% of senior citizens. All DRR efforts should also factor this huge population and their needs. Disability and Older Persons audit system for all the public infrastructure is recommended as part of the DRR resilience measures.

[25] https://www.unisdr.org/we/coordinate/sendai-framework

3.1.6 Specific Interventions

Kerala will prioritize *and* implement the following actions and investments using the Sendai Framework as a guiding principle and applying specific principles of resilience as described above.

Priority 1. Understanding disaster risk

- Mapping of all the existing initiatives (not specific) carried out on Hazard Vulnerability and Risk Assessment and carry out a Gap Analysis.
- Based on the identified gaps, conduct multi-hazard risk assessments using various return periods for major hazards. This will include hazard and disaster modelling, exposure database, vulnerability analyses of buildings, infrastructure, and communities, and calculation of damages. Prepare multi-hazard risk maps based on the risk assessments and stakeholder consultation workshops. The multi hazard risk assessments shall be done panchayat wise, encouraging community participation, with the aspiration to eventually culminate them into a Village disaster management plan or a GP level disaster management plan. Conducting a risk assessment at the grassroots level through community led participatory HVRA approach complemented by scientific mapping of hazards will help in identifying solution and supplement the panchayat plan through participatory risk informed planning
- Prepare landslide hazard zonation maps in a scale appropriate for planning at local level for all Municipalities and Panchayats in the Hilly areas (at least 1:5,000 scale).
- Integrate the risk maps into master plans and develop a guideline/policy document for preparation of risk-informed master plans by ULBs.
- Develop a disaster damage and Loss database (for 30 years) disaggregated at least up to district level
- Establish a sustainable disaster risk management information system to ensure free flow of information and data between departments and various portals by centrally linking to the Kerala State Spatial Data Infrastructure (KSDI).

Priority 2. Strengthening disaster risk governance

1. Mainstreaming disaster risk management into development planning

- Carry out a mapping of Institutions and Capacity Needs Assessment to perform DRR training and Research.
- Prepare/strengthen Departmental Disaster Management Plans including operational plans for all sectoral departments, inter-sectoral coordination and information sharing between departments for DRM and allocation of the annual plan budget of the respective department for investment in DRR.
- Ensure that disaster risk reduction plans in each department are drawn using a participatory approach and are sensitive to the needs of vulnerable groups such as women, the elderly, persons with disabilities, SCs, STs, fisherfolk and migrants.
- Develop Guidelines and Template for integrating DRR in Departmental Plans based on the findings of the 2015 state-level consultations on mainstreaming DRR.
- Develop mechanism for monitoring departmental plans and actions on fund allocation and DRR investment.
- Evolve a comprehensive training strategy of the Disaster Management Virtual Cadre in the State to capacitate the respective departments based on Training Needs Assessment.

- Establish dedicated disaster mitigation cells, units, or focal points in key sector departments (PWD, water, energy, transport, health, education, environment, and agriculture) under the overall guidance of KSDMA and Department of Environment and Climate Change.
- Since local self-government institutions (LSGIs) in Kerala fund and implement most programs, build capacity of office bearers in the LSGIs so they can address the interests of vulnerable groups like women, the elderly and children, especially in the wake of a disaster.

2. Resilient Design Standards and Enforcement

- Improve flood protection and design standards. Based on the multi-hazard susceptibility, plan and design for once in a 50-year river flood protection for major rivers including the canal systems and drainage systems in Urban areas. The planning will consider both existing climate and land use condition and future scenarios such as year 2040 with climate change and urbanization. Public service design standards may be upgraded to the 1 in 50-year return period flooding and landslide events (Nodal Department: Water Resources, Public Works Department, LSG Public Works Department).
- Review and amend as appropriate Kerala Municipal Building Rules and Kerala Panchayath Building Rules considering local risk patterns across the State, National Building Code and IS Codes keeping due consideration of disaster risks.
- Develop guidelines and design for climate resilient municipal infrastructure and ensure proper enforcement for all the physical construction works to improve the quality of municipal infrastructure services. (Nodal Department: Local Self Government Department, Public Works Department and Public Works Department).
- Strengthen the regulatory enforcement procedures and systems to ensure all new critical infrastructure projects comply with safe standards and specifications. Build the capacity of LSGD and PWD engineers as well as Kerala's construction industry in coordination with the Engineering Council of India. Apply third party structural and safety audits to ensure compliance. (Nodal Department: Local Self Government Department).
- Enhance resilience of settlements through a combination of incentives and disincentives to ensure that constructions comply with safety standards and consider site specific hazard susceptibilities. (Nodal Department: Department of Disaster Management, Local Self Government Department, KSDMA)

3. Strengthening of KSDMA, DDMAs and local institutions

- Strengthen the SDMA's role and resources to act as the coordinating and technical support agency for mainstreaming DRR and climate change adaptation into Kerala's development planning and move Kerala towards adaptive governance.
- Update the State and District Disaster Management Plans and emergency operation manuals based on lessons learned from the recent disasters.
- Establish and strengthen disaster management cells at LSGs for Cities and GP level.

Priority 3. Investing in disaster risk reduction for resilience

1. Mitigation Infrastructure and Measures

- Construct and amend facilities in the identified multi-purpose emergency shelters and improve access to such shelters. Hand over the shelters to the communities with corpus fund for operation and maintenance. (Nodal Department: LSGD Public Works Department, DDMA)

- Formulate a long-term Coastal Zone Disaster Mitigation Plan with a comprehensive Coastal Development funds package (2018-19 state budget), year-to-year basis for investments in coastal protection works. (Nodal Department: Coastal Zone Management Authority).
- Invest in flood protection infrastructure based on hydrologic and hydraulic studies in the downstream of each dam and river conveyance capacity at different river sections. At a few critical locations along the channels, install real-time water level sensors for flood early warning. (Nodal Department: Water Resources)
- Construct and retrofit education and health infrastructure in hazard-prone areas to increase safety. Nodal Department: Education, Health, KSDMA, Local Self Government Public Works Department)
- Prepare Disaster Management Plans for schools and hospitals under the overall supervision of DDMA and KSDMA (Education, Health, KSDMA, DDMA).

2. Landslides Management Strategy

- Develop an integrated approach for landslides management. This would involve land use planning, good land management practices in cropping, grazing and forestry, terrain depended road construction, terracing and other contour-aligned practices in fields and plantations, and participation of local communities. (Nodal Department: Local Self Government, Soil Conservation Department).
- Establish a coordination mechanism between Local Self Governments, Soil Conservation Department, Mining and Geology Department, and Ground Water Department for assessing local landslide risks when planning infrastructure. (Nodal Department: Local Self Government Department).
- Promote the use of bio-engineering solutions along slopes to prevent landslides in development zones and in infrastructure projects (Nodal Department: Local Self Government).
- Based on the landslide damage investigation results from the August 2018 event, consult with outside geotechnical experts including academia to develop a landslide monitoring system plan. Measures may include remote sensing data analysis of slow-moving slopes and deployment of systems such as ground-penetrating radars (GPRs) and differential GPS for monitoring landslides susceptibility.

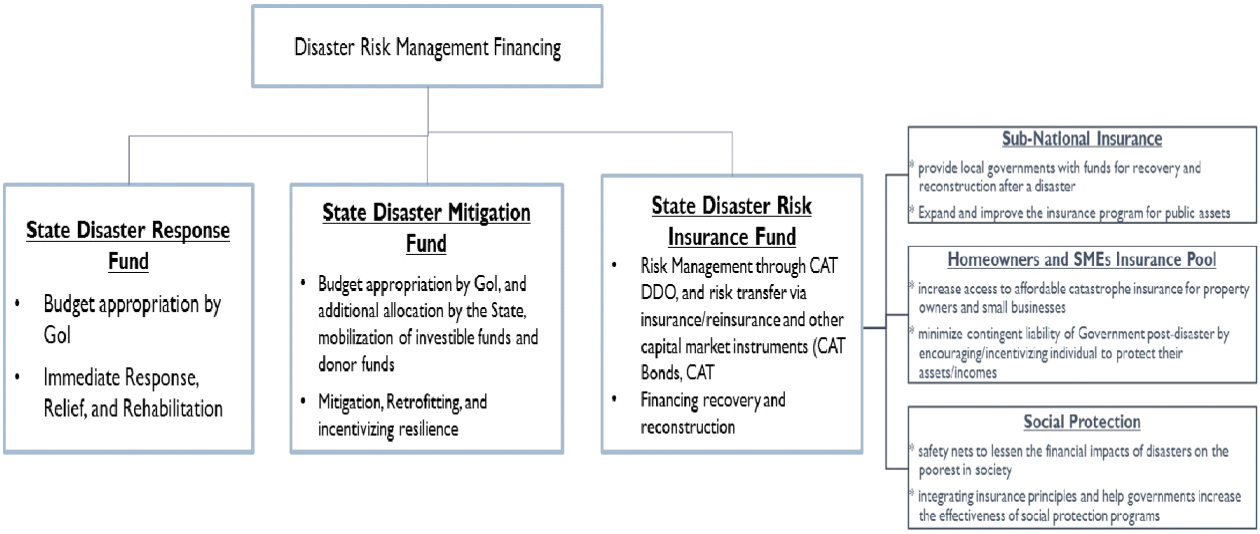
3. Drought Risk Reduction

- Prepare and implement a State Drought Preparedness and Mitigation Plan.
- Promote grey water recycling and implement public water saving awareness campaigns.

4. Disaster Risk Finance and Insurance

- Develop a State Disaster Risk Finance and Insurance Strategy underpinned by three core functions of State Disaster Response Fund, State Disaster Mitigation Fund, and State Disaster Risk Insurance Fund, as seen in the following image:

Figure 8: New structure proposed for DRM financing



- Launch Diaspora Bonds to finance resilient rebuilding initiatives.
- Develop an incentive programme[26] for homeowners and MSMEs to encourage/incentivize catastrophe insurance to protect their assets and businesses (including business interruption risk).
- Popularize existing crop insurance schemes (Nodal Department: Agriculture). Crop insurance / fishing insurance (for boat or other equipment's) scheme needs to be popularized and incentivized as many of the farmers lost crops and agriculture land during floods and other coastal erosions. This could be made a requirement for any farmer / fisherman interested is acquiring loans for agriculture purpose or fishing purpose.
- Develop a model law to insure all critical infrastructure (e.g., roads and bridges, power transmission infrastructure incl. sub-stations, hospitals and schools etc.) in which the government has an interest including Infrastructure-built and operated on PPP basis.
- Develop an insurance-linked social safety net programme to support the poorer sections of the community, particularly fishermen and subsistence farmers/agriculture labours, against natural disaster risks.
- Consider innovative value capture financing techniques like TDR, land pooling etc. for raising funds. The Town and Country Planning Act, 2016 has such provisions, however subordinate legislations detailing out these provisions needs to be issued.

Priority 4. Enhancing disaster preparedness for effective response

1. Improving early warning systems

- Improve hydro-meteorological early warning systems. Expedite the establishment of 110 automated weather stations in the State, along with end-to-end multi-hazard early warning systems.

[26] Incentive programme could include reduction in stamp duty and/or property tax rebates, interest sub-vention for home/small business loans among other alternatives.

- Develop an advanced hyper local weather prediction tool for monitoring and providing at least village-level extreme weather warnings to public and local authorities. Integrate the tool into the existing decision support system of KSEOC with the support of ISRO.

2. Improving emergency response systems

- Establish an incident emergency response system in Kerala, as per the NDMA Guidelines on the Incident Response System (IRS).
- Strengthen Fire and Rescue Services with adequate high value critical response machinery to fulfil its mandate of being the first responder to emergencies in the State.
- Create two additional Fire and Rescue and Civil Defence training institutes – one in Thiruvananthapuram and the other in Wayanad (with focus on for hill area response training) – to effectively fulfil the mandate of in-service training, community capacity building in disaster response and Civil Defence training.
- Strengthen the State Disaster Response Force with adequate human resource and machinery to fulfil its mandates with human resource shared between Fire and Rescue Services and Police.
- Establish an advanced tactical disaster response team with human resource from Fire & Rescue Services and Police.
- Revamp Coastal Police with human resource and machinery to fulfil its mandate of ensuring coastal security, disaster response and in-sea accidents.
- Strengthen Marine Enforcement with human resource and machinery to fulfil its mandate of ensuring marine security, disaster response and in-sea accidents.
- Establish a coordination mechanism between SDMA, DDMAs, and dam operators for early warning, emergency response, and action planning to mitigate downstream impacts (Nodal Department: SDMA, Water Resources, KSEB).

3. Community-based disaster risk management (CBDRM)

- Create the Civil Defence Force for strengthening and institutionalizing community-based disaster risk reduction initiatives.
- Prepare and implement a capacity building plan linked to the local Civil Defence Volunteers, Community Rescue Volunteers, creation of community emergency response teams (CERTs) and Aaptha Mithra Volunteers for community-based DRM (CBDRM) in the districts and urban local bodies (ULBs) at high risk, with a focus on women, children, the elderly, and people with disabilities.
- Design and implement a DRM awareness-raising programme for school students from class 1 to class 12 and ULBs at high risk.
- Develop a Comprehensive CBDRM – Communities must be sensitized about their capacity and duty towards DRM process and through simulation and execution drills trained and has a system in place and is capable to take on minor localized disasters at their own and can also trigger and support the government system for prompt action in case of a major disaster.
- Involve local communities in preparation of evacuation plans with a particular emphasis on evacuation of vulnerable groups like the elderly, women and children, and persons with disabilities; and components such as how early warning signals can reach them, whether they need assistive aids at the time of evacuation etc.
- Develop a programme for constituting Community-based Disaster Management Teams based on global best practices (e.g., Community-based Disaster Management practice of Cuba). It will include training and equipping the presently existing community organizations of students like the National Service Society (NSS) and Student Police Cadet (SPC) as well as community volunteer groups including

fishermen. The trainings will cover detailed first aid lessons and life skills like swimming, rowing and climbing.

Based on the above assessment and discussions with relevant line departments, **immediate time-bound interventions / activities** are summarized in table following:

Table 5: Disaster Risk Management Actions and Results Framework

Activities	Objectives	0-6 months	0-18 months	18 months & beyond	Expected Outputs
Policy / Regulatory					
1. Update the State and District Disaster Management Plans, Prepare City Level DM Plans in five city corporations and update existing plan (TVM). 1.1 Amend State Disaster Management Policy (KSDMA, DDMA, ULB)	To Review and update existing DDMP and SDMP with mainstreaming DRR and CCA Integration. To develop guideline for preparation of Departmental DM Plans and integrate with Developmental Plan. To prepare city DM Plan for 5 corporation		X	X	State DMP District DMP City DMPS Risk Sensitive departmental development plans
2. Review and upgrade flood protection design standards in consultation with concerned departments (Water Resources Department)	Take stock and Review the existing design standards Review and upgrade with disaster resilient and climate smart elements			X	Flood proof /resilient infrastructure
3. Strengthening of legal framework for land use (Land and Revenue department)	Enact a comprehensive Land-use Act. Develop a Land-use Policy				

Activities	Objectives	0-6 months	0-18 months	18 months & beyond	Expected Outputs
4. Information and Knowledge Management 4.1 Improve access to disaster risk information in coordination with KSDI, NDEM and other existing platforms (KSDMA)			X		
4.2 Conduct comprehensive land use mapping (Nodal Department: Department of Planning, Land Use Board, KSREC).	Conduct comprehensive 1:10,000 scale land use mapping and terrain linked land use zoning. Conduct comprehensive 1:5,000 scale land use mapping for select urban local bodies of the state		X	X	Land-use map and Zonation map for entire Kerala at 1:10,000 Scale 1:4000 Scale map for ULBS
4.3 Conduct a 1:25,000 scale multi-hazard, vulnerability and risk assessment incorporating 1 in 5, 1 in 10, 1 in 15 and 1 in 30-year return interval hazard scenarios. Prepare risk maps. (Nodal Department: KSDMA)		X	X		
4.4 Develop disaster damage and loss databases disaggregated up to district level.	Collect compile and analyse disaster data for a period of 30 years (minimum 2005-15 for SFM Monitoring baseline). Develop mechanism for collection and compilation of		X	X	Disaster Damage and loss data for monitoring Sendai target A to D.

Activities	Objectives	0-6 months	0-18 months	18 months & beyond	Expected Outputs
	Disaster Damage and loss data Integrate with Metadata involving NSO/ DES (KSDMA, DDMA, DES)				
4.5 Undertake resource mapping (KSDMA)	Identify and update the human, material resources and Critical supply available at departmental level Develop a mobile App Geocoding of data Integrate with NDEM database		X	X	
5. Strengthen the regulatory enforcement of infrastructure standards and building rules for resilient design and construction of infrastructure and buildings	Amend the Panchayat & Municipal Building rules based on NBC 2016			X	
6. Prepare a State Disaster Risk Finance and Insurance Strategy bringing together public and private sources of finance.	Prepare a strategy based on the study	X			Disaster risk reduction for resilience (Priority 3)
Institutional					

Activities	Objectives	0-6 months	0-18 months	18 months & beyond	Expected Outputs
7. Mainstreaming DRR 7.1 Develop Departmental DM Plans. Integrate DRR in Departmental developmental Planning and establish DM cells in nodal departments.	Establish dedicated disaster mitigation cells/units/focal points in core sector departments. Implement a comprehensive capacity building programme for the Virtual Cadre in Disaster Management available in 8 departments as priority (25 departments over 3-5 years) mainstream disaster risk reduction in the respective departments. (Nodal Department: KSDMA)		X	X	Disaster risk governance strengthened to manage disaster risk (Sendai Priority 2)
7.2 Integrate DRR in the training curricula of existing institutions under state Government	Review the curricula of training institutions IMG, KILA, SIRD, ILDM, KF&RA, KH&FW, ICCS and so on Develop DM Modules to integrate and impart Trainings Include DM training as part of the Institute's training calendar				
8. Enhance community preparedness and response capability 8.1 Establish a Civil Defence Force for strengthening and institutionalizing community-based DRR initiatives	Establish Civil Defence (similar to Kottayam under the Apda Mitra) in all the district Develop inventory of trained people in KSDRN Refresher training for Apda Mitra		X	X	Enhanced disaster preparedness for effective emergency response (Sendai Priority 4)

Activities	Objectives	0-6 months	0-18 months	18 months & beyond	Expected Outputs
8.2 Provide training and raise awareness among communities on DRM and training of community-based DRM teams. Preparation of DM plans at village level.	Constitute Village level Disaster management committees that can prepare Village DM plans using a participatory approach. Provide training for GP level and village level officials.		X	X	
Investment Planning					
9. Construct multi-purpose emergency shelters and improved access to such shelters.			X	X	Disaster risk reduction for resilience (Sendai Priority 3)
10. Construct and retrofit existing education and health infrastructure located in hazard-prone areas to higher standards.			X	X	Improved understanding of disaster risk (Sendai Priority 1);
11. Formulate a long-term Coastal Zone Disaster Mitigation Plan, Drought Preparedness and Management Plan, Integrated Flood Risk Management Plan as well as a Landslide Management Strategy including nature-based solutions			X		Disaster risk reduced for resilience (Sendai Priority 3)
12. Improve hydro-meteorological early warning systems including establishment of last mile hazard communication systems and updating				X	Enhanced disaster preparedness for effective emergency response (Sendai Priority 4)

Activities	Objectives	0-6 months	0-18 months	18 months & beyond	Expected Outputs
existing SOPs for triggering preparedness and emergency response actions (Nodal Department: IMD, KSDMA, DDMA)					
13. Strengthen State Disaster Response Force, Fire and Rescue Services, and Police with appropriate equipment.				X	Effective emergency response
14. Establish two additional Fire and Rescue and Civil Defence training institutes and Centre for Water Rescue Training.				X	Effective emergency response

3.1.7 Disaster Risk Financing and Insurance

It is worth further elaborating on the complexities of Disaster Risk Finance and Insurance introduced under 'Priority 3: Investing in disaster risk reduction for resilience'.

Uninsured losses have a substantial impact and can trigger a large cumulative output loss, whereas insured losses are inconsequential or growth-enhancing[27]. The loss of income and slowing down of economic growth are likely to reduce revenue collections. At the same time, public expenditures on disaster relief, reconstruction, and recovery are likely to rise substantially. It is estimated that, without factoring in additional resource mobilization, the revenue deficit could rise to Rs. 31,332 crore, which would be nearly two-and-a-half times the budget estimate of Rs. 12,860 crore for 2018–19 before the disaster. This impact on the overall budget of the State is in addition to direct losses from the immediate destruction of property and infrastructure, which often already make up several % of the GDP[28]. Comparison between insured and uninsured disasters suggests that insurance plays a mitigating role;

[27] BIS Working Papers No 394, December 2012

[28] According to a conservative estimate, close to 2.6% of Kerala's gross state domestic product (GSDP) got washed away by the floods instantly. (Source: PDNA, August 2018)

while it cannot guarantee positive growth, sufficient coverage helps avert the adverse growth response that typically follows a major natural catastrophe.

Losses due to catastrophic events like the 2018 Floods far exceeds the insured losses. Estimated loss/damage due to the 2018 floods is about Rs. 26,718 crores, whereas the insured loss is estimated to be less than Rs. 1,050 crores (or <4 % of total losses). More than 80 – 90 % of the insurance loss is limited to a handful of large commercial insurance contracts[29].

The private sector has borne most of the impact of the disasters. The share of private sector damages and losses is equivalent to 90 % of the total, while that of the public sector constitutes the remaining 10 %. The PDNA indicates that nearly 90 % of the damages/losses were sustained by the State's productive and social sectors (primarily housing) and employment & livelihoods.[30] From an economic perspective, the impact was felt most by the agriculture, tourism sector and micro, small and medium-sized enterprises (MSMEs), who normally have limited or no access to formal sector financing. Insurance penetration amongst these segments is also equally low.

Figure 9: insured vs Uninsured Loss

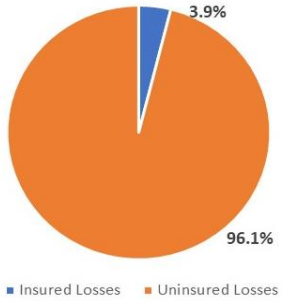
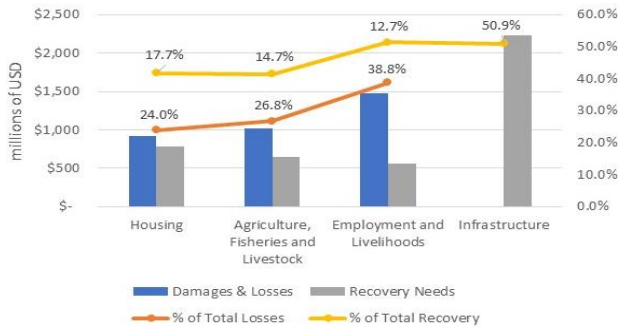


Figure 10: Sectors accounting >90% of D&L and R&R Needs



Source: PDNA, August 2018

Currently, DRM financing is characterized mostly by ex-post mechanisms (e.g., budget reallocations) rather than ex-ante (e.g. insurance of public assets, market-based risk transfer etc.). The State draws its finances for DRM activities from Government of India, and multilateral financing institutions. The existing financing mechanism consists of a mix of ex-ante and ex-post financing instruments. The ex-ante financing mechanism primarily consists of the National and State Disaster Response Funds (NDRF, and SDRF). The SDRF is capitalized by the Central and State Governments in the ratio of 75:25[31] via fiscal transfers (from the Centre) and budgetary allocation (by the State Governments). SDRF is restrictive in its use, the funds can only be used for immediate relief and recovery operations and cannot be used for post-disaster response and reconstruction activities including providing safety nets for affected households. When it comes to disaster recovery and reconstruction governments are primarily dependent on ex-post financing instruments including budget reallocation, assistance from Central Government, and raising debt

[29] Losses incurred by Cochin Airport, the Port, and some commercial establishments/businesses.

[30] Damages and losses incurred in millions of USD – housing (USD 916); agriculture, fisheries, & livestock (1,022); and employment & livelihoods (1,480) against the total damage & loss (3,819). (Source: PDNA August 2018)

[31] Recently the Central Government approved plans to increase the GoI share to 90 % across all states.

(including from multilateral financial institutions like the World Bank and Asian Development Bank) (see the figure below).

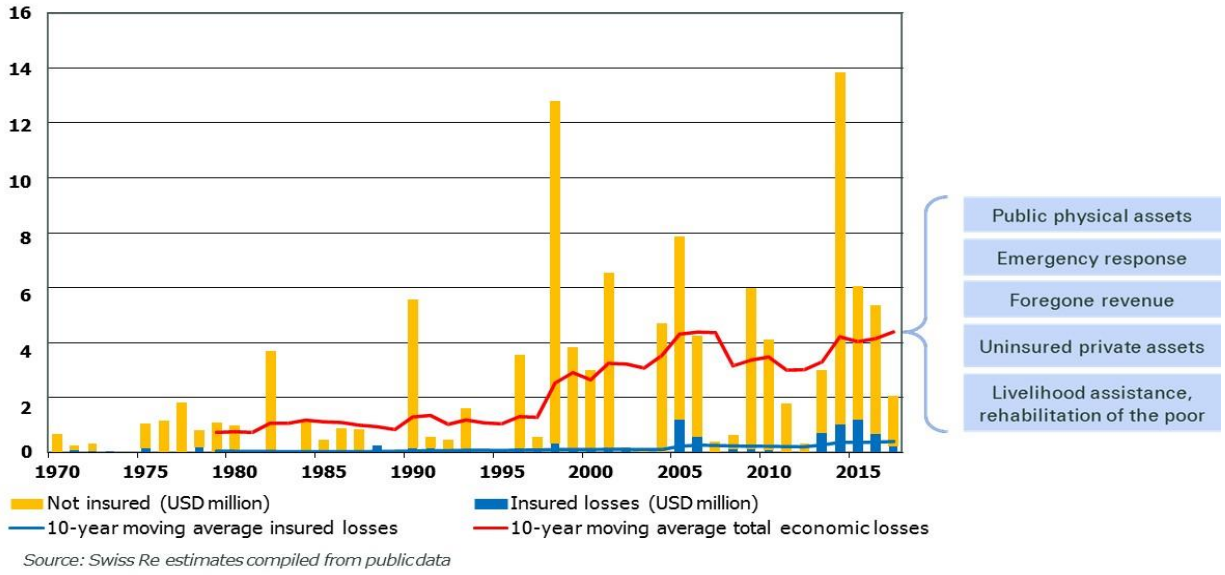
Figure 11: Pre- and Post- Financing instruments for Disaster Risk Financing

In the absence of an active DRM financing policy and institutional mechanism, the Government by default has become the (re)insurer of natural disaster risk in the State. Insurance penetration is not only low, but also disaster insurance coverage is highly inadequate. The penetration of home insurance India is just about 1% of the total general insurance penetration of 0.93%[32], hence by extension the penetration of home insurance in Kerala will not be significantly high. Also, going by the insured claims (<4% of the total losses) post-floods 2018, majority of claims are related to either motor vehicles or commercial/businesses. Similarly, in the case of agriculture insurance, less than 2% of the gross sown area in the State is insured compared to the national average of >22%. In 2017-18, an estimated 48,250 farmers (about 0.7% of farm holdings in the State compared to >35% of total farm holdings insured at the National level) where insured under the Pradhan Mantri Fasal Bima Yojana (PMFBY).

Even a one percentage point (1%) rise in insurance penetration can reduce the burden on the taxpayer by 22%. New research from the world's specialist insurance market, Lloyd's of London, warns of significant insurance deficit in 17 high growth countries severely exposed to the long-term costs of catastrophic events, including India. The average uninsured cost of catastrophe in India is estimated to be 1.18 % of GDP (or approximately Rs. 1,38,562 crore)[33]. Given that the post-disaster recovery and reconstruction are primarily the responsibility of the respective State Governments, the shortfall (namely the uninsured portion of the losses) leads to unnecessary burden placed on the State fiscal.

[32] Insurance penetration = Total General Insurance Premium Volume/GDP. General Insurance Penetration in India is equivalent to 0.93% of GDP compared to China (1.89%), Brazil (1.77), and South Africa (2.74).
[33]USD 19.72 billion finding by Centre for Economic and Business Research (CEBR) for Lloyd's Global Underinsurance Research (2012)

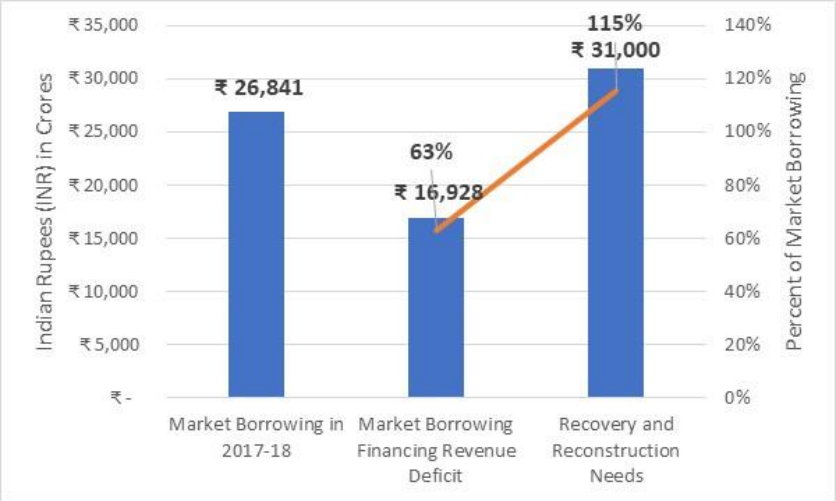
Figure 12: Natcat Protection Gap in India, nearly 90% uninsured losses



Source: Swiss Re estimates compiled from public data

The State's ability to finance post-disaster reconstruction is significantly constrained by both the scale of the reconstruction cost and the state of financial condition. The outstanding liabilities of the State was about 30.7% of GSDP, and significant chunk of these liabilities are financed through market borrowings. The estimated market borrowings for 2018-19 (prior to the flooding) was Rs. 23,881 crores of which 54% (or Rs. 12,860 crores) will be used to finance revenue expenditures (pensions, interest payments, and salary). This is likely to see significant increases; the revenue deficit could rise to Rs. 31,332 crore, nearly two-and-a-half times the budget estimate of Rs. 12,860 crore for 2018–19 before the disaster. As a result, both the market borrowings, revenue and fiscal deficits are likely to increase. The estimated recovery and reconstruction costs (Rs. 31,000 crores), on average, works to about 15% of the State's outstanding liabilities, and 40% more than the market borrowings by the State in 2017-18 (Rs. 22,082 crores).

Figure 13: Recovery & Reconstruction Cost and Financing Revenue Deficit as a Proportion of Market Borrowing



3.1.7.1 *Roadmap: DRM financing*

The State of Kerala will face a number of major climate change adaptation and disaster risk management challenges; a key one will be to adjust to the greater severity, frequency and geographic scope of natural disasters. As witnessed by the recent floods, Kerala is vulnerable to increasing risk of climate change. Extreme precipitation events and flooding that cause losses to human lives and infrastructure have increased under the warming climate. The frequency of great floods and extreme precipitation events has substantially increased under the warming climate, which is consistent with the observations as well as climate model projections. As climate change intensifies weather-related hazards, the government faces the twin challenges of strengthening the State's resilience to disasters and other climate-induced changes, and ensuring it has sufficient reserves to respond when disasters strike.

The GoK recognizes this urgent need to invest in climate adaptation and disaster resilience, and to set aside funding for disaster response. One approach for the GoK for advancing DRM financing could be the setting-up of a Climate Adaptation and Disaster Resilience Fund (CADRF) that can anchor GoK's financial protection strategy against natural and climate related disasters and finance investments to improve climate and disaster resilience, while also funding low-carbon projects. The proposed Fund's design could be tested with select stakeholders, including private sector reinsurance and insurance companies and investors, and disaster risk management and climate resilience experts to ensure it maximizes private investment in climate resilience and disaster risk mitigation. If the Fund is successful, it could create a replicable model which could be considered by other States to scale up public/private efforts to invest in climate resilience.

The Climate Adaptation and Disaster Resilience Fund will include two complementary windows to increase climate adaptation and disaster resilience, that need to be designed and operationalized in tandem:

1. **A Disaster Risk Financing and Insurance (DRFI) window**, focused on three priorities: 1) mobilizing resources for emergency relief and response, effectively strengthening the existing SDRF mechanism; 2) establishing a disaster insurance mechanism for the government to fund post-disaster recovery and reconstruction, particularly to support the poor and vulnerable households with post-disaster safety net payments, and in reconstruction of public infrastructure; and 3) adjusting policy settings and creating public-private partnerships to increase the financial protection of households, and small and medium enterprises (SMEs), agricultural producers against natural disasters.
2. **An Investment window,** focused on financing public sector and targeted private sector investments in disaster risk reduction including supporting investments in resilient infrastructure, and climate change adaptation. The investment window will reduce disaster-related losses and therefore lower insurance costs. It will also finance selected low carbon, green growth investments that increase climate resilience while contributing to the global effort to reduce emissions.

Best available estimates suggest there exists a significant funding gap that needs to be addressed and the CADRF has a potential to narrow it. The size of this gap will depend on the policy design of the Fund's two windows. However, it is clear that the government will need to consider new sources of funding – both domestic and international – to deliver the desired outcomes. In order to maximize synergies between the two windows, the Government will need to ensure they are embedded within a comprehensive and mutually re-enforcing climate change and disaster risk management strategy.

Over the long run, effective investments in climate adaptation and disaster resilience will reduce the funding needs for recovery and reconstruction. As public infrastructure is upgraded over time and more stringent building standards are implemented, the State of Kerala will become more resilient to climate change impact and disasters, and the cost of recovering from disasters will be reduced. Therefore, both

windows should be considered within a single coherent policy framework that strikes a balance between investing in climate change adaptation, disaster risk reduction and disaster response.

The CADRF is a critical step forward to form the core of the implementation of this strategy. The development of the strategy should also be seen in the context of the government's broader fiscal risk management framework. To ensure that GoK will be adequately prepared to manage the financial impacts of natural disasters, the government has to situate financial protection of the budget against disaster shocks within a larger decision framework for contingent financing. This should consider parameters such as the GoK's current cost of debt financing[34], the State's debt to GDP ratio, the potential fiscal impact of disasters, and the cost of transferring this fiscal risk to the markets.

By elevating the public financial management of disasters to the core of its climate and disaster risk management work the Government of the Kerala will seek to align itself with increasing trend taking hold in the international community. This recognizes the importance of disaster risk financing and insurance as an integral component of disaster risk management, public financial management, and financial sector development. Development banks, such as the Asian Development Bank, and the World Bank, have integrated financial protection into their disaster risk management frameworks. In addition, the 2014 World Development Report: Managing Risk for Development, emphasized the role of risk management, including disaster risk financing and insurance, and risk mitigation, as a powerful instrument for the international development agenda.

Some of the key questions around the design, governance, and funding of the CADRF that need to be addressed include:

1. What is the best structure for the fund – off-budget or on-budget?
2. Which domestic revenue options are most feasible and realistic?
3. What are the best potential sources of domestic and international funding and how should the private sector be involved?
4. What is the relationship between the CADRF and existing institutions? How would the CADRF supplement the SDRF, and relevant mainstreamed budget allocations to other agencies, e.g. by providing additional financing once they are exhausted? What is the relationship between the CADRF and the State Insurance Fund?

3.1.7.2 *Disaster risk financing and insurance window*

The proposed Disaster Risk Financing and Insurance (DRFI) window of the CADRF could form the backbone of a comprehensive strategy. The DRFI Window could complement existing disaster funds, most notably the State Disaster Response Fund (SDRF). The existing annual allocation could remain in place to respond to high-frequency, low-intensity disasters, while the DRFI window could provide additional layers of contingency funding for lower-frequency, higher-intensity disasters. The fund could provide immediate liquidity for response and recovery as well as long-term financing for reconstruction. The DRFI window could be organized around three core functions:

1. **Relief and Response Contingency Fund** to mobilize resources for emergency relief and response, through reserves and market-based catastrophe risk transfer solutions. This contingency fund should accumulate resources across years to establish a financial buffer that will prevent large-scale disasters from disrupting too severely the government's annual budget, particularly in supporting the poor and vulnerable households' post-disasters. For instance, small farmers (land holding sized at 1 to 2 hectares) & marginal farmers (land holding sized at 1 hectare or less; a large proportion of marginal

[34] Current GoI G-Sec yield is about 7.42 %

farmers are additionally vulnerable as they cultivate on leased/rental land and/or are "sharecroppers"), fisherfolks, casual laborers, persons with disability (PWD) etc. will need government assistance post-disaster to meet their consumptions needs i.e., food, medicine, and essential needs.

2. **Catastrophe Risk Insurance Facility for Insuring Public Infrastructure Assets**, the estimated reconstruction funds needed for rebuilding the roads and bridges is in excess of Rs. 10,000 crores, whereas the State's annual allocation for roads and bridges is slightly above Rs. 1200 crores and majority of these funds are primarily meant for maintenance and upkeep of the existing road infrastructure. Capital expenditure in Kerala is very low, 1.6 % of GSDP, compared to more than 5 % in other progressive States like Gujarat, Maharashtra, Andhra Pradesh etc. Following major disasters, like to the 2018 floods, the need for funds is enormous and cannot be met through re-appropriations etc.

Table 6: Funding needs of Infrastructure Sector, Post-Disaster Reconstruction

	Damages and Losses	Total Recover Needs
Water, Sanitation and Hygiene	₹ 1,361	₹ 1,331
Transportation		₹ 10,046
Power		₹ 353
Irrigation		₹ 1,483
Other Infrastructure		₹ 2,446
Total	₹ 1,361	₹ 15,659

Source: PDNA, August 2018

3. **Domestic catastrophe risk insurance market development** through regulatory change and public-private partnerships to increase the financial protection of households, and SMEs, agricultural producers against natural disasters. This complex issue will require land, cadastre and planning mechanisms to be established to support effective implementation of this core function.

Given the very different nature and coverage for each of the core functions of the DRFI Window, there will be a need to develop separate instruments (e.g. funds) and insurance structures with different management and other characteristics. Options of the design of such instruments will be discussed with the government in a later stage.

3.1.7.3 *Investment window*

The Investment Window of the CADRF would provide a dedicated source of funding for investments that strengthen the GoK's resilience to climate change and natural disasters. The window would also aim to contribute to climate change mitigation efforts through 'green investments' that enhance climate resilience while also reducing emissions. Investments could include ex-ante resilience projects and top-

ups of ex-post recovery expenditure to fund the resilience improvements made to assets as they are rebuilt. The projects could range across three areas:

1. **Risk identification and planning**, including hazard mapping and integrating better information in budgeting and planning processes of the line departments i.e., PWD, Water and Sanitation, Irrigation, Public Schools and Hospitals;
2. **Infrastructure,** including 'structural' infrastructure such as strengthening public buildings and flood protections and 'non-structural' such as forecast and early warning systems and development of climate-resistant crops; and
3. **Capacity building**, including updating building standards and training to enforce them, and public awareness campaigns.

3.1.8 Technical Studies and Assessments

The list of key studies to be carried out to support the above policy, institutional and investment activities is provided below.

Table 7: Disaster Risk Management List of Studies

List of studies	0-6 months	0-18 months	18 months & beyond
Policy / Regulatory			
Conduct a mapping of existing sources of data for Hazard Risk and Vulnerability Analysis (HRVA) and assessments at various levels and gaps (KSDMA). The State has a 1:50,000 scale assessment of hazard and vulnerabilities. The need for preparing a finer resolution HVRA and identifying the desired scale is a requirement. The required studies are, develop benchmarks and baselines for conducting detailed HVRA of the state. Prepare a term of reference for conducting a detailed HVRA at the desired scale.		X	
Conduct a study to explore sustainable financing options for DRR, preparedness, and response and to establish a sustainable financing mechanism		X	
Develop a Comprehensive Disaster Risk Financing Strategy for Kerala - Policy reform and financing instrument recommendations.		X	
Examine the feasibility, and cost-benefit of – 4.1 Incentivizing homeowners/SMEs to buy catastrophe insurance to protect their assets/businesses – incentives could include rebates on property tax, stamp duty. 4.2 Insuring critical infrastructure assets	X	X	

List of studies	0-6 months	0-18 months	18 months & beyond
Institutional			
Conduct an institutional and regulatory assessment for enforcing the Kerala Municipality Building Rules including legal and administrative procedures, construction quality, supervision, and certification systems. (ULB)			X
Institutional Capacity Assessment Mapping of Key state level institutions and Training Needs Assessment Study (KSDMA).		X	
Investments Planning			
Conduct a detailed state-wide vulnerability assessment of critical public infrastructure and assets to site/location specific hazards (Nodal Department: PWD, LSGD PWD, DDMA, KSDMA)			X
Integrating Ecosystem Approach to DRR through development programmes – Pilot study (LSGs, KILA, KSDMA)		X	
Assess the Capacity of the State and District EoCs including the EWS and develop a roadmap for strengthening the systems (KSDMA)		X	
Crowd management: Kerala has numerous religious and non-religious festivals attracting large numbers of individuals. There are basic protocols laid for crowd management in the State. Rudimentary protocol exists but requires significant investigations into effectiveness. This study will recommend minimum non-negotiables for crowd management to be prescribed in the religious and non-religious festivals of Kerala.			X
Shifting from explosive use to pyrotechnics: Use of explosive fire crackers in festivals is a long continuing practice. The State is seeking viable and acceptable alternatives. A study needs to be conducted to identify the requirements of the festival organisers and viable safe alternatives needs to be identified			X
Quarrying: There are numerous quarries in the State, that follow explosive type quarrying considering the cost required for adopting other lesser destructive type of methods. Explosive type quarrying is known to increase the probability of landslides in the immediate adjoining landslide prone areas. A study needs to be conducted to identify suitable and viable alternatives that does not increase landslide probability.			X

3.2 Environment and Climate Change

3.2.1 Introduction

Kerala is flanked by the Western Ghats - one of the 36 global biodiversity hotspots – on the East and the Arabian sea on the West. The tropical evergreen forest on the Western Ghats, the tropical monsoon climate and the long coastline with an intricate system of backwaters along the coast make Kerala a unique geographical and environmental location. The urban and rural areas of the State are interspersed amid biodiversity- rich ecosystems in a rural-urban continuum.

Kerala has three natural regions — coastal lowlands, midlands and highlands; four major rock formations — crystalline, sedimentary, laterites and sediments forming the low-lying areas and river valleys; ten soil types derived from the laterite base; and twelve distinct agro-climatic zones. There are 44 rivers, of which 41 flow westward as the terrain shifts from the hills to the coast. All the rivers are rainfed and tend to have little or no flow during the summer months. In total, there are 1,750 river sub-basins and 4,452 mini watersheds. While none of the rivers are nationally considered 'major', there are four 'medium' rivers between 150 km-250km long: Chaliyar, Bharathapuzha, Periyar and Pamba rivers. There are also backwaters and lagoons along the coast. Kerala is endowed with several wetlands, including three Ramsar sites - Sasthamkotta Lake, Ashtamudi and Vembanad-Kole Wetlands. Although, as per the Wetlands Conservation and Management Rules (2017) of the Ministry of Environment, Forest and Climate Change (MoEF&CC), the list of wetlands (above 2.25 ha) excludes forests and coasts, these are also to be soon notified as wetlands in the State. There are mangroves in some of the coastal districts. Almost 80% these are in the northern district of Kannur. Finally, there are 33 Important Bird Areas (IBAs).

Even outside of these declared eco-sensitive areas and forests, Kerala's natural environment is unique as it is gifted with varying soil profile, rich vegetation, distinct agro-climatic zones, vibrant climate, dynamic hydrology, distinct geological domains and terrains and different mineral deposits. Therefore, economic development – agriculture, industrial, infrastructure, urban, rural, tourism – will have to be embedded in this rich natural environment. The two-way interaction, i.e. economic development depends on the natural environment and the natural environment must bear the impacts of economic development, is significant and pronounced in the Kerala context given its narrow land strip and dense population. Given this context, scientific land use planning focusing on sustainability is a high priority for the State.

3.2.2 Institutional Framework

The Department of Environment undertakes activities related to the protection and conservation of environment through its three wings – the Directorate of Environment & Climate Change (DoECC), the Kerala State Pollution Control Board (KSPCB) and the Kerala State Biodiversity Board (KSBB). Each wing has their stipulated activities. For instance, conservation and protection of wetlands, coastal zone management and undertaking various technical studies on climate change are carried out by the DoECC. Pollution abatement and regulatory activities are carried out by the KSPCB. The conservation of biodiversity-rich ecosystems is carried out by KSBB which is a statutory body that performs facilitative, regulatory and advisory functions on issues of conservation, sustainable use of biological resource and fair equitable sharing of benefits of use of bio-resources. Per the Biological Diversity Act (2002), there is a

decentralized biodiversity management system with the National Biodiversity Authority (NBA) at national level, State Biodiversity Board at state level and Biodiversity Management Committees at local level. Further, since environment is a cross-cutting sector, several other departments like Agriculture, Forests, Mining and Geology and LSGD, as well as institutions like the Institute for Climate Change Studies (ICCS) also are key stakeholders.

3.2.3 Impact of 2018 Floods

Broadly, the impacts of 2018 floods to the natural environment differ based on their geographical location. In the hilly ranges, the major impacts in the forest areas have been landslides. While 209 landslides were reported by various Forest Divisions, a total of 342 landslides occurred in the Revenue Department marked land extents. Some of these landslides are 3-4 km in length and 20- 30m average in width. Landslides were predominantly seen in slopes above 22° and most common between 22° - 28° slopes. Majority of the landslide sites were along the fringes of forests, indicating that forest fragmentation disrupting slope continuity was a major causal factor.[35]

In the midlands, plains and coastal areas, major environmental assets have been impacted. The overall impacts of floods on the wetlands have not yet been studied. Nevertheless, due to flooding, wetlands have received sizeable quantities of waste – accumulation of weeds, garbage, mud and silt, debris, sewage, sullage and other pollutants — that have changed the organic composition of the water bodies. Of these, the Vembanad Kole, a Ramsar wetland, has suffered the largest impacts. The midlands and plains have also received the rich top soil run-off from the highlands. These have been collected and used by the local community to meet their needs. Damages to wetlands/coastal resources were also noticed in Vembanad, especially Thottappally, Kochi bar mouth and Munambam bar mouth. Decrease in native fish diversity and catch were reported. Solid waste accumulation, especially plastic, in the spawning and feeding grounds was observed. Mangroves at Mulavukad, Vallarpadam, Vypin, Mangalavanam, Kumbalam, Nettoor-Valanthakad, Pallippuram, Chenganda, Cheranalloor, Vechur north and Kumarakom were affected due to plastic and other solid waste accumulation.

Biodiversity impacts have also been extensive — it is estimated that 771 different landscapes, including riverine, forest, plantations and agricultural fields were affected. The impact on landscapes will have more long-term bearing on biodiversity as this leads to habitat modification.

In 2013, the IUCN identified and validated 25 key aquatic biodiversity areas in Kerala which holds significant number of threatened species of conservation concern. Of these, eight aquatic systems have been severely impacted. The major ecosystems affected were the riverine ecosystems. In fact, the degradation of river banks due to removal of riparian vegetation, land use change and unscientific construction of small check dams has aggravated the flood situation. The natural assets of rivers that have been impacted include:

- Rocks in the river bed in the hilly areas close to the landslide locations.
- Erosion/deepening of the river.
- Fall in both the surface and the adjoining sub-surface water table along selected river stretches.
- Changing course of rivers in a few locations.
- Formation of sandbanks along the river. Rivers, irrigation canals and drains became heavily silted, which increased turbidity of water for household wells and river flora and fauna.

[35] Kerala Floods and Landslides 2018, Rapid Damages and Needs Assessment Report, 2018, Government of Kerala/World Bank/Asian Development Bank, September 2018.

The impact on forest ecosystems is marked by soil erosion, loss of humus and widespread destruction of the riverine vegetation. The problem is largely visible in areas where heavy rainfall has occurred. There were limited losses of certain larger animals like tigers and elephants. Post-disaster observation of birds, amphibians, reptiles and fishes indicate losses, which will be impact the population in future, as any change in habitat and landscape will take time for the species to recover. Rapid assessments appear to reveal that the impact was more on the invertebrates, e.g. insects, than on animals. An adverse impact on the invertebrates would result in adverse impacts along the food chain for animals.

Damage and Loss – As per the PDNA, the total damage, loss and recovery needs estimated for the sector were as follows:

Damage (Rs. crore)	Loss (Rs. crore)	Total Effect (Rs. crore)	Total Recovery Needs (Rs. crore)
26	0.04	26	148

*The data includes forestry as a subsector of environment sector.

3.2.4 Major Legacy and Current Issues

The environmental factors contributing to such a disaster and the subsequent impacts/damage were analysed. Considering the magnitude of floods, certain negative impacts are only to be expected. However, there are certain pre-existing factors that have likely contributed to the devastating nature and extent of flood impacts.

- Growing population pressures and constraints of land availability that have resulted in largescale conversion of unsuitable land for habitation purposes — e.g. in the immediate vicinity of the rivers. This is due to inadequate land use planning policy, weak enforcement of land use codes and disregard of environmental factors during construction. The number of landslides in the forests was much less compared to similar steep areas that were open to human activities. In particular, road construction is seen as a major reason behind a number of the landslides.
- Information gap, including a lack of research on ecology, environmental management and eco-system conservation, about landslide-prone areas and vulnerability hotspots in the hill ranges, as well as the inadequacies in the use of such information in decision-making (e.g. locating habitation and quarrying activities) aggravated the impacts.
- Lack of sharing of environmental data amongst various departments, institutions and agencies in a manner that it can be gainfully utilized for improved environmental decision-making. Utilizing the existing data for formulating better developmental strategies also was not practiced.
- Limited coordination between the Department of the Environment and other important departments, particularly the LSGD, Mining and Geology and Water Resources, in order to mainstream environmental considerations in decision-making and implementation processes of these departments and their line agencies.
- Weak capacity of the institutions under Department of Environment, especially the DoECC, and therefore ineffective management of environmental issues, particularly in the field/at the zonal level.
- Absence of conservation and management plans for eco-sensitive areas such as coastal areas,

mangroves and wetlands, undermining resilience of community in the vicinity.

- Non- availability or ineffective waste management systems leading to poor solid waste management across the State. In particular, the use of non-recyclable plastics and other similar materials resulted in large amount of debris in the water bodies during the floods. The clogging of drains due to these plastics resulted in localized flooding.
- Absence of proper sewerage networks and sewage treatment plants led to the dumping of liquid wastes in water bodies. During the floods, the absence of appropriate practices worsened the impacts. Inadequate wastewater and solid waste management services not only affected the quality of life in urban areas, but also impacted water bodies — which are valuable economic, environmental, cultural and heritage assets — surrounding the urban areas (backwaters). They also led to deleterious environmental health implications. Likewise, inadequate storm water drainage systems limited the ability to urban areas to deal with flash flood events.
- Absence of a protocol and expertise to manage asbestos waste that were generated due to the damage caused by landslides and floods.
- Overall, lack of adequate attention on addressing issues related to land, groundwater and surface water contamination that may have aggravated the impacts of the floods and landslides.

3.2.5 Proposed Approach

Risk drivers noted above contributed led to negative environmental impacts and contributed to flood losses. Therefore, recovery through creating resilient environmental measures would help in addressing disaster risks and reducing impacts of future disasters. This section includes the list of policy, institutional and investment interventions that will be required to address the environmental dimensions of disaster risk management. The proposed interventions will build on each other chronologically by:

- Strengthening environmental data and knowledge.
- Developing institutional technology and partnership capacity.
- Developing Eco-sensitive Policy.
- Integrating relevant agencies and community-level stakeholders working on building resilience.

The following areas have emerged as the key environmental interventions that need to be addressed in the context of building resilience.

3.2.6 Specific Interventions

3.2.6.1 *Policy interventions*

State Biodiversity Strategies and Action Plan: The National Biodiversity Action Plan (NBAP) at national level and the Kerala State Biodiversity Strategies and Action Plan (SBSAP) at state level are the principal instruments for mainstreaming biodiversity and for implementing the UN-CBD Strategic Plan for Biodiversity 2011-2020 and the 20 UN Aichi Biodiversity Targets. To successfully conserve ecosystem services, biodiversity should be integrated at all levels of policy and decision-making processes of development. Necessary policy guidelines/orders may be given to all biodiversity managing line departments and organizations to implement SBSAP. KSBB is proposing to establish a Biodiversity

Information System, which will be a single window source for all biodiversity information concerning Kerala linking databases established by different institutions, departments and universities.

Banning specific uses of throwaway/single use plastic materials: Plastic usage is universal and diverse in Kerala. Disposal of large amounts of plastic waste through incineration or landfilling is not eco-friendly. The leachate from some of the plastic material causes the introduction of chemical substances to flora, fauna and humans. Further, during the floods, non-biodegradable plastics caused several problems. For example, clogging of drains and nallas due to plastic wastes resulted in localized flooding in many areas; deposition of plastic and micro-plastic waste in wetlands, rivers and other water bodies caused danger to marine and freshwater biodiversity, as well as reduced the carrying capacity of the water bodies. Given this, it is necessary to consider a ban on single use plastics for certain uses – for example, carry bags, plates, cups, tumblers, forks, spoons, thermocol-based products and decorative items. Alternatively, a tax could be levied on single use plastic material. The list of banned or taxed items should include plastic-coated items such as flex boards, which caused significant waste accumulation and disposal problem in the aftermath of the floods and landslides. A list of alternate sustainable materials shall be provided along with the ban. The concept of Extended Product Responsibility (EPR) shall be introduced on plastic materials.

Extended Producer Responsibility (EPR): A technical committee should be established to identify the products that can be imposed with the EPR liability to reduce waste generation. EPR should be initially introduced on a list of articles and then scaled up based on the learnings from the same.

Eco-sensitive area conservation policy: Areas of ecological importance in the State, such as the hill ranges (Western Ghats), the coastal ecosystems (mangroves and beaches), the wetlands (Ramsar sites and others) and the river ecosystems are facing excessive population pressures. An overarching policy would be required to limit further degradation of such eco-sensitive areas and to restore areas that are currently degraded. For example, there are several quarries in the hill ranges, many of which are illegal. Since these quarries create soil disturbances that facilitate landslides, their activities should be managed better through appropriate policy and regulatory actions. Where recovery strategies are required, these should be site specific, eco-friendly and based on a landscape and ecosystem approach to disaster risk reduction, such as the use native vegetation for riverine area protection and slope stabilization, or the adoption of "eco-safe" methodologies for road construction and maintenance in hilly or eco-sensitive areas.

Declaration of state wetlands under the Wetlands Conservation and Management Rules: A draft list of wetlands in the State having area above 2.25 ha has been identified. These wetlands are important for building community resilience. Once declared, these wetlands would contribute towards strengthening the resilience as their management would be in line with the Wetlands Conservation and Management Rules. For instance, there would be a no-development zone of 50 metres distance from the boundary on the landward side around each declared wetland. This would provide the required buffer for protecting the community surrounding these wetlands during extreme precipitation events. These wetlands are expected to be notified by November 2019.

Safe rebuilding of affected areas: To ensure safe rebuilding of affected areas, the following measures should be considered:

- Slope protection should be ensured at the time of developmental activities. A review of Kerala Minor Mineral Concession Rules, Panchayat and Municipal Building Rules in tune with the State Disaster Management Plan and hazard zonation must be ensured, especially considering biodiversity, hydrological parameters.
- Identification of origins of perennial streams and conservation of watershed areas should be implemented.

- Natural hazard zonation map at the cadastral level should be made available to Local Self Government Institutions and District Planning Committees to ensure that construction of buildings and siting of development projects, especially sensitive one like mining or check dams, do not happen in hazard zones or vulnerable areas, especially for landslides and floods.
- Slope protection should be ensured at the time of developmental activities. A review of Kerala Minor Mineral Concession Rules, Panchayat and Municipal Building Rules in tune with the State Disaster Management Plan and hazard zonation must be ensured, especially considering biodiversity, hydrological parameters.

3.2.6.2 *Institutional interventions*

Strengthening the DoECC: Institutional strengthening of the DoECC, particularly establishing its zonal presence, is critical. The responsibility for managing environmental issues within the State lies with the Department of Environment in general, and the DoECC in particular. The responsibility for coordinating, monitoring and evaluating implementation of the State Action Plan on Climate Change (SAPCC) also lies with the DoECC. The institutional capacity of DoECC is weak, particularly in terms of their zonal office presence across the State. The DoECC's management efforts are largely restricted to Thiruvananthapuram since they do not have zonal or field-based offices. Their role in integrating and coordinating with the other sector departments has so far been limited, particularly in terms of its zonal presence. Therefore, the institutional strengthening of the DoECC through establishment of offices in the North, Central and South Zones is imperative for effectively managing environmental issues and overseeing environmental programs across the State.

Audit Cell: An internal audit mechanism will be established within the DoECC to review the institutional effectiveness of various statutory bodies working under the DoECC. This cell will also remind the various institutions about the need for coordinated efforts in achieving SDGs.

Institute for Climate Change Studies (ICCS): The ICCS must be integrated with and developed as a technical support centre of the DoECC. As part of the rebuilding initiative, the ICCS can revisit regulations, policies and strategies of various development sectors based on SAPCC. The ICCS could also undertake and disseminate research on the impacts of climate change on key development sectors of the State. As part of this, it could compile relevant studies and make it available in the public domain within a specified timeframe.

Availability and sharing of environmental data and information: As part of institutional reforms in environmental management, improving the availability of environmental data and information would be undertaken. Relevant primary data and information would be shared so that for these can be gainfully used for decision-making across departments. This would be a part of the cross-sectoral open data initiative being planned under RKDP. As part of this, there should be a proper linkage between the DoECC and State Council for Science Technology, and Environment, especially to strengthen data projects like the ENVIS.

Further, there would be initiatives to strengthen IT-enabled supervision, monitoring and reporting systems on environmental management across the State. The DoECC and the various authorities are responsible for a number of initiatives that constitute the environmental management in the State. Further, the DoECC is also responsible for the SAPCC. These initiatives require regular supervision, monitoring and reporting. The current approach would be IT-enabled, streamlined and reports would be made available for improved decision-making across all sectors.

Conservation and management of coasts and wetlands: There is a need to designate technically competent field functionaries to monitor the conservation and protection of coasts and wetlands. Towards this, an institutional arrangement is required designating the Social Forestry Wing of the Forest Department to actively engage in the management, protection, monitoring and conservation of the coasts as well as the wetlands. Management strategies for the same will also be formulated.

District level monitoring mechanism for wetlands: Identified wetlands will be managed by a monitoring mechanism in the district level. The district level monitoring mechanism will comprise an expert member from CWRDM, Environmental Engineer from the SPCB, a nominated member from District Panchayat and a nominated member from fishermen community. Social Forestry division of Forest Department will be coordinating this monitoring mechanism under the leadership of a Revenue Officer.

Green Technology Centers: Every household in Kerala has multiple possibilities for application of greener technologies such as household composting, solar energy and resource recycling. Technical assistance for eco-friendly building practices can also be provided by such centres. Green Technology Centres could be established in local bodies, where young people could be trained in the installation and maintenance of green technology. This concept could be initially tested as a pilot project and replicated subsequently, as relevant, based on lessons learned.

3.2.6.3 *Investment interventions*

Implementation of the Integrated Coastal Zone Management Project: This is a World Bank-funded project which works with coastal communities and other stakeholders. The objective of the project is to restore and conserve coastal environs and to reduce pollution, thereby ensuring sustainable livelihoods and upscaling economic benefits of ecosystem services through community participation. This project is viewed and evaluated through sub-systems viz. environment and resources, society and economic development. All of these interventions will contribute towards building the resilience of the coastal ecosystems. The total budget is ₹280 crores.

Multiple investments to conserve the State's three Ramsar wetlands: The management action plan of three Ramsar wetlands has been approved by the Ministry of Environment Forests and Climate Change. Budget allocations have been made and approved activities are expected to be initiated very soon. These investments would not only conserve the wetlands but also contribute gainfully towards building resilience of communities in the vicinity of these wetlands.

Implementation of Low-Carbon Economy projects: Costs-benefits of area-specific low-carbon economy projects such as "Carbon Neutral Meenangadi" need to be examined to explore if similar projects can be implemented in other districts as well. Similarly, by promoting more energy production from renewable resources like solar and wind, the State can take steps forward to achieve SDGs.

The following is the table of interventions along with the proposed time lines and expected outcomes.

Table 8: Environment Actions and Results Framework

Activities	(0-6 months)	(0-18 months)	(18 months & beyond)	Expected Outcomes
Policy / regulatory				
Establish a Biodiversity Information System as part of the Kerala State Biodiversity Strategies and Action Plan		X		Enhanced mainstreaming of biodiversity to implement the UN-CBD Strategic Plan for Biodiversity 2011-2020 and the 20 UN Aichi Biodiversity Targets
Banning specific uses of throwaway/single use plastic materials through a Government notification		X		Reduction in volume of plastic waste generation and impacts
Extended Producer Responsibility (EPR) policy		X		Reduce waste generation through identifying products that can be imposed with EPR liability
Eco-sensitive area conservation policy		X		Enhanced conservation of eco-sensitive areas to contribute towards increasing resilience
District level mechanisms to monitor wetlands and coasts		X		Enhanced management of wetlands and coasts.
Slope protection rules in turn with State Disaster Management Plan ensured and natural hazard zonation maps made available to Local Self Government Institutions and District Planning Committees to ensure that construction does not happen in hazard zones or vulnerable areas	X			Safe rebuilding of affected areas.
Institutional				
Institutional strengthening of the DOECC, particularly establishing its zonal presence	X	X		Enhanced capacity to inform and provide recommendations on environmental/ climate change issues at the field level

Internal audit mechanism established within the DoECC to review the various statutory bodies working under the DoECC		X		Increase in institutional effectiveness
Institute for Climate Change Studies (ICCS) integrated with and developed as a technical support centre of the DoECC.		X		Increased availability of public, relevant and high-quality climate research on regulations, policies and strategies
Environmental data and information availability and sharing to be transformed	X	X		Streamlined use of data /information for effective decision making
Declaration of state wetlands under the Wetlands Conservation and Management Rules		X		Improved functionality of the wetlands for enhanced resilience
Establishing and maintaining IT enabled supervision, monitoring and reporting systems on environmental management	X	X		Streamlined oversight and management systems for effective decision making
Green Technology Centres under Local Self Govt Institutions			X	Rebuilding a sustainable Kerala by shifting households into green technologies
Investment				
Integrated Coastal Zone Management Project	X	X	X	Improved coastal zone management that results in enhanced coastal resilience
Multiple investments to conserve the state's three Ramsar wetlands.	X	X	X	Improved functionality of the wetlands for enhanced resilience
Implementation of low-carbon economy projects (e.g. "Carbon Neutral Meenangadi")		X	X	Better use of natural resources and more sustainable localities

3.2.7 Technical Studies and Assessments

Guidelines on landslide-prone areas and critical vulnerable hotspots in the hill ranges: There have been past studies on landslide-prone areas and critical vulnerable hotspots undertaken by organisations such as the National Centre for Earth Sciences Studies (NCESS). The natural hazard vulnerability maps available with KSDMA should be used as a basis for guidelines to be used by various departments and licensing authorities to determine the suitability of particular areas for specific development activities. Regulatory frameworks like Municipal/Panchayat Building Rules and Minor Mineral Concession Rule shall be reviewed based on this to ensure that the risk of disasters can be mitigated through proper planning.

Additionally, there are distance regulations such as 1 km from Protected Areas, 50m from the nearest habitation and 7.5 m from the boundary of nearest property. These would be reviewed in the context of the available studies. Further, these Guidelines would be constantly updated with new information available so that the clearance decisions have a scientific basis.

Study on mining impacts: A study on the impacts of mining on ground water level and destabilization of slopes is critical. This would be undertaken by institutions like the NCESS to develop safe and sustainable mining practices. Expected budget of ₹2 crore.

Low-material use and eco-friendly construction: Reducing dependence on materials sourced from quarries would have to be done as they are resulting in negative impacts on the hill ranges. The use of natural materials in construction would have to reduce in time. A study would examine alternative approaches to construction to progressively reduce dependence on quarried materials.

Updating Kerala CZMP in line with the new CRZ 2019 notification: The new CRZ 2019 notification was published on 18th January 2019. Soon, the MOEFCC would require the states to update their CZMP in line with the new notification. Some of the provisions of the new notification are oriented to support tourism and therefore requires the strengthening of the resilience measures by project proponents. For example, certain construction activities in CRZ-III Zones have now been permitted. Therefore, the Kerala Coastal Zone Management Authority (KCZMA) would have to strengthen its clearance conditions so that there is greater resilience built into the project.

Planning studies for Kuttanad region: Climate projections (IPCC AR5) have predicted a sea level rise of 1.8 - 2 mm by 2030. Studies have revealed that about 169 sq.km. would be inundated due to a one metre increase sea level in and around Kochi region.[36] Agriculture and related activities in Kuttanad region are expected to be severely affected by this sea level rise. This has major implications on the habitations – their houses, their livelihoods and related activities - in and around the Kuttanad region that is expected to be submerged. With the expected increase in rainfall intensity, a number of coastal cities would also be prone to water logging and flooding. Planning studies would be undertaken to examine how this progressive change would be addressed in Kuttanad region. These studies are imperative to ensure the resilience of the Kuttanad communities.

Updating the Kerala State Action Plan on Climate Change (SAPCC): The process of updating the SAPCC 2014 is ongoing and would be completed by December 2019. Once done, the implementation of SAPCC 2019 would commence. This would involve not only the environmental sector but other sectors too. About 32 stakeholders (line departments, agencies and R&D centres) have been involved in updating the SAPCC.

Medium- and long-term impacts of disaster on biodiversity: Preliminary post-disaster studies on biodiversity and ecosystem impacts revealed that the invertebrates, like insects, have been adversely affected. Invertebrates serve as food for humans and are key elements in food chains that support birds, fish, and many other vertebrate species. An adverse impact on the invertebrates would result in adverse impacts along the animal chain. Further studies are required to determine the nature and extent of damage and determine the remedial measures. Interlinkages with agriculture and fisheries sectors would also need to be explored as part of such a study. This could lead to a detailed action plan for recovery and improvement of biodiversity. Expected budget of ₹50 crore.

Studies of rivers and canals leading to the Ramsar wetlands: While the management action plan focuses on the Ramsar wetlands per se, there is a need to study rivers and canals that lead to the wetlands. For instance, the Vembanad-Kole wetland has 8 rivers feeding into it. These studies would result in identifying

[36] Fifth Assessment Report, IPCC.

upstream preventive and management measures that would reduce the impact on the wetlands.

Impacts of floods on soil/land, ground and surface water contamination: There is evidence of contamination of groundwater due to the 2018 floods. Further, due to damage on sanitation facilities, there has been a contamination of both ground and surface water bodies. The nature and extent of contamination across the State would need to be studied and remedial measures identified. As part of this, the likely presence of PCBs and PAHs (used in transformers, lubricants and other heat exchanger uses) would also be studied.

Implications of prevailing hazardous, medical and e-waste management practices in the context of disasters: These three types of wastes are regulated under the the Environmental Protection Act. There are several waste management practices, which are prevailing in different parts of the State. A study would be undertaken to review the ongoing practices to determine how these practices would be managed in the context of disasters.

Study to examine the issue of asbestos in the context of damage to roofing material caused due to the disaster would be done. Though asbestos is banned, it was in use in the past, particularly as a building material in construction, e.g. roofing. During the recent floods and landslides, there were damages that could have released asbestos fibres, which are injurious to health. There is no protocol for the handling of asbestos in the State. There are also no facilities available for their proper disposal. This study would examine how to handle the issue of asbestos as relevant to potential disaster events would be done.

Table 9: Environment List of Studies

Activities	0-6 months	0-18 months	18 months & beyond
Policy / Regulatory			
Guidelines on landslide-prone areas and critical vulnerable hotspots inthe hill ranges		X	
Low-material use and eco-friendly construction		X	X
Updating of Kerala CZMP in line with the new CRZ 2019 notification.	X	X	
Planning studies for Kuttanad		X	X
Updating the Kerala State Action Plan on Climate Change (SAPCC)	X		
Medium- and long-term impacts of disaster on biodiversity		X	X
Studies of rivers and canals leading to the Ramsar wetlands		X	X
Study of soil/land/ground and surface water contamination due to 2018 disaster		X	
Study on the implications of prevailing hazardous, medical and e-waste management practices in the context of disasters	X	X	
Study to examine the issue of asbestos in the context of damage to roofing material caused due to the disaster	X	X	

3.3 Strengthening Institutional Efficiency and Resilience

3.3.1 Public Investment Management Profile of Kerala

The overall public investment management (PIM) profile of Kerala is noted in the table below.

Table 10: Public Investment Management Profile of Kerala

Total public investment (Rs. crore (2016-17)[37]	RS.14500 crore	Total public investment (% GSDP) (2016-17)[38]	2.3%
Total Capital budget Expenditure (2016-2017) (Rs. crore)[39]	RS.10120 crore	Capital expenditure overrun (2016-2017) (%)[40]	109.4%
Private infrastructure finance (2018)[41]	RS. 2.555 crore 6 projects	Centrally sponsored schemes (in value and number, Capital Account)[42]	87; RS. 20.30 lakh
Cost overrun of State sponsored infrastructure projects (%)[43]	21.0%	Cost overrun of Centrally sponsored infrastructure projects (%)[44]	16.5%
Net Devolution and Transfer of Resources from the Union (% of revenue)[45]	31.3%	Total debt stock (% GSDP) (2016-2017)[46]	30.2%
		Grants from the State to LGUs (% of revenue)[47]	7.2%

[37] Government of *Kerala government statistics (2016-2017)*. Includes the sum of capital outlay, KIIFB revenue, externally aided projects and centrally planned schemes.
[38] Ibid
[39] Reserve Bank of India and staff calculations.
[40] Ibid. Ratio of actual capital expenditure to capital budget estimates (using PEFA methodology).
[41] Database of Infrastructure Projects in India 2018.
[42] Kerala Finance Accounts (2018). CSS/Central Plan expenditure in capital account, part of capital outlay.
[43] Ministry of Statistics and Programme Implementation (2018). Indicator refers to the original cost divided by the anticipated cost.
[44] Ministry of Statistics and Programme Implementation (2018). Indicator refers to the original cost divided by the anticipated cost.
[45] Reserve Bank of India, current Rs. Net refers to Gross devolution and transfers minus repayments of loans to center and interest payments on loans from center. Total revenue is the sum of total revenue receipts, recovery of loans and advances, and miscellaneous capital receipts per RBI methodology.
[46] State Planning Board, Kerala Economic Review (2018).
[47] Reserve Bank of India, current Rs. Total revenue is the sum of total revenue receipts, recovery of loans and advances, and miscellaneous capital receipts per RBI methodology.

Disaster risk exposure (Verisk Maplecroft)[48]	2.0	Human Development Index (2017)[49]	0.784
Losses due to natural disasters (%GSDP)[50]	6.5%	Firms expected to give gifts for government contract (%, 2014)[51]	77.9%

3.3.2 Introduction

Bridging the infrastructure gap to sustain Kerala's growth will require a quantitative and qualitive jump in public investments. Kerala has made important progress in socio-economic development to date and is distinguishing itself by its high human development. Going forward its transition to higher income status will require a quantitative and qualitative jump in infrastructure, which is currently constrained by low levels of public investments (2.3 % of GSDP in 2016-2017 and a lower bound estimate of 1.3 % for 2017-2018 based on the latest budget data)[52]. Kerala's current share is low by Indian — the national average is 5 % of GDP while the average of States is 4.3 % of GSDP — as well as by international standards. Emerging economies such as Mexico spend an average of 4 % of GDP while countries like Colombia and Thailand up to 6 % of GDP[53]. The Government recognizes this public investment gap and has established the Kerala Infrastructure Investment Fund Board (KIIFB) to help address this issue, but this alone might not be sufficient. Leveraging more private infrastructure finance is another solution in light of largely untapped potential. The current level of public-private investment is very modest (6 projects totalling Rs. 2.555 crore).

Enhancing the allocative efficiency of public investments to maximize the socio-economic development impact. These scarce resources are spread thin across an ever-growing project portfolio reflecting institutional fragmentation and bottom up approach to project identification. Capital budget allocations seem to be more driven by the recurrent demands of numerous constituencies, agencies and Special Purpose Vehicles (SPVs), rather than based on the evolving development priorities of the economy or the potential socio-economic impact of the projects. The over concentration of public investments in one subsector — roads (35 %), even though the State's road network is three times denser than the national average, is an illustration of the potential to improve allocative efficiency through a more strategic and stringent appraisal and prioritization framework.

[48] Verisk Maplecroft (2018). The Climate Change Vulnerability Index evaluates the susceptibility of human populations to the impacts of climate extremes and changes in climate over the next three decades. It combines exposure to climate extremes and change with the current human sensitivity to those climate stressors and the capacity of the country to adapt to the impacts of climate change. The index score is presented on a scale of 0-10, where 0 represents highest risk and 10 represents lowest risk. For Kerala, the average of the following five cities was taken: Kochi, Kollam, Kozhikode, Thiruvananthapuram, and Thrissur.

[49] World Bank (2017). Average of the subnational values of three dimensions: education, health and standard of living. In its official version defined at the national level, these dimensions are measured with the following indicators: Education measured with the variables Mean years of schooling of adults aged 25+ and Expected years of schooling of children aged 6; health measured with Life expectancy at birth and standard of living measured with Gross National Income per capita (PPP, 2011 USD).

[50] UNDP (2018). Kerala Post Disaster Needs Assessment.

[51] World Bank Enterprise Surveys (2014).

[52] Preliminary estimates does not include KIIFB and Externally funded expenditure due to data availability.

[53] IMF Capital Stock Database (2015). Capital expenditure is used as a proxy measure the State-wise average using RBI's latest available data.

The resilience of Kerala's infrastructure needs to be improved considering its high exposure to climate risks (Maplecroft Climate Vulnerability Index). Climate related extreme weather events such as floods, damaged a substantial share of the State's assets in 2018 and require the equivalent to more than half of the 2018-19 Annual State Plan outlay for reconstruction.[54] The frequency and severity of such extreme weather events and losses are expected to increase due to climate change based on the IPCC scenarios. The Public Investment Management Framework would benefit from being upgraded to become more climate informed, through a systematic screening of the climate risk exposure and resilience of major infrastructure projects.

The operational efficiency of Kerala's public investments has room for improvement considering the important implementation delays and cost overrun of projects, affecting their socio/ economic return. Centrally sponsored projects have on average a cost overrun of 16.5 % vis-a-vis 21 % for State sponsored schemes. These are conservative estimates based on the data available as many projects do not even report the amount of cost overruns in the financial accounts and CAG's reports. Implementation delays of State sponsored projects are very high, reaching an average of 24 months compared to their initial schedule. These delays and cost overruns significantly reduce the return on the State's investments.

Transparency and accountability of public investment management are improving, leveraging the State's strong social capital, ICT competencies and the innovative and participatory approach introduced by RKI. KIIFB is publishing its projects on its Website. In the wake of the post disaster assessment the Kerala State IT mission started mapping public and private assets, which could form the back bone of the State's public investment and asset database to be developed.

3.3.3 Trends in Public Investment

3.3.3.1 *Kerala's public investment efforts*

The State of Kerala with a population of 33.4 million people, had a Gross State Domestic Product (GSDP) per capita of Rs. 171,780 in 2016-2017. In recent years, Kerala has taken important steps in socio-economic development, with the highest Human Development Index in the country as of 2017. In fact, Kerala's Human Development Index shoulders with countries such as Mexico, Colombia and Thailand, ranging in high 0.70's[55]. However, Kerala's path towards a higher income status is constrained by its low level of public investments, estimated at 2.3 % of GSDP for 2016-2017 and a preliminary 1.3 % for 2017-2018.

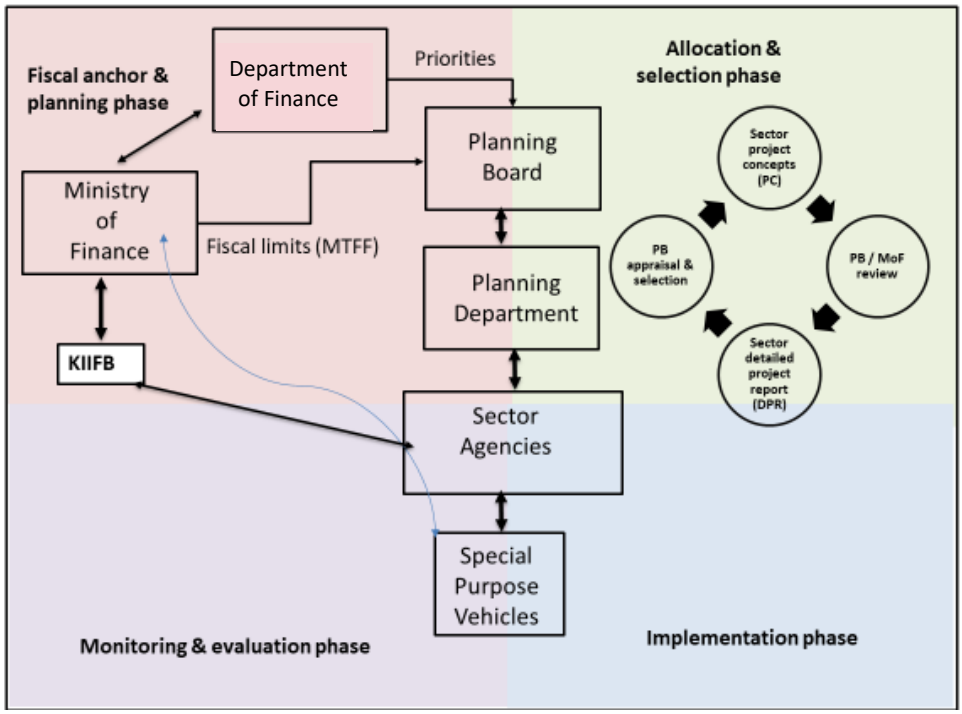
There are many actors at play in Kerala's public investment system. At the planning phase, the Chief Minister sets investment priorities taking into consideration the fiscal anchors put forth by the Department of Finance derived from the Medium-Term Fiscal Policy Plan. The State Planning Board develops the five-year plan and the annual plan, integrating the project proposals from the different administrations and Special Purpose Vehicles. The Board also carries out an annual review called the annual economic review, which is sent to Parliament with the next year's budget proposal. Project proposals are reviewed by the Board at two stages. First at the concept stage, based on the project profile and then at the appraisal stage, based on detailed project report. Following administrative sanction, the corresponding funds are released by the Department of Finance to the line department/implementing agency. In the absence of accrual accounting, the annual cash releases cover payments for both ongoing

[54] The Annual State Plan outlay for 2018-19 is Rs. 29,1500 million.
[55] Global Data Lab (2017).

projects as well as for the preparation / start of new projects. This makes it difficult to precisely estimate the fiscal space available for new investments.

In the implementation phase, each sector agency implements investment projects, either directly or through SPVs, while the Planning Department provides implementation monitoring jointly with the Planning Board. Project monitoring focuses mainly on inputs and outputs and feeds into the annual economic review. The evaluation function is very nascent, and the planning department is in the process of setting up a division for project evaluation. There is currently no evaluation policy in place that would provide common standards, guidance, and processes across sectors and actors. The feedback loop of project monitoring and evaluation into the following planning and budget cycle is not systematic nor documented, thus only marginally contributing to improve allocative and operational efficiency of public investments. The figure below attempts to illustrate the main actors and phases.

Figure 14: Public Investment Actors and Process



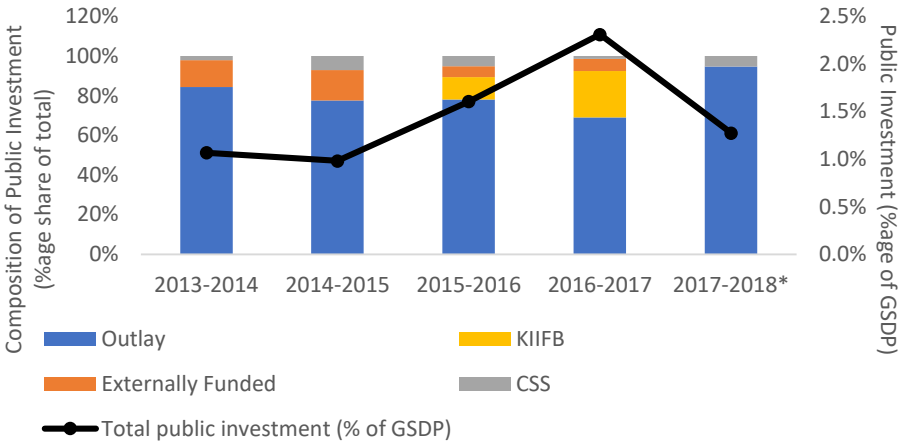
Source: elaboration based on interview with Government agencies.

Kerala's public investments are financed through four different mechanisms comprised of the Plan projects financed through the budget's capital outlay, the KIIFB, centrally funded schemes and externally aided projects. Even though Kerala's overall capital expenditure has been steadily increasing, public investments remain low by Indian standards and international standards for an emerging economy. Kerala's overall total public investment amounts to 2.3 % of its GSDP, with capital outlay making up the largest share of investment with 70 %, followed by KIIFB with 23 %, externally funded projects with 6% and centrally sponsored schemes with 1% (see below figure)[56]. Preliminary estimates from the latest budget point to a total investment of 1.3% of GSDP for 2017-2018. This reduction is largely driven by a

[56] CSS/Central Plan expenditure in capital account, part of capital outlay.

decrease in capital expenditure. Compared to other Indian States, Kerala has the highest HDI, however it has the 7th lowest level of public investment in the country.[57] The public investment national average is 5 % of GDP while the State-wise average is 4.3% of GSDP.

Figure 15: Breakdown of Public Investment in Kerala



Source: World Bank Staff elaboration based on Government financial accounts.

Note: New and enhanced KIIFB began disbursing from 2016 onwards. CSS is part of capital account.

**Preliminary estimates, does not include KIIFB and Externally funded expenditure due to data availability.*

In light of Kerala's low public investment, the Government modified the KIIFB in 2016 to be its main SPV for financing large scale infrastructure projects[58]. The amendment of 2016 also empowers the fund with innovative funding structures approved by the Reserve Bank of India and the Securities Exchange Board. As can be seen on the figure above, the share of KIIFB financed projects has been increasing, yet the total level of public investments as a share of GSDP has remained rather constant and low. There is thus potential to leverage additional resources for productive investments, including from the private sector and by creating more fiscal space. Beyond the level of public investments, it is essential to also improve the allocative and operational efficiency of these investments to ensure that they generate sufficient economic and tax returns to be sustainable.

3.3.3.2 *Allocative efficiency of Public Investment*

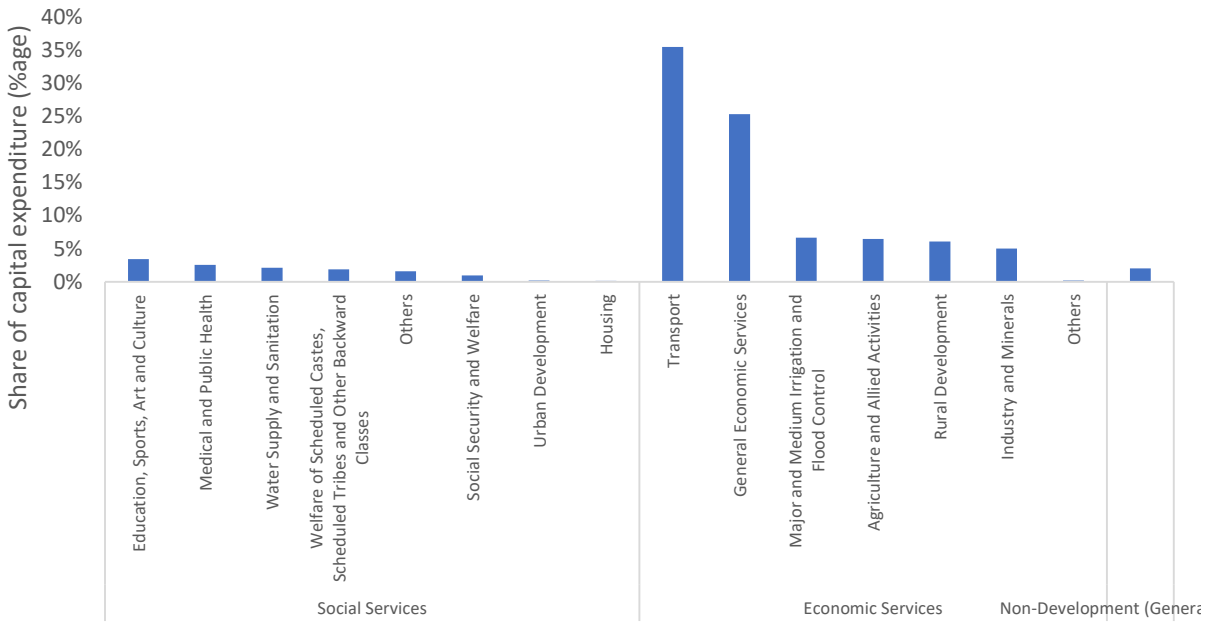
The allocative efficiency of Kerala's public resources can be improved. There seem to have been a crowding out effect of public investment by the growing current expenditures, as shown by the low and declining share of public investments. While the investment cycle process is well defined and fiscally disciplined, there is evidence of low allocative efficiency driven by over-concentration of investments in one subsector (roads) and an institutional fragmentation, resulting in scarce investments being scattered

[57] Please not that in this case Kerala public investment is defined as the sum of capital outlay, KIIFB investments, centrally sponsored schemes and aid from abroad. For the remaining of the States, only capital outlay was used.
[58] KIIFB invests in both social and physical infrastructure projects that are worth more than Rs. 98 crore

across a large project portfolio. Quantity is being emphasized over quality, particularly regarding roads, as Kerala has one of the most extensive road networks in India, yet the leading cause of unnatural deaths in the State are road accidents.[59] Maintaining such a large road network becomes indeed increasingly difficult and costly, particularly in the wake of climate change.

Recent evidence points to the crucial role investment effectiveness and public capital productivity play on an economy's potential output and overall public finances in the long run, with diligent project selection as the cornerstone.[60] Looking closely at the distribution of the State's capital expenditure, economic services made up 85 % of capital expenditure, followed by social services with 13 % and lastly non-development expenditure. In terms of economic services, transport, particularly roads and bridges, had the largest share of expenditure in 2016-2017 with 35 %, followed by general economic services with 25 % and major and medium irrigation and flood control with 4 % (see below figure).

Figure 16: Capital expenditure share by category 2016-2017



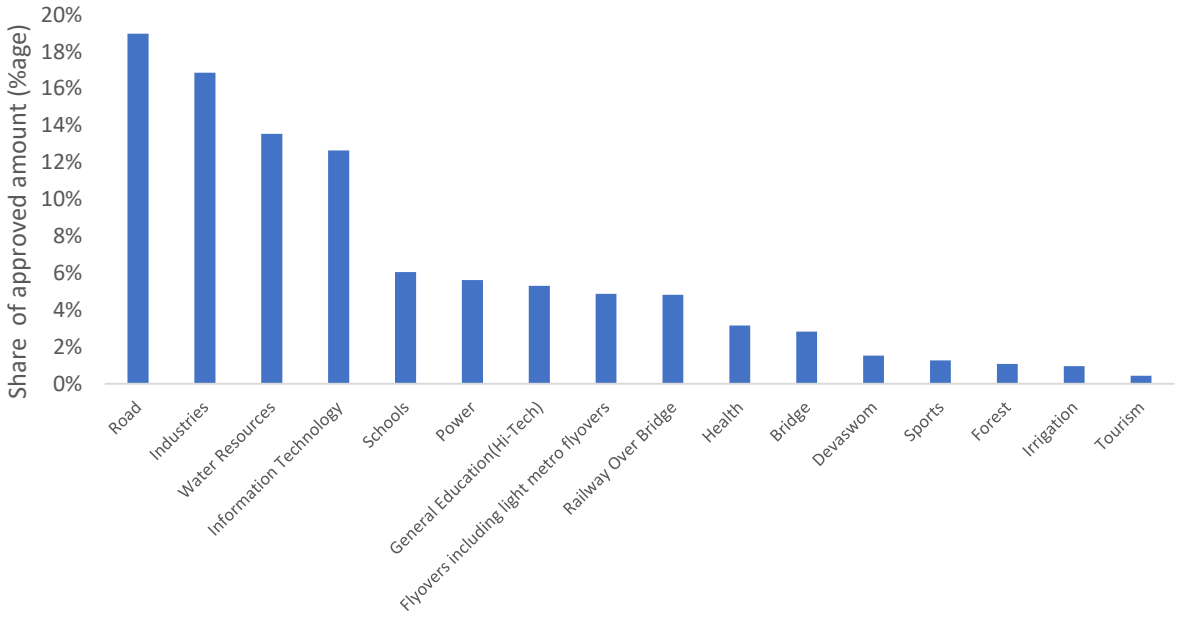
Source: Reserve Bank of India (2017). 0 percentages are numbers below 1 %.

The sector concentration is less acute in the KIIFB portfolio. As of September 2017, the KIIFB approved Rs. 9100 crore projects with the road sector receiving the highest share of investment (19.0 %), followed closely by Industries (16.9 %), Water Resources (13.5 %) and IT (12.7 %) (see below figure). Latest available data points to an overall capital outlay of Rs. 3,339 crore in 2016-2017. The cross-cutting nature of KIIFB and its stringent project preparation and vetting process can help improve the allocative efficiency of the State's investments.

[59] Based on interview with the of the Secretary Public Works Department (PWD).

[60] De Jong, J. et al. 2017, "The Effect of Public Investment in Europe: a model-based approach". European Central Bank Working Paper 2021.

Figure 17: Approved KIIFB projects by sector (2017)



Source: Kerala Investment Infrastructure Board (2017).

Indeed, the State's allocative efficiency seems undermined by the current institutional fragmentation with multiple SPVs competing for resources also hinders a more strategic and integrated resource allocation focused on public policy objectives, such as improving mobility and clean multimodal transport, instead of inputs such as km of roads built. Kerala's rapid socio-economic development and drive for resiliency will require increasingly investing in cross-cutting policies and programs that transcend the administrative silos and imply coordination and cooperation. The planning and project selection process may need to be revisited to enhance prioritization and incentivize collaboration, including by introducing an options analysis to screen competing demands in terms of their impact and cost-effectiveness to achieve a policy objective. This would also be an opportunity to introduce a more stringent readiness filter and a climate screening to improve operational efficiency and enhance project resilience and adaptation as discussed below.

3.3.3.3 *Operational efficiency of public investment*

The operational efficiency of Kerala's public investments has room for improvement in view of the long delays and cost overrun of projects, affecting their socio/ economic return. It is important to address the overall operational bottle necks as there is empirical evidence of a positive correlation between public investment efficiency and the quality of institutions[61], thus resulting in higher quality infrastructure and robust economic growth.[62]

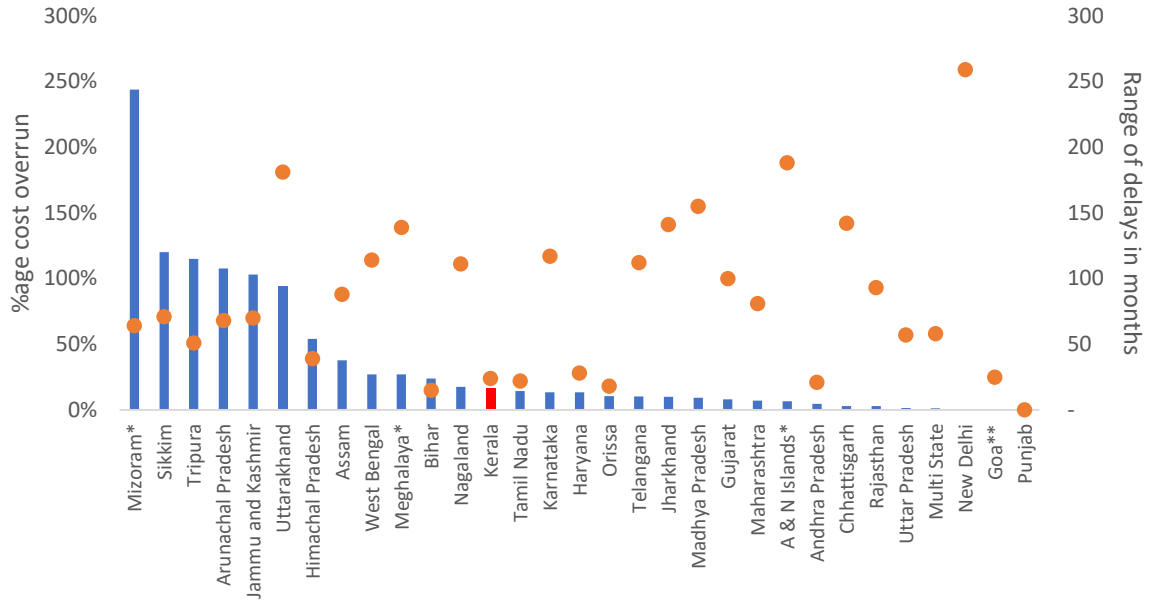
[61] Barhoumi, K., and others, 2018, "Public Investment Efficiency in Sub-Saharan African Countries What Lies Ahead?," Policy Paper 18/09 (Washington: International Monetary Fund).

[62] "Making Public Investment More Efficient," IMF Staff Report (Washington: International Monetary Fund) 2015.

Measuring the efficiency of public expenditure is not straightforward. It requires comparing the inputs (capital budget), the outputs (assets created and value) and the outcomes (economic and social impact). One upstream proxy indicator is the overall cost overrun of infrastructure projects that are centrally funded and are worth more than Rs 14.70 lakh. In the case of Kerala, recent estimates point to an overall cost overrun of Rs. 3750 crore, representing a percentage cost overrun of 16.5 %, above the national average of 14 %.[63] In terms of delayed projects in months, Kerala has 21 delayed projects with delays that range between 9 and 31 months (see below figure). Regarding State funded projects, there are currently 252 incomplete works that are past their initial completion date totalling a budgeted amount of Rs. 1.491 crore (only those worth more than Rs. 1 crore are accounted for). The total cost overruns of State funded projects amount to 21 %[64] and average implementation delays are 24 months. In terms of cost overruns, bridges had a cost overrun of 25 %, while buildings and roads incurred cost delays of 20.7 % and 14.1 % respectively.

Figure 18: Cost overrun of centrally sponsored projects by State

(Rs. 14.70 crore and above, 2018)



Note: Includes only projects worth Rs. 150 core or more. Manipur was excluded from the graph given that its cost overrun percentage was 1,385 % (Outlier).

This also affects the State's budget. Kerala has averaged a total revenue deviation of –8 % since 2008-2009, while its total expenditure deviation has been only -2 % over the same period. However, in recent years the absolute capital expenditure deviation changed drastically from an under-execution of 19 %

[63] (Cost overrun is the anticipated cost – original cost of a project)/original cost of a project.
[64] Only accounts for projects to which information was available (77 out of 252).

to an over execution of 6 % between 2015-2016 and 2016-2017, which in a cash-based accounting system is likely to lead to arrears affecting contractors and future bids.

For the latest available year, total expenditure overshot the initial budget by 9 %. Applying the international Public Expenditure and Financial Accountability (PEFA) assessment framework, under Pillar one -Budget Reliability- Kerala would score a B for indicator PI-1 (Aggregate expenditure outturn)[65] and a C for indicator PI-2 (Expenditure composition outturn).[66] Looking closely at the absolute deviation of capital expenditure, outturn reached 109 % in 2016-2017 driven also by the conservative forecast of loans and advances by the State government. In terms of indicator PI-3 (Revenue outturn)[67], Kerala scored a D in terms of its aggregate revenue outturn and a C for variation in revenue composition. The main driver of Kerala's low revenue forecast were low levels of non-tax revenue such as social security and welfare contribution and other social contributions. These contributions come in the form of fees government employees pay for insurance and other services provided by the government.

3.3.3.4 *Resilience of public investment*

The resilience of Kerala's infrastructure needs substantial improvement considering its high exposure to climate risks and susceptibility to natural disasters, floods being the most common. Around 14.8 % of Kerala's land area is prone to floods and in specific districts this goes up to 50 %. Furthermore, Kerala is a climate change hotspot compared to the rest of India per Verisk Maplecroft's Climate Change Vulnerability Index, which currently stands at 2.09 for the whole State.[68] These risk factors were highlighted by the 2018 floods.

In macroeconomic terms, upper bound estimates point to a total loss of 6.56 % of Kerala's GSDP while recovery needs currently stand at Rs. 30,800 crore. Around 2.6 % of its GDP was immediately lost because of the floods. These losses have the potential to hinder Kerala's economic growth. Looking specifically at sectors of the economy, the infrastructure sector was the most affected by the floods and has the highest share of total recovery needs (Rs. 15,400 crore) (see figure on left, below.). Looking within the infrastructure sector, the transportation sector was the subsector that needs the most recovery funds (see figure on right, below).

[65] Aggregate expenditure outturn was between 90 % and 110 % of the approved aggregate budgeted expenditure in at least two of the last three years.

[66] Variance in expenditure composition by programme, administrative or functional classification was less than 15 % in at least two of the last three years.

[67] Performance is less than required for a C score and variance in revenue composition was less than 10 % in two of the last three years. Kerala had 89 % outturn in each of the three years examined.

[68] The Climate Change Vulnerability Index measures the susceptibility of human populations to the impacts of climate extremes and changes in climate over the next three decades. It combines exposure to climate extremes and change with the current human sensitivity to those climate stressors and the capacity of the country to adapt to the impacts of climate change. The Climate score is presented on a scale of 0-10, where 0 represents highest risk and 10 represents lowest risk. Kerala is currently in the 0-2.5 range.

Figure 19: Share of disaster effects and recovery needs by sector

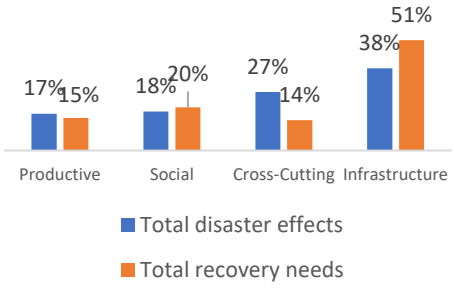
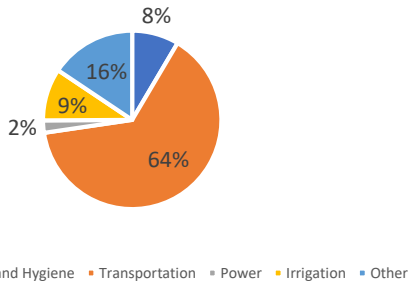


Figure 20: Recovery needs by infrastructure subsectors. Total recovery needs: Rs. 15,400 crore



Source: UNDP Kerala Post Disaster Needs Assessment (2018).

The damage of roads alone is estimated to be Rs. 10,000 crore. In terms of budgeting, the floods are likely to have a negative impact on revenue generation. According to preliminary estimates, the revenue deficit could increase to Rs. 313.32 crore representing an increase by a factor of two compared to the 2018-19 original estimate. The frequency and severity of such extreme weather events and losses is expected to increase due to Climate change. Currently there is no such climate risk and resilience screening in Kerala's public investment management framework. The feasibility studies of large projects focus more on the environmental impact of the project. Despite the fact that Kerala is highly vulnerable to natural disasters and most of its public investment is directed at public works, resilience is not considered in the prioritization and appraisal framework. This situation and the Government's focus on re-building a more resilient State, would warrant upgrading the current public investment management system to make them more climate informed and the resulting infrastructure more resilient. This would include the systematic climate risk screening of major infrastructure projects, the climate stress-testing of project proposals and their economic and financial analysis as well as an integrated information system, including geotagging of projects and assets.

Table 11: Assessment of Essential PIM features (Kerala)

Strong *Moderate* *Weak*

Key Features	Effectiveness	Strength
Fiscal anchor	Legal limits exist on deficit, debt, and guarantees through the Medium-Term Fiscal Policy Plan (MTFP) in compliance with the Kerala Fiscal Responsibility Act (2003). The MTFP is presented in the State legislature and fixes targets for all fiscal variables. Furthermore, Kerala's State Finance Commission is mandated to review the State's financial position and make overall recommendations. However, there	

	is an implementation gap. The fiscal target for the capital budget informs the planning process but does not represent a strict ceiling used for project prioritization. As the budget allocations are cash-based rather than commitment-based it leads to resources being spread thin over the project portfolio and time.	
Investment planning & guidance	State-wise and sectoral plans exist; the State's Twelfth Five Year Plan provides strategic guidance for schemes and public investments, including centrally sponsored schemes and foreign-funded projects. An annual review, sent to Parliament along with the budget proposal, provides an overview of the implementation of the plan and major projects. Reporting is uneven across departments and more focused on inputs and outputs than on policy or project outcomes. The Planning Board and the departments issue guidelines for the submission of plan proposals, including schemes and projects by the departments. The plan is gender and child sensitive and aims to incorporate the SDGs. Plan submissions are now done online through http://www.planspace.kerala.gov.in, of which aggregated information is available to the public. The submissions do not distinguish between schemes and projects and the readiness and quality of the s submissions and reporting vary greatly by departments. KIIFB infrastructure project database is publicly available and provides more granular information on the guidance and project status. The RKI Memo envisages the development of an integrated, transparent and participatory public investment management database, which could build on and integrate KIIFB and the Plan's systems and leverage the geospatial mapping/ portal currently being developed by the State's IT centre.	
Formal appraisal	Project appraisal is uneven. The Planning Board and the departments issue guidance and templates for project submission at concept and at decision stage (administrative sanction). There do not seem to be central unified rules and regulations on project appraisal processes and methodologies. The KIIFB has recently issued robust project appraisal methodology for specific sectors. The methodology includes cost benefit analysis, feasibility studies, demand analysis and environmental management plans per the Kerala Infrastructure Investment Fund amendment of 2016. These requirements were legally incorporated in the Kerala Infrastructure Investment Fund (Amendment) Act of 2016. The Public Works Department is currently upgrading its guidelines for the appraisal of road projects. The development of common rules and standards for the appraisal of large projects, incorporating Climate risk and resilience is recommended.	

Independent review	Central review exists and is done by the Planning Board and by KIIFB for their respective projects. There are published criteria and pipeline of pre-approved projects on their respective Sites. However, details of project design, results frameworks, costs and feasibility studies are not publicly available, nor are the results of the reviews of these projects. While the central review is independent from the departments proposing the projects, it is still part of the government. The current central reviews can therefore not be considered fully independent and the lack of detailed project information available to the public does not enable an independent assessment of the projects.	
Project selection & budgeting	There are high level selection and prioritization criteria for schemes and projects (often included in broader schemes), including through the plan and through the budget process. However, detailed selection criteria in terms of project options analysis, affordability, return on investment and readiness are not explicit nor publicly available. The high concentration of capital investment on roads, the underinvestment in maintenance as well as the large cost and time overrun of projects indicate the lack of selectivity and project readiness and the potential for a more stringent project selection and prioritization process. KIIFB is introducing project selection criteria and accrual accounting of project's full costs, which can help strengthen the pipeline.	
Project implementation	There is an implementation gap, as evidenced by the important delays in project implementation (24 month on average) and cost -overrun. Centrally funded megaprojects face on average a cost overrun of 16.5 percent State sponsored projects have a cost overrun of 21 percent. The State government does provide a list of projects facing delays, however, fundamental information regarding specific time delays and cost overrun are missing for many projects. Despite the government's efforts there is a lack of adequate and timely progress reports, including on the central on-line portal PlanSpace. CAG also highlights numerous issues with project implementation and SPVs, including payments arrears, incorrect reporting of expenditure, important reallocations of funds within the year, procurement issues, and lack of compliance with project management and reporting guidelines.	
Procurement	Robust procurement guidelines exist, and e-procurement is already developed. There is a unified e-procurement platform where tenders are updated every 15 minutes. Procurement capacity is uneven across departments and delays are important, particularly for construction and civil works. The Government aims to strengthen the procurement framework through a law. A more detailed procurement assessment	

	is recommended to inform the reform and build capacity where it is most needed.	
Asset management	The budget and accounting systems are cash based and not accrual. The State IT Mission is currently in the process of geocoding government assets, starting with government offices, electricity networks. Roads and other public infrastructure could follow. This would provide a digital and geo-localized asset registry that would be useful to optimize asset management, maintenance and disaster risk prevention. This would also require a unique common ID for public investments from their planning stage to the asset delivered, integrating both physical and financial information.	
Completion Review & Evaluation	While elements of monitoring and review are embedded in the plan, the State does not have a comprehensive evaluation policy as yet. There exists Concurrent Evaluation and Monitoring of Schemes for selected departments which are meant to directly feed into the programming and budgeting cycle. However, these were formally introduced in 2017 and have only been implemented across 9 departments so far. Likewise, the disclosure and feedback loop of evaluations could be strengthened.	
Transparency	The State has a well-established right to information framework introduced by the Right to Information Act of 2005. However, operationally while there is a centralized portal that compiles all RTI requests, it is out of date and request and responses are rarely made public. The proactive disclosure of information pertaining to public investments and projects could be strengthened along the project cycle. The development of a unified and public project portal as envisaged under RKI would be a major improvement.	
Climate smart	There was no evidence that the most recent five-year plan or its guidelines effectively support strategic screening or prioritization of major projects in terms of climate risk and resilience. This is a priority of RKI which aims to enhance the State's resilience by mainstreaming it in country systems, such as public investment management and to rebuilt stronger. Regarding adaptation and mitigation, strategies were included in the recommendations provided by the working group charged with formulating the plan. Kerala does have a State Action Plan on Climate Change that is aligned with the 2008 National Action Plan for Climate Change (NAPCC). Furthermore, Kerala is currently in the process of implementing the Energy Conservation Building Code (ECBC). The ECBC is the central government's initiative to address energy efficiency in the commercial building sector.	

3.3.3.5 *Main Recommendations*

- Enhance public investments, more in line with the national average, to sustain Kerala's emergence to a high middle-income economy, including by leveraging more public-private partnerships and investments.
- Improve the allocative efficiency of public investments through a more stringent cross-sector vetting and prioritization process for high impact, affordable and ready projects, based on formal and transparent criteria and reviews.
- Issue unified and upgraded regulations for project preparation and appraisal, based on KIIFB and international good practice to enhance operational efficiency and development impact.
- Integrate systematic climate risk and resilience screening in these regulations, starting with major and risky projects.
- Develop an integrated project processing and monitoring platform, available to the public and building on the initiatives of PlanSpace, KIIFB and the geotagging of public assets and infrastructure.
- Ensure that each project and related asset has a unique common ID, compatible with the plan, budget and accounting classification for effective monitoring and maintenance. Open it to the public for crowdsourcing and monitoring.
- Develop a State policy for the evaluation of public investments and institutions, including ex-ante, mid-term and ex-post evaluation.

3.4 Open Data

3.4.1 Background

National and sub-national governments around the world are promoting open data initiatives to facilitate improved access to data services in order to improve governance and citizen awareness. In Kerala, there is currently no systematic way in which even basic data in a number of key sectors is made accessible in open, public, analysis-ready formats. Such a coordinated and collaborative effort across the Government could result in major efficiency improvements and usher in the foundation of a new range of applications using modern technologies. This approach could not only save lives during future disasters such as floods but also help put the State on a leadership path as freeing basic data in appropriate formats could in turn unleash a creativity revolution in the IT start-up sphere and the youth of Kerala, providing new types of knowledge services for its population.

3.4.2 Proposed Activities under a Kerala Open Data Initiative

1. **Create Public-Domain Content:** Identify and categorize existing data in each Agency to determine data that can be freed in the public domain. Facilitate relevant agencies to collate data, create/update basic datasets (e.g. through data creation workshops using Open Street Map, Google Earth, basic GIS, spreadsheets, etc.) and learn about options for how these can be sorted (e.g. those that can be in public domain and those for internal use), served, and accessed. A focused effort to remove inconsistencies in data pulled from different agencies (based on a predesigned and approved guidelines) would be taken up before making that available in public domain. The open content can include tabular data, geospatial data, visualizations, other data and multi-media documents.
2. **Evolve a comprehensive framework for the Open data project through stakeholder discussions:** These should cover the formulation of guidelines for data cleaning and removal of inconsistency, data visualisation and data use (product service development).
3. **Strengthen Open Online Analysis-Ready Services:** Facilitate the hosting of services and cataloguing of other relevant services from global, national, Kerala state, and other agencies. This could be implemented by strengthening the Kerala Spatial Data Infrastructure (KSDI) which has been started to host these kinds of services but currently does not do so in the public domain in appropriate analysis-ready formats using open data Application Programming Interfaces (APIs) and appropriate Open Geospatial Consortium (OGC) services. Attention also needs to be given to reduce restrictions in using the data (e.g. eliminating passwords, etc.) and using appropriate licensing (e.g. from Creative Commons) to make it truly open data and to encourage innovative uses. An example of an open data platform is the Malawi Spatial Data Platform MASDAP http://www.masdap.mw/ where you can access basic public-domain data across government agencies as thumbnails, online maps, downloadable GIS shapefiles, or as open online services.
4. **Application Development/Facilitation:** Develop a Kerala Data Visualization Platform (e.g. prototype http://spatialagent.org/Kerala/) to illustrate how public-domain data can be pulled in from services from several agencies. This can build on increasingly powerful global data from earth observation and global institutions that collate data from countries around the world, and also include data from

national, state, and other sources. These applications can take the form of web portals, mobile Apps, interactive e-books, and customized dashboards to support specific decisions at all levels. These applications could be developed both by government agencies (e.g. for coordinated reservoir operations, water resources planning, transport and urban planning, agricultural services, service monitoring, etc.) as well as by others. These applications could also move beyond data provision to include powerful new ways to analyse these data using models, cloud analytics, modern artificial intelligence solutions (e.g. machine learning, deep learning), and additionally make such analytics available in the public domain through this initiative through script repositories such as GitHub or other analytic APIs. The applications could borrow from a wide range of free data science libraries to allow for modern visualization of, and interaction with, complex data customized to be intuitive to support decisions.

5. **Outreach:** Develop a range of Kerala Open Data Apps through government and non-government initiatives, hackathons (e.g. through the Kerala Start-up Mission in IT), open data jams, e-book youth competitions and challenges, etc. These can be based on using the open data APIs and web services from the Kerala Open Data Initiative and the products developed (including interactive data visualizations and curated interactive content) can also be featured by the Kerala Open Data Initiative.

All this work can be phased to grow from some initial set of basic themes (e.g. climate, water, environment, disaster management, forest, landcover, infrastructure, etc.) to iteratively include more agencies, data, and more advanced analysis-ready services.

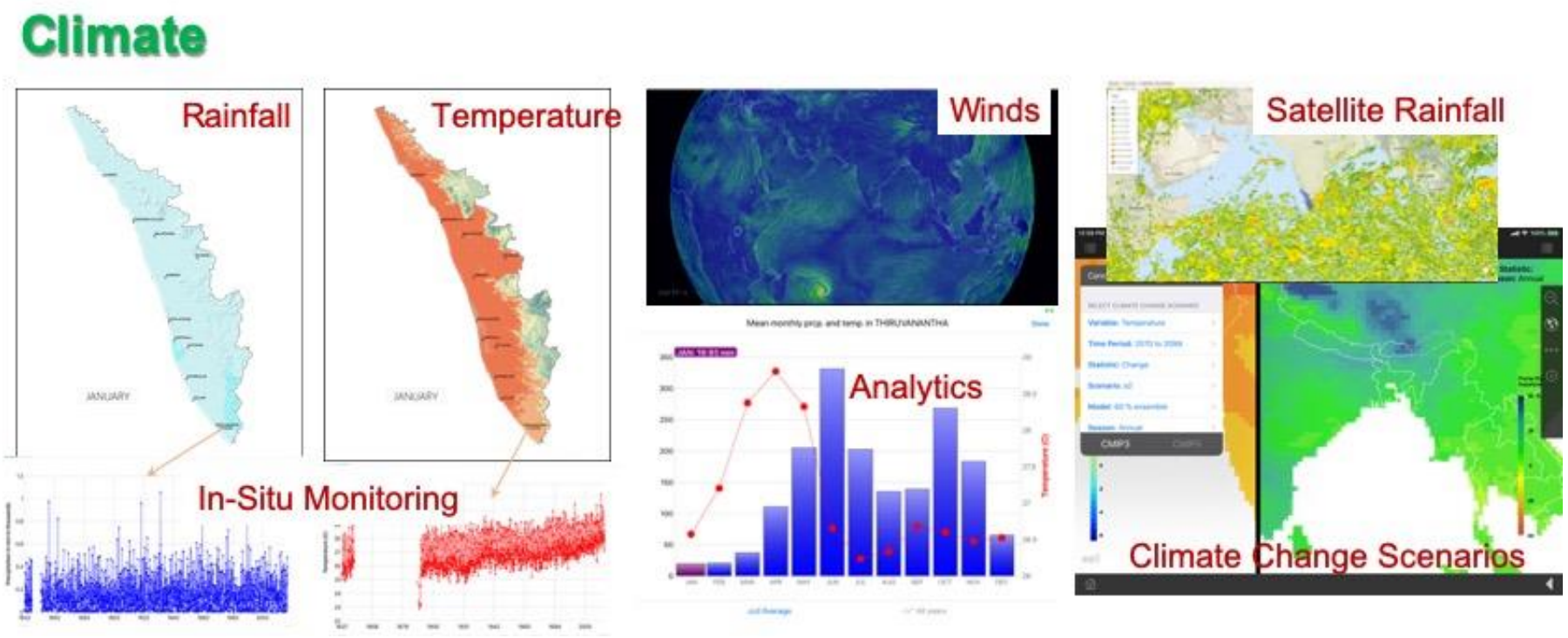
3.4.3 Benefits

This activity could be a critical part of RKI's activity in terms of moving the State to the level of 'global good practice' with results visible even in the first few months. A concerted effort across departments to truly embrace this concept with the appropriate safeguards (e.g. on privacy, data security), will allow Kerala to join the ranks of just a select few parts of the world (e.g. Ireland) that have become leaders in this field.

- Improve creation of, and access to, open, free public-domain data services:
    - Improved systematic cataloguing of available potentially-useful free data in the public domain from global (e.g. NASA, ESA, NOAA, ECMWF, UN, World Bank, etc.), national (e.g. India WaRIS, etc.), and state-level sources (incl. from government, academia, CSOs, private sector, etc.).
    - Facilitated creation of new critical data across themes of relevance to Kerala's sustainable development.
    - Improved access to these data as online Services in the public domain in analysis-ready open formats
    - Improved use of the data to generate information and knowledge to support decisions through analysis and visualization. Some examples:
    - Improved flood forecasting and early warning systems
    - Inputs to Decision Support Systems (DSS) for Integrated Basin/Watershed Planning
    - Inputs to real-time DSS for operation of water infrastructure (e.g. dams in a basin context)
- Improved technology for provision of a new range of modern government services especially as connectivity inevitably improves even beyond the current levels in the coming years. These could include the use of this open data and analytics foundation to spur the deployment of other "disruptive" technologies (e.g. incentivizing or using such data through blockchain enabled systems).
- Improved public awareness to critical issues and options. Improved transparency of the government and ability to build beneficial knowledge partnerships. Improved engagement of youth and diaspora to contribute to the State's welfare.

The Kerala Open Data Initiative supported by an appropriate Government Order, strategy, action plan, and initial resources could help bring about a quiet revolution in the State in terms of modernizing the way unfettered data can help connect institutions to solve current and future challenges, taking advantage of opportunities that are already present in the State.

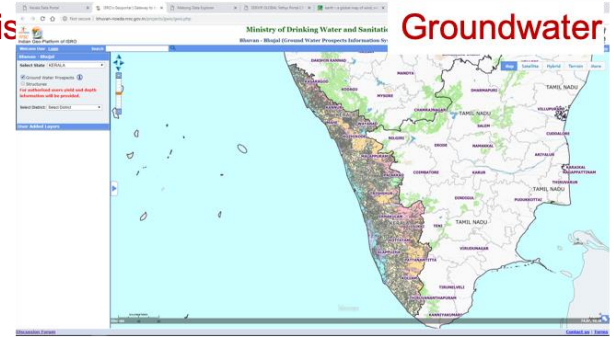
Figure 21: Types of Data



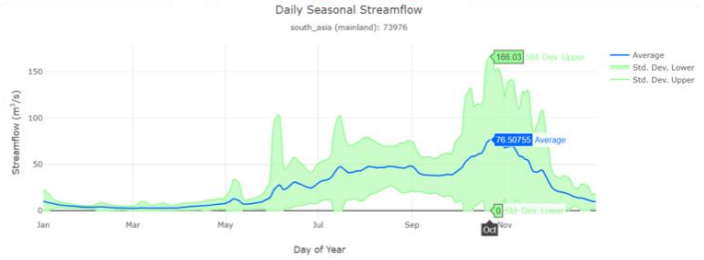
Water

Basin/Watershed Analysis

Groundwater

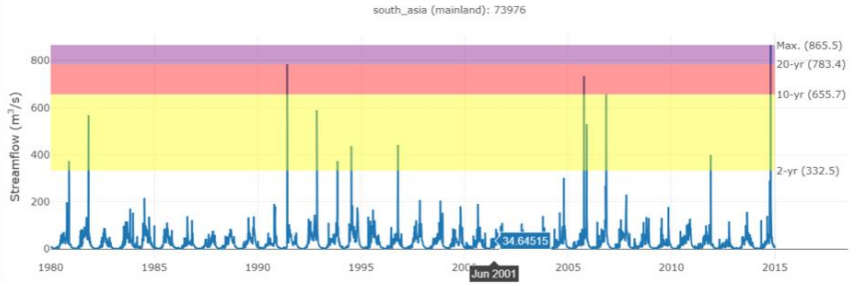


Hydrology Analytics

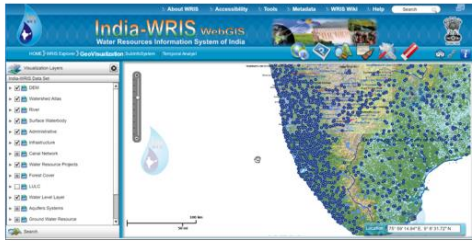


Reservoir Levels

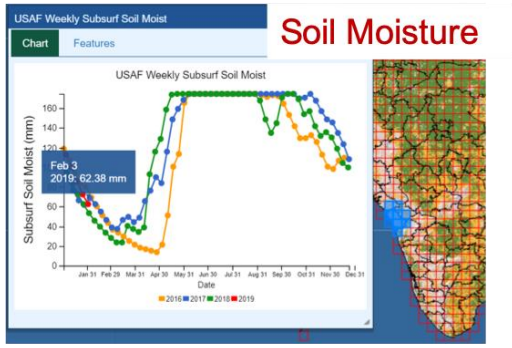
Historical Streamflows



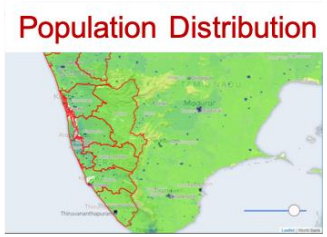
Water Infrastructure



Agriculture



Socio-economic



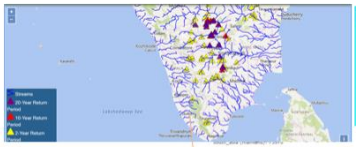
+ other Demography, Education, Occupations, Health, Gender, Vulnerable groups, Economic status, …

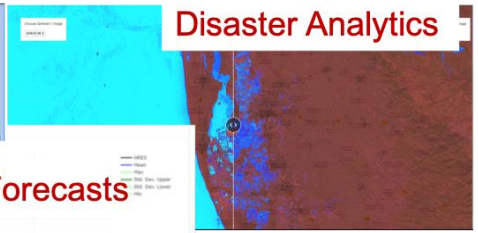
Environment

+ wetlands, coasts, water quality, air quality, dumpsites, toxics, soil health, biodiversity, ecological services, sand mining, aquifer health, etc.

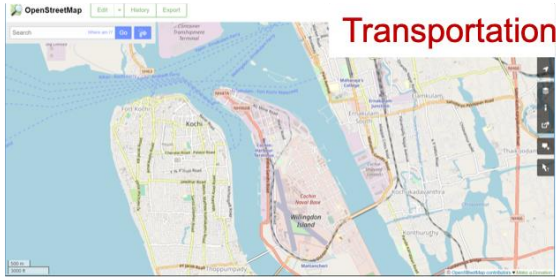
Disasters

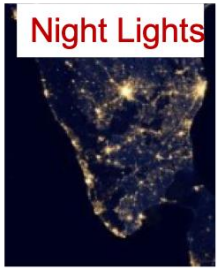
Disaster Hazard, Exposure, Risk

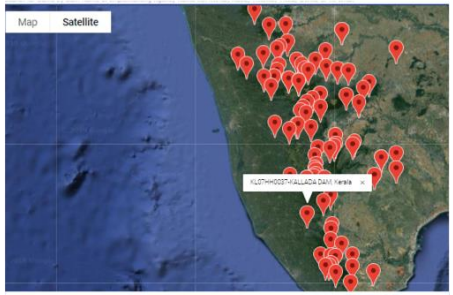




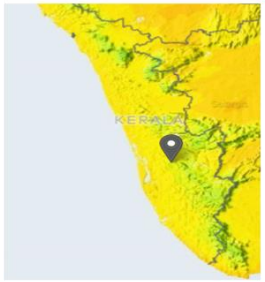
Infrastructure





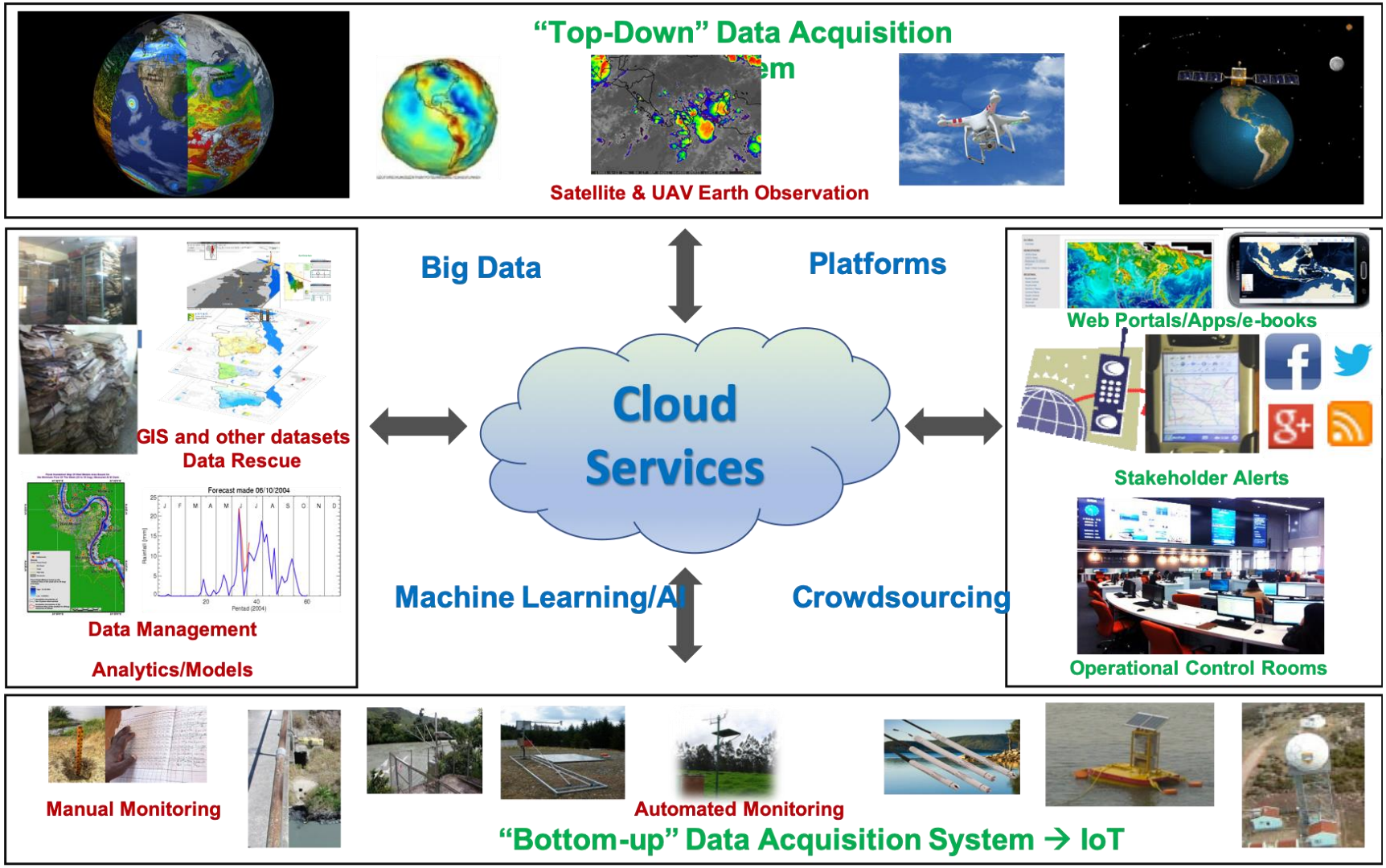


Dams & other Water/ Hydropower/ Irrigation Infrastructure



+ Water Supply, Sanitation, Wastewater Treatment, tourism, service centers, etc.

Figure 22: Kerala State Water Data and Analytics Centre



Chapter 4: Key Sector Priorities Under RKDP

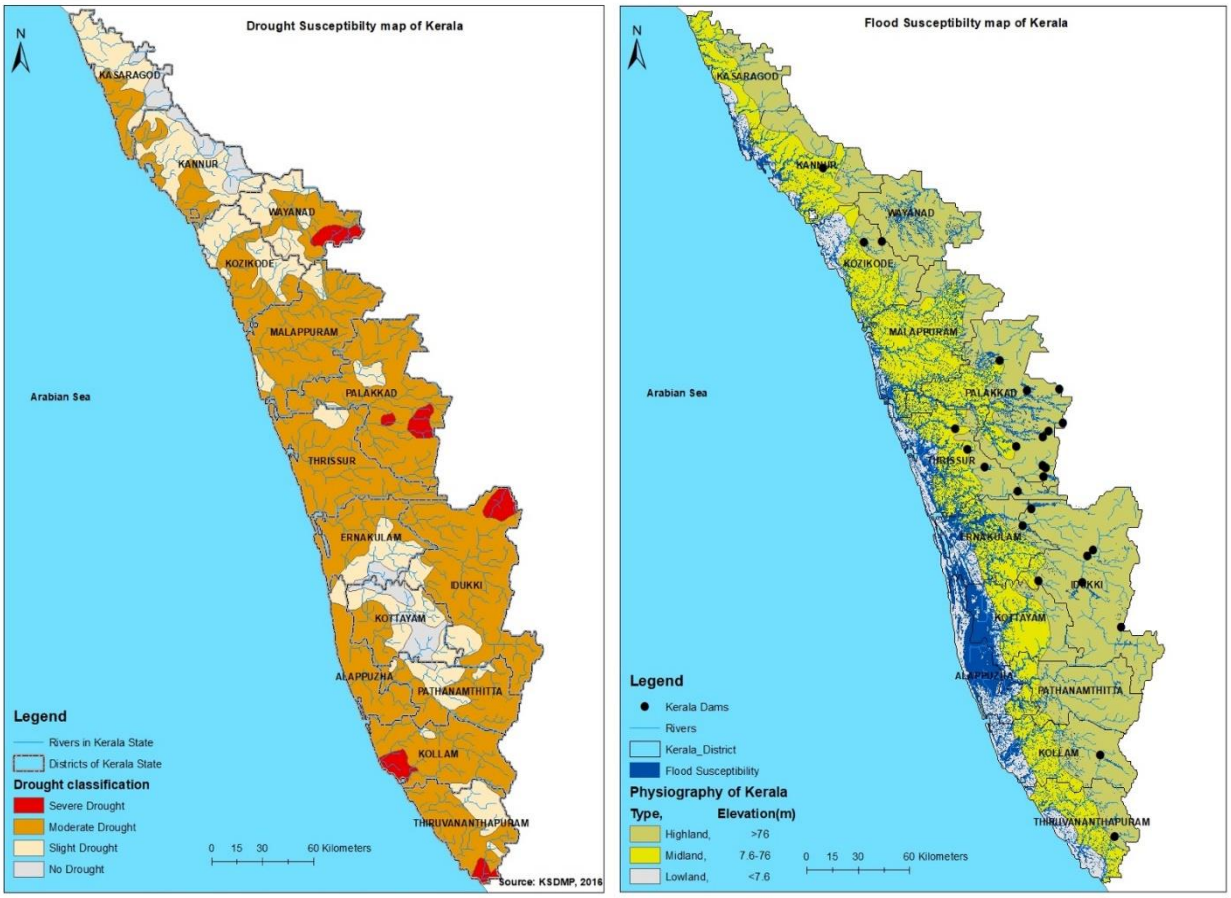
This chapter details areas of critical reform and investments across sectors and departments that have suffered the worst damage from the floods and where the impact on enhancing resilience will be most significant. The chapter is a deep-dive into the particular key sector priorities themselves; going into detail of the sector, how it was impacted by the floods, major legacy and current issues that hampered its rapid recovery, a proposed sector-specific approach to resilient rebuilding, specific interventions to support this approach, along with supplementary technical studies and assessments. Key sectors covered are Integrated Water Resource Management, Water Supply, Sanitation, Urban, Roads and Bridges, Transportation, Forestry, Agriculture, Animal Husbandry and Dairy Development, Fisheries, Livelihoods and Land.

4.1 Integrated Water Resource Management

4.1.1 Introduction

Kerala is blessed with rich endowment of water resources. It has a high average annual precipitation of approximately 3,000 mm and has 44 small and medium rivers, several lakes and ponds, a vast stream network, as well as many springs and extensive wetlands. However, this natural system of water resources varies both spatially and temporally, resulting in occasional floods and droughts, as shown in the figure on the next page. Within the same year, seasonal variation in rainfall is quite remarkable. The bulk of rainfall is received during the southwest monsoon, which typically sets in by June and extends up to September. The State also receives heavy rains during the northeast monsoon, from October to December. Approximately 90% of rainfall occurs during these six monsoon months. The high intensity storms during the monsoon months result in heavy discharges in all the rivers, while the prolonged dry seasons jeopardize farmers' incomes and people's livelihoods. Additionally, Kerala has a diverse topography ranging from the high ranges (Anamudi Peak at 2,695 meters) to midland and coastal plains and lowland areas near the coast that fall three meters below sea level, all within a 100-kilometer (km) distance. This combination of intense rainfall in the high ranges with a drastic elevation difference over a short distance causing peak runoffs, combined with flat terrain towards the western coast presents the conditions for flooding like that witnessed in August of 2018.

Figure 23: Significant areas of Kerala that experience climate risk



4.1.2 Impact of 2018 Floods

During the August 2018 flooding, irrigation canals and drains became heavily silted, canal banks collapsed, and many structures such as cross drains, sluice gates, weirs, check dams, diversion channels, etc., were damaged. The drainage systems in urban areas were blocked due to flood waters carrying heavy sediment load, compounded by local high intensity rainfall. Gushing waters spread deep into the habitations, aggravating the damages to public and private assets. Both inland and coastal protection structures were impacted, which caused salt water intrusion in the Vembanad Lake area.

In the case of hydraulic infrastructure, most of the damages occurred in smaller storage systems such as small dams, storage ponds, diversion channels, embankments, etc. No major damage was reported to large and medium dams. Nearly 200 storage ponds and 70 minor dams were damaged. Several gates are now either non-operational or experiencing severe leakage due to structural damage – such as ruptures in spillways, crevasses, sluice gates, etc. Approach roads leading to dams, site offices, and residential areas were also heavily damaged.

As suggested by the PDNA, recovery activities could include integrated water resources management (IWRM) embedded in a long-term vision laid down in Kerala's sustainable development planning. With IWRM in place it is possible to make proper plans for water safety and water security, based on actual and planned land-use, resulting in multiple basin plans. The integrated basin plans need to be based on sufficient and reliable data, and state-of-the-art hydrological models. The recovery process should break inter-sectoral barriers to establish a holistic and mutually-beneficial framework for coordination; and through doing so, identify best practices from various disciplines that encourage the creation of a healthy river ecosystem that is beneficial to communities, economies, and biological processes. This RKDP further develops on the suggested sector recovery activities proposed in the PDNA through further analysis of the root cause and through consultations with public and relevant stakeholders.

4.1.3 Major Legacy and Current Issues

Current drivers of 2018 Floods

The challenges presented by water resources in Kerala can either be mitigated or exacerbated based on how they are managed and developed. The severe damages incurred by the recent floods in Kerala are a consequence of inadequately managed water resources. For example:

- Poor watershed management in hilly areas and loose soil from land not covered by vegetation, loss of natural systems and flood plains along with the extraordinarily high intensity of rainfall over a very short period, contributed to the landslides in the hilly areas.
- The immense siltation of canals, drains, gates, etc. exemplifies the lack of proper land management.
- Poor land use planning over the last decades resulted in increased flood exposure. Vembanad Lake has been halved to less than 70 square miles over the last few decades and, with increased siltation, the lake's water-holding capacity has diminished by three-quarters. Similarly, the Kuttanad wetland has declined by two-thirds reducing capacity for moderating floods.
- Loss of flood plains accentuated the impact of flooding which exemplifies lack of master planning and inadequate attention to the role of nature-based solutions for flood mitigation — the areas where wetlands reclamation was most significant were also the ones to bear the severest of the impacts of the flood, which exemplifies poor land use and water resources planning.
- The massive volume of water released by the reservoirs systems highlighted the lack of coordinated operations and inadequate multipurpose storage capacity.
- Inadequate flood and landslide warning systems contributed to the loss of over 498 lives.
- Post flood sedimentation and unregulated disposal of solid waste in rivers resulted in a reduced carrying capacity and increased flood occurrence.

Although the recent flooding was produced naturally by the heavy monsoon rains, it was exacerbated by poor management of water resources. The lack of monitoring systems and inadequate institutional capacity limits the State's ability to anticipate, forecast, and respond to extreme events and leads to sub-optimal and ad hoc response, from one disaster/emergency to another.

Legacy challenges

The August 2018 floods have catalysed the State's commitment to improve water resources planning, development, and management to decrease its vulnerability to water-related risks. This presents a major opportunity for Kerala and its management of water resources to rebuild and reform in a more sustainable and resilient manner. To do so requires adopting multifaceted strategies and a range of actions that combine short-term measures for rapid recovery with medium to long-term measures to build in resilience.

Although the State offers great potential for development of water as an economic engine, it has substantial water resource management challenges that need to be systematically addressed to accelerate resilient development. The major challenges associated with water resources management in the State, many of which are mentioned in the Kerala Water Policy (2008) and were re-emphasized in the post-flood analysis, include the following:

Water storage and coordinated reservoir operation: Reservoir storage and release, flood control, hydropower production and utilization of available water has been site specific, reactive, and uncoordinated. This approach has not allowed for optimized benefits from the multiple uses that a properly-planned and managed storage would present. Storage in Kerala is also limited – reservoirs only have the capacity to store less than a tenth of the State's average annual rainfall.

Carrying capacity of major water systems: As noted above, for Vembanad Lake this is reported to have reduced to an abysmal 0.6 BCM from 2.4 BCM[69] as a result of land reclamation causing erosion in top soil from hills and upstream areas, and poor maintenance of existing storage and regulation infrastructure.[70]

Wetlands degradation: The numerous wetlands in the plains have come under threat due to entry of agricultural runoff causing eutrophication, and encroachment for various uses including constructions, disrupting the various ecological and economic services that these wetlands provide. Excessive withdrawal of groundwater in the plains is also reducing the inflows into the wetlands. The management of wetlands for sustainable fisheries, tourism, transportation, etc. is inadequate.

Poor Management of Hill Watersheds: Inadequate management of hilly-region watersheds has led to range of problems. High-intensity cultivation in this well populated zone has resulted in increased top soil erosion, to some extent increased the quantum of surface runoff and sediment yield and reduced infiltration, leading g to downstream flooding, and reduced groundwater discharge during lean season. The latter is critical to the of villages across the State relying on natural springs, rivulets, small watersheds as their primary source of water supply.

Deteriorating Surface water quality: Kerala has a very highly urbanized population. Many rivers in Kerala are highly polluted – above permissible limits – due to inflow of untreated domestic and industrial effluents, and agricultural runoff. Most industries and large towns/cities are located near the floodplains that are densely populated, and the capacity of wastewater treatment systems remains inadequate for treating the effluents from industries and city municipalities.

Groundwater use and quality: In the plains and also in the midland, groundwater extraction is rampant and unregulated both for agriculture activities and domestic uses, which is resulting in excessive seasonal

[69] July 2008 report of Planning Commission

[70] As an example, the damaged Thottappally spillway a leading channel1310 m long 365m wide with a bridge-cum-regulator across the spillway channel, with 40 vents, each having 7.6 m clear span. The original discharge capacity of the spillway is about 1812 cumec. The post flood assessment by a team of Central Water Commission (CWC) experts reported that the average maximum discharge passing through the spillway is limited now reduced to 630 cumec, which is almost 1/3rd of the design capacity of the spillway.

drawdowns, causing drinking water shortage during summer. Percolation of untreated waste water and other chemical pollutants and liquid effluents from septic tanks is contaminating groundwater. Seawater intrusion is occurring due to the uncoordinated withdrawal of fresh groundwater from coastal aquifers. Monitoring and treatment programs are needed to protect users of groundwater and the crops being irrigated. Although restrictions have been proposed by the central government to regulate extraction, enforcement is inadequate.

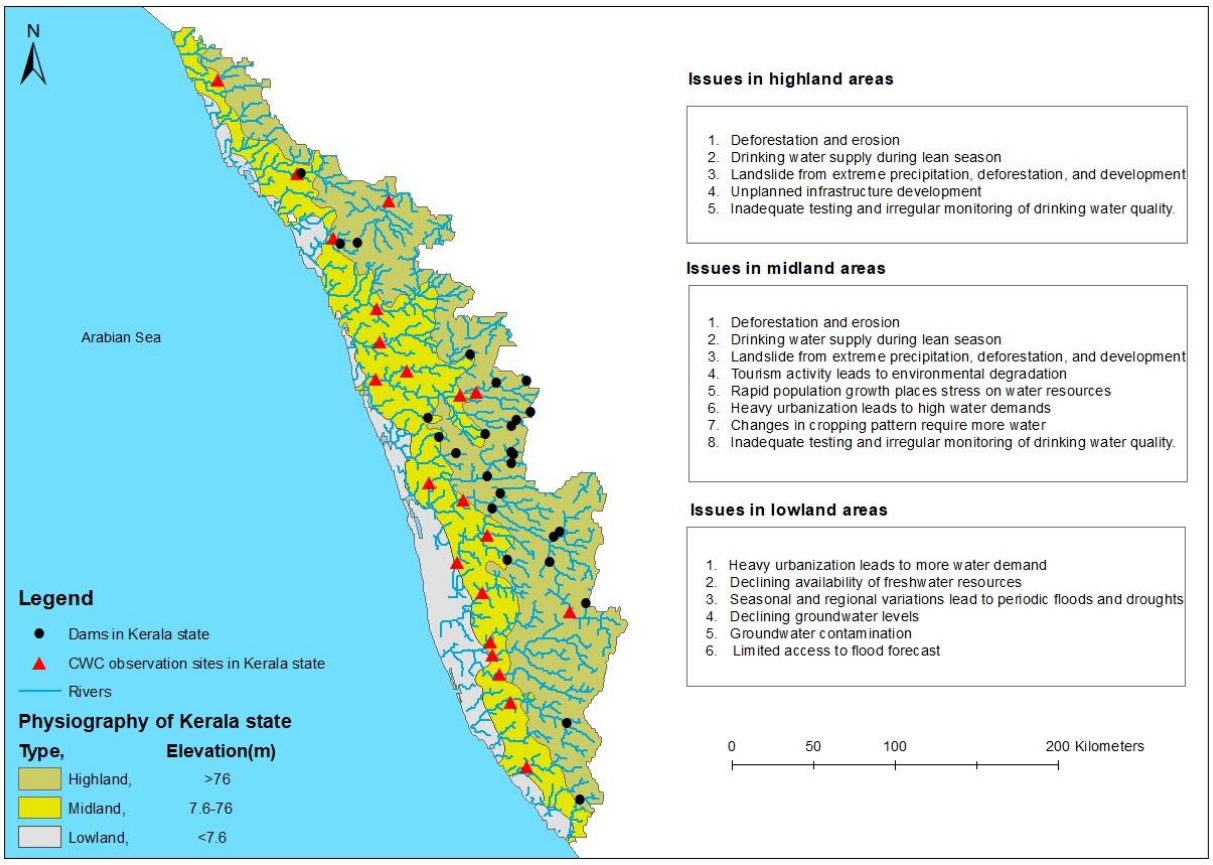
Sand quarrying: Unregulated sand quarrying in rivers and watersheds has led to bank erosion, lowering of the water table, and created other environmental problems.

Coastal erosion: Coastal erosion in Kerala has destroyed hundreds of homes, forcing families into temporary shelters, many of whom have been stuck there for several years now. Experts say a major factor for the erosion is, ironically, the series of seawalls built by authorities along the coastline to prevent the problem. The cyclical nature of the erosion has traditionally meant that sediment swept out to sea is later deposited back on land. But the seawalls prevent the latter from happening. Other factors have also been cited, including a 2017 cyclone, as well as intensive sand mining along the coast.

Climate change: Climate change could exacerbate Kerala's vulnerabilities, if business continues as usual. According to the Kerala State Action Plan on Climate Change (SAPCC), "…the country is highly vulnerable to climate change because of high physical exposure to climate related disasters (65% is drought prone,

12% is flood prone, 8% susceptible to cyclones) and also the India economy and population depends on climate sensitive sectors like agriculture, forests, tourism and fisheries." Kerala specific impacts include potential increase in variability in annual rainfalls and intensity of rainfall events, which could increase the risk of floods and droughts in the State, increased temperatures which could increase water requirements for crops, forests, and other vegetation, potential for increase in intensity and frequency of cyclones, etc. Geographically, Kerala roughly divides into three climatically distinct regions – the eastern highlands (rugged and cool mountainous terrain), the central midlands (rolling hills), and the western lowlands (coastal plains). Although there are some commonalities, the key challenges across these three regions vary as shown in the image on the following page.

Figure 24: Natural Resources Issues in Three Regions of Kerala



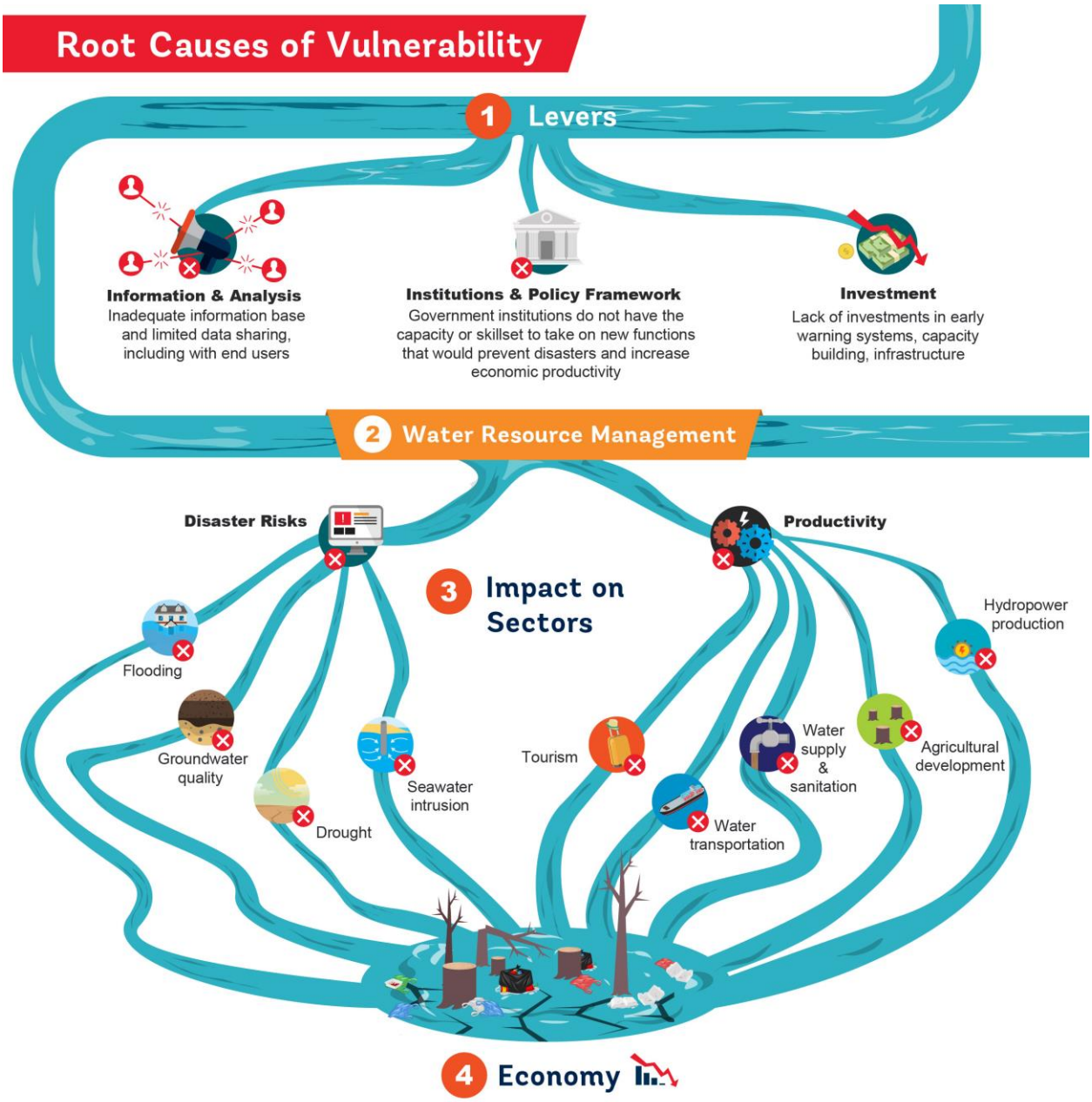
Overarching Challenges

In addition to the fragile natural resources system in Kerala, inadequate management of water resources and development also contributes to Kerala's inability to mitigate risks and make more productive use of water resources. Specifically, there are weakness in the three fundamental 'levers' or 'determinants' of water resource development and management, i.e.:

1. Institutions and Policy Framework – Low capacity of institutions, inadequate coordination amongst water-related institutions and between various wings of the Water Resources Department, and inefficiencies due to partial implementation of Kerala's Water Policy approved in 2008;
2. Information and Analysis – Inadequate hydrological data base, information systems, and tools for sound decision-making and to enable forecasting and early warning to trigger emergency response;
3. Investment Planning and Implementation – Inadequate investments in building resilient infrastructure, poor operation and maintenance of assets, contributing to economic losses across sectors during extreme events.

As shown in the figure following, the state of water resources development and management is a function of these three 'levers' or 'determinants' which combined, determine the resilience of the state to water-related risks and its ability to use water productively in various water-dependent sectors. This, in turn, leads to development outcomes in terms of economic growth and poverty reduction.

Figure 25: Root Causes of Vulnerability in Kerala



When there are weaknesses in these 'levers' or 'determinants' as is currently the case in Kerala, water resources cannot be planned, developed and managed in a sustainable manner. The first order impacts are seen in heightened disaster risks and other environmental problems, in addition to lost opportunities for growth in the numerous sectors that are dependent on water resources. Ultimately, economic growth is jeopardized. It is the inadequacies in these three areas – Information and Analysis, Institutions and Policy Framework, and Investment Planning and Implementation – that contributed to the disastrous consequences of the 2018 floods. Addressing these areas will help Kerala better prepare for future water-related disasters. The current challenges in each of these areas are described below.

Institutions and Policy Framework

An enabling institutional and policy framework with supporting legal regimes and adequate enforcement is required for integrated management of water resources. The institutional and governance framework for water resources management has evolved over time in response to the growing challenges in the sector. A decade ago, the government adopted integrated water resource management (IWRM) as the basis for water resources planning, development, and management. However, the sound Water Policy (2008), which mandates this approach, has not been fully implemented. The objectives of the policy were to adopt an integrated and multi-sectoral approach for planning, development and management of water resources. The policy calls for using river basins as the basis for planning and emphasized the importance of comprehensive watershed and water quality management, as well as the establishment of evidence-based planning and monitoring systems to enable appropriate institutional mechanisms and legal measures for sustainable water resources.

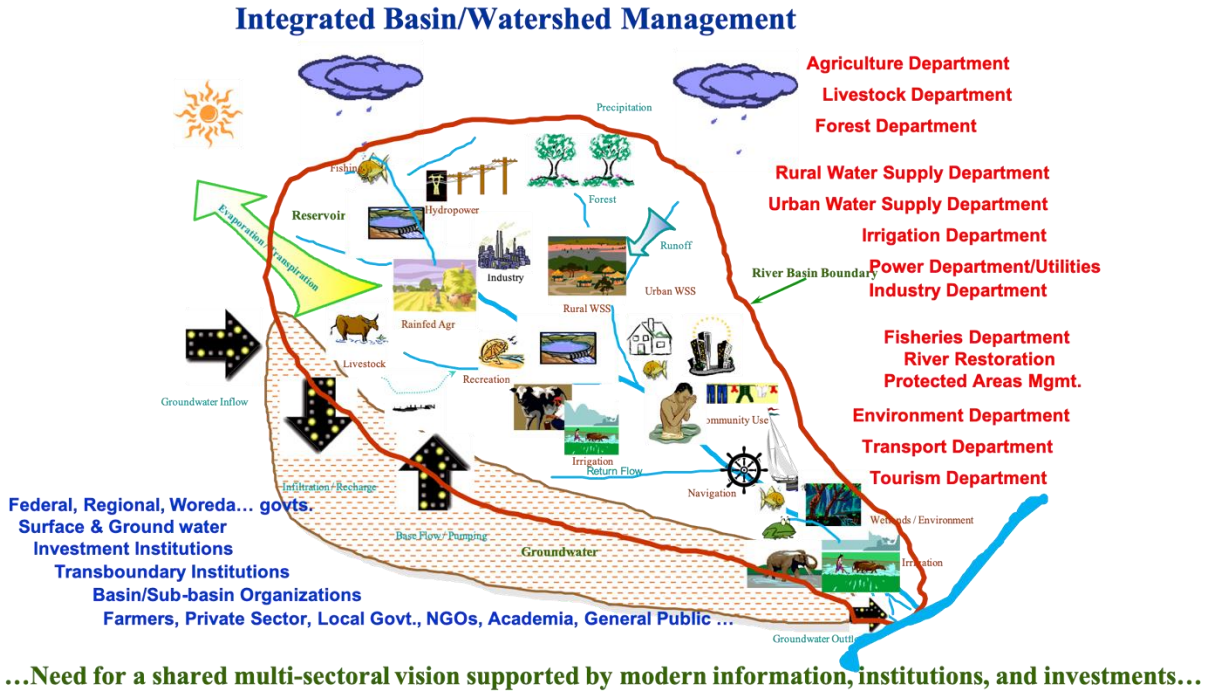
The agencies at the national level that are relevant to water resources management in Kerala include:

- The Indian Meteorological Department (for weather monitoring and forecasting)
- The Central Water Commission (for national hydrology standards, centrally-monitored flow/level data and official flood forecasts)
- The Central Ground Water Board (for collecting and validating data on groundwater levels and groundwater quality)
- The National Remote Sensing Center (for improving access to earth observation products and potential aerial digital elevation model (DEM) creation for low-lying areas)
- The Survey of India (for survey products including UAV-based DEM generation
- Central Pollution Control Boards (for pollution data and management guidance)
- National programs such as the PMKSY that integrated other programs and that finance irrigation and watershed management activities.
- At the state-level, there is a complex array of agencies responsible for water resources management including:
- Water Resources Department (still primarily focused on irrigation and projects)
- Kerala Water Authority (for water supply)
- Kerala State Electricity Board (operating hydropower dams that account for most of the dams in the State)
- Centre for Water Resources Development and Management CWRDM (that reports to the Kerala State Council for Science, Technology, and Environment)
- Kerala State Disaster Management Authority (to manage disasters such as floods)
- Other agencies that play a role, including the Kerala State Remote Sensing and Environment Center, Kerala Agriculture Department, Kerala State Pollution Control Board, and other institutions at State, District, Village and community-levels.

The principles established in the Kerala Water Policy have not been fully adopted. The implementation of the policy is faced with many challenges. There are institutional inadequacies due to the way agencies are created and structured for managing water. The multiplicity of line agencies engaged in the water sector are operating largely in isolation in sectoral (irrigation, drinking water supply, industrial water supply) and fragmented manner without taking cognizance of the interaction between the resources (groundwater, surface water) and the sectors (irrigation, municipal water supply, hydropower, environment) they deal with, and without considering the potential for co-sharing of benefits with a cross sectoral approach results in sub-optimal performance of the sectors and agencies. The approach of the agencies is largely 'supply oriented', with no attention being paid to water demand management. These apart, there are issues of the same agency performing multiplicity of functions. For instance, water resource assessment, water resource planning & water development activities are undertaken by the State WRD. This involves trade-offs. The WRD also undertakes flood control services along with irrigation, which act at cross purposes. Similarly, the State Pollution Control Board, while undertaking water quality monitoring of rivers and other aquatic resources, is also responsible for pollution control with inherent trade-offs. This reduce the effectiveness of these agencies. Yet there are certain crucial areas of water management that are left out-management of catchments, environmental flows in rivers, overall water resources management, developing early warning system for floods.

Overall, with so complex an institutional structure, a multisectoral and cross-institutional approach to planning, development, and management of water resources, which straddles sectors, presents a particular challenge. In addition, water resources agencies lack the human and financial resources to take on the massive tasks established in the Kerala Water Policy. Some such potential major capacity gaps are in the following areas: catchment hydrology; water economics; environmental hydrology; computational hydraulics, including flood forecasting and inundation mapping; dam safety; early warning system for floods; reservoir sedimentation, and institutional economics. In general, there is a need to significantly strengthen the capacities of water-related agencies as indicated above, including WRD, KWA, KRSSA, KSEB, KSPCB, and other state agencies. As noted in the Kerala Water Policy (2008), "technical support for integrated water resources planning at the level of Local Self Governments is grossly inadequate."

Figure 26: Illustrative Diagram of the Multiple Stakeholders in Kerala River Basins



…Need for a shared multi-sectoral vision supported by modern information, institutions, and investments…

Information and Analysis

Across all water-related departments, evidence-based planning and management needs to be strengthened. Fundamental to this is reliable, accurate, and accessible water information system as "you cannot manage what you cannot measure." High-quality and timely availability of and access to water data are the foundation of sound planning and decision making. But Kerala currently confronts several challenges on this front. There is limited availability of data at the level of meso- and micro-catchments due to an inadequate hydro-met system, including lack of sampling stations, low density of gauges, broken equipment, etc. This leads to poor quality data that is not sufficient for sound decision making.

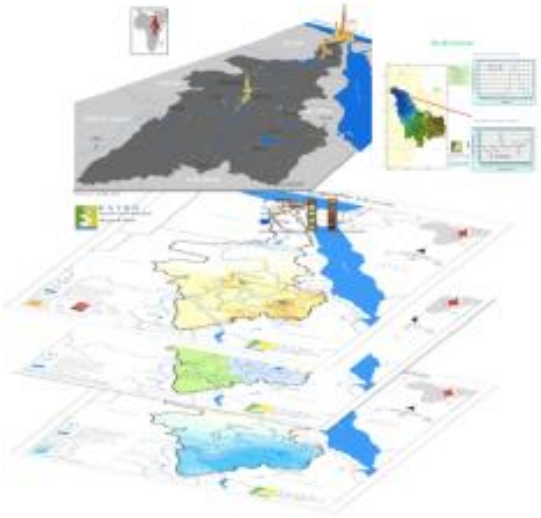


Figure 27: Modernizing Institutional Infrastructure

The State is endowed with a large number of perennial rivers, but there are very few river gauging sites, which have long duration time series data, a prerequisite for hydrological analysis such as assessment of surface water potential, flood frequency analysis, sedimentation studies, groundwater-surface water interactions, etc. Further real-time monitoring of river discharge and stages is required for flood forecasting.

Kerala has witnessed significant alterations in hydrology during the past 4 to 5 decades. The land use in the State has undergone remarkable change not only in the upper hilly, forested catchments but also in the midland and plains, with plantation crops like rubber replacing natural vegetation in the upper catchment, and coconut and banana replacing paddy in the midland and coastal plains. This had a major impact on the hydrology of rivers, especially on the surface runoff, base flow, flow regimes, the flood absorption capacity of the river basins, and sediment load in the river water. However, there is limited information on the impact of land use changes on catchments and basin hydrology.

A significant part of the flows in Kerala's perennial rivers during summer period, which is a major source of water for drinking water supplies, is due to groundwater discharge into the streams during the lean season. A large proportion of the water which infiltrates underground during the monsoon comes out as stream flows downstream. But there is hardly any research contributing to the knowledge on groundwater-surface water interactions in river basins of Kerala. Most artificial recharge schemes in the hilly areas are planned without taking this factor into account.

An equally challenging problem is the limited accessibility of data, which does not allow agencies to access information for planning and management of water resources. This is due to several factors, including inadequate information systems and restrictions to data. Available data are scattered across several agencies (e.g., Irrigation Department, CWRDM, KSEB, EOC, etc.) and often access to data is restricted, hampering sharing of information across agencies. Without available and widely accessible data, it is simply not possible to properly manage and develop water resources in the State.

Overall, there is a lack of detailed information on water resources conditions that is required for scientific analysis to properly manage water resources and plan measures to make more productive use of water in various water-dependent sectors (agriculture, energy, tourism, water transport/navigation, etc.) and mitigated water-related risks (floods, droughts, sediment, etc.). Regular collection and analysis of data relating dynamics of floods, erosion, sedimentation is required to analyse the potential impacts and to support forecasts / predictions. Improved information management systems are needed to assimilate, triangulate and process data for this purpose.

Investment Planning and Implementation

The objective of adopting an integrated and multi-sectoral approach for planning, development, and management of water resources using the river basin as the basic unit as stipulated in the Kerala Water Policy (2008) is yet to materialize. Multiple investment plans have been and are being made by various agencies, but these are not yet consolidated, jointly analysed, or integrated, in large part due to the segmented approach mentioned above. Cross-departmental shared-vision planning and coordinated operations using appropriate knowledge base, analytical tools, and multi-stakeholder perspectives accounting for all potential uses of water and water-related risks is needed. For example, well planned and designed multi-purpose storage projects could generate multiple benefits, including generating power, flood cushioning, increasing water security for irrigation and drinking water, and offering opportunities for aquaculture.

Amongst the challenges related to investments are the following:

- Need for integrated water resources management to unlock the development potential of water resources, including making more productive use for various purposes (hydropower, agriculture, fisheries, energy, domestic needs) and reducing water- related risks and vulnerability of the State to floods, erosion, sedimentation, environmental water stress and pollution.
- Inadequate analysis of water availability and use patterns, current and future, and with respect to the vagaries of changes in weather/climate year-on-year – required for proper water resources planning and management
- Limited understanding of the interaction between surface and groundwater management, and limited application of measures for improved conjunctive use to ensure water availability for meeting various uses.
- Inadequate understanding of several issues does not allow sound investment planning, including:
    - The vulnerability of agriculture, aquamarine life, and navigation to low-flows.
    - Damages to lives, assets, livelihoods from various flooding/heavy rainfall patterns.
    - How much micro-hydropower (run of the river or water channels with minor diversions) could be generated and connected to the grid and / or made available for use in local areas.

- How reservoirs should be operated to maximize multiple benefits of water – hydropower generation, flood control, irrigation and water supply, fisheries, and environmental flows.
- Re-orienting the current supply side orientation towards demand management.

Additionally, investment programs supporting locally distributed storage are needed to improve the flood cushioning capacity of the river basins. The disastrous impacts of the recent floods and historic episodes of droughts stressed the importance of improved watershed management for maintenance of reliable water sources—a low-cost high-reward investment. Lakhs of hectares of irrigable lands could be developed increasing agricultural production across multiple cropping seasons and reducing poverty levels. Reviving inland water transport presents a major opportunity but requires addressing current carrying capacities of rivers that have been silted, amongst other measures. Other measures that should be explored include:

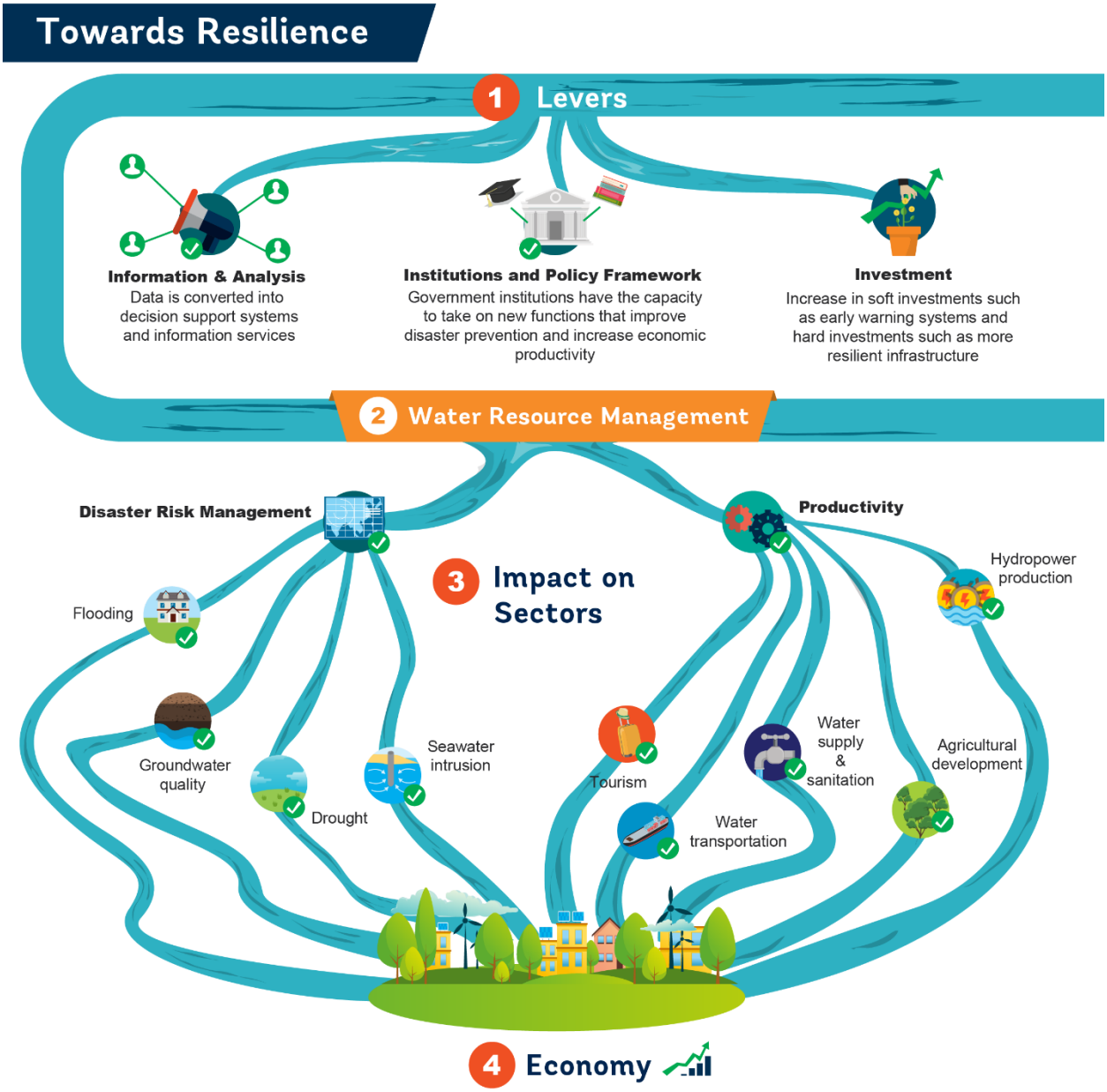
- The utility of water storage systems (ponds, wells, tanks) during periods of water shortages (non-rainy seasons) and augmenting storage by recycling grey water;
- Using canals to store flood waters by appropriately regulating the flow when water is not required;
- Developing customized Bandharas for water storage;
- Bringing abandoned rock quarries that have the potential to store large amounts of water during summer months under the State's storage network; and
- Above all, measures related to living-with-nature, restoration of wetlands, and maintenance of flood plains should also be central to improving the State's ability to respond to future disasters and improve adaptive capacity to projected climate change.

The investment needs in the sector are substantial, and public financing alone is insufficient. Mobilizing private finance for water is critical for filling the gap, requiring a major coordinated effort. A framework for financing of the sector is needed, which requires developing a multiyear programme to prepare and launch projects for public-private partnerships; work with stakeholders to prepare them to access commercial finance; implement actions to boost capital mobilization. Strategic investments for water irrigation expansion, hydropower development, and flood protection could be pursued as part of this framework.

4.1.4 Proposed Approach to Resilient Rebuilding

Water resources management in Kerala presents an opportunity as much as a challenge. To address the challenges discussed above and unlock the potential, there need to be simultaneous actions to improve the three 'levers' or 'determinants' of: (i) Information and Analysis, (ii) Institutions and Policy Framework, and (iii) Investment Planning and Implementation. The specific actions that need to be taken are described below. With these in place, the root causes of Kerala's current vulnerabilities would be addressed, and the State would build resilience. As shown in the figure below, improving the three 'levers' or 'determinants will contribute both to better managing disaster risks and to using water more productively, which, in turn, will lead to improved outcomes for economic growth.

Figure 28: Towards a Resilient Kerala



4.1.5 Specific Interventions

The key interventions to address these challenges and contribute to sectoral resilience are as follows:

Table 12: Water Resource Management Institutions and Policy Framework

Actions	Description
Institutional reforms for improved water resources management	Defining roles and responsibilities of various actors and mechanisms for improved coordination; Restructuring WRD by basin groups to facilitate implementation of Water Policy for improved water resources management operations; Improving planning and operational coordination across agencies including the WRD, KSEB, KSDMA, agriculture, fisheries, animal husbandry and transport sectors; Assessing the institutional capacity building needs of the water sector, including institutional reforms, organizational restructuring and human resource development. Evolving the institutional design principles to be followed for creating new institutions for water resources management and basin-wide water development and use regulation such as the river basin authority; the overall institutional structures for integrated water resources management at the river basin level; define the key functions of various agencies in the new institutional set up. A clear distinction between water resources management and water allocation functions which RBMA should carry out, and the water-related services The current practice of multiple agencies performing similar functions in the water resources sector of the State and same agency performing multiple functions which reduce institutional effectiveness needs to be avoided to improve transparency and accountability. Representation from LSGs should be ensured in River Basin Management Authority. Implementing measures to improve coordination with national level agencies Establishing a state level command centre for integrated and effective coordination of operation of all reservoirs in the State
Capacity building	Developing capacity building programme for WRD staff and other relevant stakeholders; and Collaborating with other river basin management organizations, CWRDM, universities and other research organizations for knowledge acquisition and application in planning and investments.

Actions	Description
Policy framework	Implementing actions detailed in the Water Policy (2008) Setting water resources management objectives Establishing effective quality and quantity regulation and allocation regimes; Providing incentives for improved watershed management, detention storage, water quality, etc. Framing policies relating to supply and pricing in irrigation, domestic water supply and energy sectors that encourage efficient use of water and energy resources, and promote improved financial working of water and power sector, and resource conservation.

Table 13: Water Resource Management Information and Analysis

Actions	Description
Information Analysis	Improving data acquisition and knowledge management systems, including reliable monitoring systems (water level, water quality, water use) with adequate spatial and temporal coverage; Establishing Kerala Water Resources Management Information System in RBMA with interface with other systems under CWRDM, EoC, WRIS, etc.; Developing modern management information systems (MIS) for mapping and application of spatial and non-spatial data for analysis planning investments and disaster risk reduction/mitigation activities; Establishing decision-support systems for planning investments and monitoring real-time operations; and Improving availability of open, public-domain data and analytical tools (including cloud analytics) for water resources planning and management
Strengthening Knowledge base	Conducting targeted technical studies, including hydrological and geo-morphological assessments of river basins and aquifers, river carrying capacity, impact of land use change on basin hydrology and river flood discharge; sediment loads, groundwater-surface water interactions, especially impact of groundwater intensive use on lean season flows, assessment of environmental flows; possible reduction in groundwater overdraft through adoption of efficient irrigation of plantation crops Assessing water storage capacity of dams, lakes, wetlands and other bodies in the State; Assessing the impact of climate change on water resources; Developing master plans for Kuttanad, and other critical flood plains; and

	Developing basin / catchment management plans
Facilitating knowledge sharing among various stakeholders in Kerala	Establishing ICT data pooling and access systems with hierarchical data access protocols for government agencies and public; Disseminating data and information for research by external stakeholders; and Establishing mechanisms for improved institutional cooperation with other RBMAs for exchange of information and best practice

Table 14: Water Resources Investment Planning and Implementation

Actions	Description
Investment planning	Integrating investment plans across sectors linked to water resources, including identify gaps and overlaps in investments by various agencies and harmonizing / rationalizing / coordinating planning and implementation; Exploring convergence of resources for higher economic returns on investments; and Identifying prioritizing, sequencing and designing basin /sub-basin investments.
Implementing investments	Targeting investments for improved flood management, multi-purpose dams and locally distributed storage, irrigation development, watershed management wetlands rejuvenation, etc. Integrating reservoir operations systems for improved management and use of water.

Financing Strategy: A cross cutting issue is the need for a financing strategy for the sector. Revenue policy needs to be brought in line with the water management policy and fiscal objectives. As indicated in the Water Policy (2008), revenue policy in the water sector can be designed to promote efficiency and to protect natural resources and enhance their value in use, as well as to generate fiscal resources. This approach could apply to water charges. For example, irrigation water pricing will provide the incentive to value and better conserve water, while also providing the finances to secure key operations and maintenance functions such as dam operation and safety and irrigation water services. The policy could also apply to pollution charges, with higher charges and efficient regulation deterring harmful behaviour and raising resources for environmental protection. Overall, this approach would provide the enabling conditions for an incentive framework that better aligns policy and fiscal objectives to drive best management practices.

Based on the above needs assessment, specific interventions should be implemented in the following areas:

Basin Investment Planning

Decision Support Framework for Integrated Basin Investment Planning -

- Compile water data, hydrological, geo-morphological and sedimentation data into a GIS-based information system to consolidate information, interface it with other systems to improve data analytics and application of results, access to information in the public domain on hierarchical basis for research and development activities.
- Undertake studies to develop the following: adequate knowledge of catchment hydrology--runoff coefficients & base flow coefficients for different magnitudes of rainfall; changes in Maximum Probable Floods of different river basins in the wake of changing land use, and implications for reservoir operations/spillway design;
- Groundwater-surface water interactions--particularly the impact of reducing paddy area on groundwater recharge and the impact of groundwater over-draft on lean season flows
- The extent of reduction in groundwater draft possible through efficient irrigation technologies; impact of land use change on flood absorption.
- Undertake special studies to develop flood, drought, and landslide hazard, exposure, and risk maps, climate resilience, green and grey infrastructure integration, wetlands and riparian vegetation, coastal zone management, water quality, aquifer management, watershed management, river rejuvenation, riverfront development, land-use management, inland water navigation, sand mining, saline water intrusion, etc., in addition to Environmental Flow and Dam Safety assessments (indicated below).
- Develop a detailed and robust analytical/modelling framework for basin planning and management.
- Mapping of all the stakeholders of water and other natural resources in the highlands, midlands and coastal plains of major river basins to understand how the actions and interests of different water users within the basin are interconnected need to be understood for integrated water resources management planning at the basin level.
- Develop integrated basin/catchment management plans, using scenario analysis and incorporating environmental flow assessment (refer below) to identify, prioritize and sequence future investments. These should be developed with a combination of appropriate broad-based analytical and stakeholder inputs.

Environmental Flow Assessment

- Conduct multi-scale environmental flow assessments.
- Conduct basin-wide analysis of flow regime (using a range of ecologically relevant flow variables and statistics) at critical reaches.
- Analyse implications of flow regimes on habitat, river geo-morphology, water quality, river ecology, and socioeconomic, cultural and spiritual values.

Dam Safety

- Prepare Emergency Action Plans (EAP)
- Conduct Dam Break Analyses

Basin Investment Operation

Real-Time Decision Support Systems (RTDSS) for Flood Forecasting and Early Warning

- Develop real-time monitoring, flood forecasting and early warning systems.
- Improve systems for collection and dissemination of information on near real time basis.
- Build capacity at multiple levels to better use information.

Integrated Operation of System

- Develop systems for real-time monitoring, long-lead streamflow forecasting and integrated reservoir operation system as part of the Operational DSS.
- Review and update operation guidelines and polices for integrated reservoir management.
- Establish Central Command Centre for integrated reservoir operation system in line with Dam Safety Bill (pending).
- Conduct integrated operation analysis of the entire river systems and impacts of proposed interventions and their hydrological effects in the basin area.

Institutional and Policy Reforms and Strengthening

- Thoroughly review existing institutional frameworks, policies and regulations, and make appropriate changes so as to improve climate resilience, water productivity, ecological benefits, and other social, environmental, and economic aspects of water resources management.
- Creating the River Basin Management Authority (RBMA) as a separate agency to regulate water resources development and use across the river basins and to perform water resources management functions. The authority will also ensure intersectoral cooperation, resolving conflicts. The role of existing line agencies in the water sector of the State need to be redefined vis-à-vis the newly created River Basin Management Authority.
- Improve provision of relevant water resources related data in free, public-domain, analysis-ready formats. Convert appropriate available data to analysis-ready open data services, include relevant earth observation data, use appropriate analyzation and visualization tools, and promote access through appropriate apps, portals, and other platforms.
- Improve asset management system for water infrastructure
- Improve capacity to undertake and review environmental and social assessments for new water-related investments based on appropriate data, tools, and effective stakeholder consultations.
- Set up state-of-the-art water centre to promote modern, multi-sectoral water resources planning and management across agencies (incl. deputation from all relevant water related agencies, internships, training programs, data integration, analytics, applied research, coordination, etc.)

Training and Capacity Building

- Develop training modules, materials, guidelines, etc. tailored to stakeholders needs. Improve links to global and national good practices.
- Carry out awareness-building, analytical and participatory planning, technical training, short courses, internships, visiting experts, staff exchanges, etc. for relevant staff and other stakeholders
- Design and implement mass public awareness programme, outreach and crowdsourcing activities.

Facilitating Knowledge Sharing in Water Resources

Based on the above assessment and discussions with relevant line departments, immediate time-bound interventions / activities to make more productive use of water resources and mitigate water-related risks are provided below. These include cross-sectoral linkages to achieve optimal results and utilize resources more efficiently.

Table 15: Water Resources Management Actions and Results Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Policy /Regulatory				
Approve regulation / Act to establish River Basin Management Authority	X			River Basin Management Authority established.
Operationalize River Basin Management Authority (RBMA) in line Water Policy (2008) and the River Basin Authority Act (pending).		X		Basin-wide water resources management and regulation of development and use of water by various sectors Improved quality, efficiency, transparency, and accountability in delivering water and related services An umbrella for Dam Safety Organization, Wetland Management Authority, Water Policy and Planning Management, and data systems management Central Command Centre for dam operations established
Strategy for mobilizing financial resources for sector development and fund allocation.	X			Implementation of Article 2.13 of Water Policy (2008).

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
				Volumetric measurement of water consumption for tariff collection. Cost recovery for operation and maintenance of service provision Financial resource for management of water sector
Preparation of water management plan (to improve rain water harvesting, storm water recycling, ground water recharge etc.) by ULBs to combat drought.				
Institutional				
Establish and staff the water monitoring unit for management and operationalization of a real time data acquisition system for comprehensive monitoring of water and environment.	X			Implementation of article 2.10 of Water Policy (2008) Data generated made available and accessible to the public. Mechanisms for data pooling and sharing across agencies. Develop River Basin Planning Decision Support System and sub-basin plans. Establishment of Kerala Water Resources Management Information System in RBMA with interface with other systems under CWRDM, EoC, WRIS, etc.
Establishment and staffing of water research, planning, and strategic studies	X			Implementation of Article 2.4 of Water Policy (2008)

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
				State level master plan for WRM Analytical/ modelling framework established for surface and groundwater management, including analysis of e-flows, surface-groundwater interaction, etc. Established action plan for institutional strengthening, reforms and capacity building of technical cadres across all water related agencies Integrated Master Plan for Kuttanad and integrated basin / catchment management plans.
Strengthen the Dam Safety Authority with clear roles and responsibilities				Implementation of Article 2.3 on Water Policy (2008)
Reorganize Department of Irrigation around river basins and define their relationship with the newly created RBMA	X			
Investments Planning				
Real-Time Data Acquisition and Decision Support Systems for water management. Development of early warning systems for floods	X			
Investment plans and for priority river basins.		X		
Prepare priority investments (with adequate attention to technical, environmental, social, economic,				

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
financial, and institutional aspects) based on integrated basin plans				

4.1.6 Technical Studies and Assessments

The list of studies to be carried out to support the above policy, institutional and investment activities is given below:

Table 16: Technical Studies and Assessments

	0-6 months	0-18 months	18 months & beyond
Policy / Regulatory			
Conduct detailed assessment of existing institutional frameworks, policies and regulations and provide recommendations of reforms required	X		
Institutional			
Review and provide recommendations for institutional strengthening and reforms (institutional structures, key functions of various agencies, etc.) as well as capacity building of technical cadres across all water related agencies. Design modern information system (using modern spatial and data visualization tools and online services) to consolidate information, interface it with other systems to improve data analytics, visualization, and use. Provide access to information in the public domain on hierarchical basis for research and development activities, and general information for raising public awareness Identify the ways to operationalize the concept of IWRM	X X		
Technical			
Develop analytical/modelling framework for basin planning and management that includes: Maximum Probable Floods of different river basins due to changing land use and other factors, and implications for reservoir operations/spillway design; impact of reduction in paddy on groundwater recharge and groundwater intensive use on lean season flows; and impact of	X		

change in land use on flood absorption capacity of river basins; etc. Conduct studies on catchment hydrology—relationship between rainfall and runoff coefficients, and rainfall -base flow coefficient at different magnitudes of rainfall Undertake environmental flow assessments, analysis of flow regimes at critical reaches on a basin-wide basis, implications of flow regimes on hydraulic habitat, river geomorphology, water quality, river ecology, and socioeconomic, cultural and spiritual values Conduct Dam Break Analysis and prepare Emergency Action Plans (EAP).			
Investments			
Develop short term priority investment programme with implementation action plan (tentative list of proposed investments attached, and feasibility studies will be developed at a later stage) Undertake integrated investment planning on priority basins to identify medium to longer term investments across multiple water-related sectors (including WSS, agriculture, hydropower, tourism, disaster risk management, etc.) Formulation of guidelines on the structure, functions and framework for monitoring of the proposed River Basin Management Authority (RBMA) Prepare the policy framework for the protection and coordinated management of various surface water storages like ponds and quarry ponds (including those in private ownership) to be taken up as part of the total water security plan of river basin Develop localized systems for grey water management and channelizing the outcome for maintaining minimum environmental flow in water systems Ground water recharging Irrigation requirements at homestead level Explore possible programme for rehabilitation/ upgradation of existing structures identified by departments like the Chamravattam regulator cum bridge; Poringalkuthu spillway; Boothathankettu barrage etc.			X X

4.2 Water Supply

4.2.1 Introduction

Kerala has an estimated population of 35 million, up from 33.38 million in 2011[71]. Kerala is a little more than two times more densely settled than the rest of the country, with an overall population density of 860 per square kilometre. About 52 % of the population lives in Gram Panchayats and 48 % lives in Municipal Towns and Corporations. Despite the administrative boundaries, the population in Kerala spreads across the State without any 'confined settlements' that can be classified as rural or urban habitations, unlike other States in India. In fact, Census classifies about half of the population as urban, however most of the population expects urban standards of living. This unique form of settlement has its own challenges in extending piped network to all.

Data from the 69th National Sample Survey Office (NSSO) (2012) shows that 78% of rural households and about 50% urban households in Kerala use well water as their primary source compared to the national average of 10% urban households depending on well water, with tribal households depending more on well water. About 75% of these are uncovered wells. More recent data (Kerala Rural Water Supply and Sanitation Agency (KRWSA) survey 2017) shows that 80% of the rural population access well water as their primary source, which is boiled for drinking as it is high on bacteriological contamination.

Based on 2018 data from KWA, about 54% of the population in rural areas and 60% of the population in urban areas have access to household connections and public stand posts. However, only 2.23 of 8 million households (28%) have piped household connections/Piped Water Supply (PWS), showing under-utilization of the water assets created. Further, SC and ST households have lower access to piped drinking water in their premises than the average household in Kerala. In sum there is a huge service delivery gap in Kerala in addressing the Sustainable Development Goals (SDGs) which stresses on quality, availability of water at all times and access within the premises (~ a water connection within premises to all and supply of potable water).

Niti Ayog and United Nations had released SDG India index Baseline report in 2018. The score of Kerala in overall performance with respect to SDG goals is 69 which is higher than the national score of 57. However, when it comes to SDG 6 pertaining to WASH, the State score is 62 which is below the national score of 63.

Table 17: Status of Kerala on SDGs

States	Overall SDG score	SDG-6 score
India	57	63
Kerala	69	62

**Source: SDG India Index: Baseline report 2018*

[71] http://worldpopulationreview.com/territories/kerala-population/

Table 18: Status of Kerala and India on various indicators pertaining to targets under SDG:6

States	Population having safe & adequate drinking water in rural areas (%)	Annual ground water withdrawal against net annual availability (%)	Installed sewage treatment capacity as a proportion of sewage created in urban areas (%)
Target 2030	100	70	68.79
India	71.8	61.53	37.58
Kerala	22.26	46.47	5.99

**Source: SDG India Index: Baseline report 2018*

As mentioned in the table, Kerala has achieved its target in ensuring the access and usage of a functional toilet to all. The groundwater withdrawal is also within the limits. However, access to safe drinking water, sewage treatment and door to door waste collection is a major challenge.

The two guiding policy documents of Water in Kerala are (a) Kerala Water Policy (2008), and (b) National Water Policy (2012). Provisions related to service delivery in drinking water sector in terms of legislation, rules, regulations and notifications are covered under two Acts: (i) The Kerala Water Supply and Sewerage Act, 1986; and (ii) The Kerala Panchayat Raj Act, 1994. The Kerala Water Policy (2008) recognizes access to water as a human right and focuses on adopting an integrated and multi-sectoral approach. The State policy envisages to capacitate the Panchayat Raj Institutions (PRIs) for fulfilling their responsibilities in water and sanitation sector as envisaged in the constitutional amendments.

Water Institutions

***Water Resources Department*:**

The Water Resources Department (WRD) administered by an Additional Chief Secretary, has an overarching responsibility for water resource management in the State, including policy and regulation, and takes the administrative level decisions of various line/subordinate Departments including Irrigation Department, Kerala Water Authority (KWA), Groundwater Department, Kerala Rural Water Supply and Sanitation Agency (Jalanidhi), Command Area Development Authority, and Kerala Irrigation Infrastructure Development Corporation. The implementing agency for water supply is the KWA, an autonomous statutory authority established for the development and regulation of water supply and waste water collection and disposal for the State, with the Additional Chief Secretary WRD as the usual chair of the Board of the KWA. In addition, the Local Self Government Department (LSGD) is responsible for administering and managing the civic services in Gram Panchayats and Urban Local Bodies, including small schemes and programs for water supply and sanitation.

***Kerala Water Authority*:**

Total number of schemes	1081
Total installed capacity	3468 MLD (3016 through WTP and 452 through Non WTP)
New schemes proposed	127
Additional current capacity	1832 MLD
Total likely capacity	5300 MLD
Per capita availability	**176 lpcd**

(KWA December 2018 Presentation)

Institutional arrangements for water supply went through considerable changes during the late 1980s. The KWA was established by the Government of Kerala (GOK) under the Kerala Water and Waste Water Ordinance of 1984, by conversion of the erstwhile Public Health Engineering Department (PHED). This ordinance was replaced by the Kerala Water Supply and Sewerage Act of 1986, whereby KWA became an autonomous authority for the 'development and regulation of water supply and waste water collection and disposal in the State of Kerala'. This implies both regulatory and service delivery functions with an implementing agency which has resulted in poor accountability and under-performance of the sector.

Under the decentralization initiative, GOK took a policy decision to devolve water supply responsibilities to the local governments (Gram Panchayats and Municipalities) through the Kerala Panchayat Raj Act, 1994 and the Kerala Municipal Act, 1994. However, most local governments continue to depend on KWA for water supply services, mainly due to capacity and financial constraints. As of now, KWA has total assets worth Rs. 11,000 crores and further assets are being added with ongoing and planned projects worth Rs. 12,500 crores (total Rs. 23,500 crores). If the proposed schemes are completed, KWA would have capacity to supply every person in both rural and urban at '176 LPCD' which is quite high when compared with other States in India. The production capacity, however, is not evenly spread across the State. KWA currently has an average cost of Rs. 24 / KL and revenue of Rs. 16 / KL. KWA survives with annual subsidies worth Rs. 330 crores for salaries and Rs. 281 crores for power. Further, the current accumulated liabilities of KWA are Rs. 2291 crore, of which power dues are Rs. 1321 crore, several times the annual subsidy received. There is need for a better understanding of the costs, revenues, tariffs and subsidies associated with the KWA programme. In addition, given the production capacity, it is critical that KWA improves distributional efficiency and increases its revenues streams. Currently about 400 MLD of treated water is not being distributed due to lack of distribution networks. So far, the investments have been skewed, with preference for creation of assets rather than improving services and running a financially sound utility, resulting in low connections and low revenue.

PWS Coverage	54% Rural; 60% Urban
Metering	100% (except stand posts)
Collection Efficiency	85%
O&M Cost recovery	41%
*Non-Revenue Water**	40%

(KWA December 2018 Presentation)

*As per KWA presentation on 19/03/2019

The KWA has one head office, three regional offices, 12 circle offices, 49 division offices, 136 sub-divisional offices, and 293 section offices. It has 4859 technical staff including 743 engineers, 3938 ministerial staff and 6000 contractual staff, which translates into 5.6 staff per 1000 connections. KWA's average income from its operations is Rs. 42.43 crore/month, while its expenditure is much higher at Rs. 102 crores /month. While scheme level data is not available, the overall information shows there is inadequate spending on O&M of systems (Rs.

78.19 crore of Rs. 1245.64 during 2017-18, i.e. less than 6%), and hence difficult for KWA to sustain services at a reasonable level. Several retirees were not paid their terminal benefits for the last two years. Current liabilities of KWA are Rs. 2291.28 crore, of which power dues are Rs. 1320.97 crore. Although KWA has implemented 100% metering (except for stand posts) and volumetric tariffs, the service connections need to be extended, service delivery improved, and tariffs revised to improve the revenue stream. At the same time the schemes need to be made cost-effective by improving operational efficiency, including reducing power costs and NRW.

In the absence of scheme-level data, it is difficult to say which schemes are performing well and which are contributing to losses. KWA water supply systems in Thiruvananthapuram and Cochin are notable with 70% coverage, aiming at 24 /7 supply, and contribute the bulk of the revenue of KWA. While KWA has traditionally been an engineering agency with priority for asset creation, however, following the floods of 2018 and recognizing the shortcomings in service delivery, the GoK has now decided to transform KWA into a service delivery agency. This is also well-accepted by the KWA as it would like to transform itself into a modern, professional utility.

***Kerala Rural Water Supply and Sanitation Agency* (Jalanidhi):**

The Kerala Rural Water Supply and Sanitation Agency (KRWSA) was created as a special purpose vehicle to pilot sector reforms based on demand responsive approach, enhance local community ownership, and provide access to remote habitations that were neglected. This programme, taken up with World Bank support as “Jalanidhi”, aims at building local capacity and ownership, and facilitates transfer of single village schemes to Beneficiary Groups (BGs) for improving service delivery. KRWSA has implemented Jalanidhi 1 from 2001-08 and Jalanidhi 2 from 2011-19. Jalanidhi 2 is due to be completed in June 2019. It is expected that 11 % of the rural population receives coverage under the Jalanidhi project. KRWSA has succeeded in demonstrating sustainable operations through building partnership between GPs and BGs, thus contributing to the decentralization and self-governance agenda.

Some of the highlights are: (i) The schemes are fully operated by local committees without any grant. The entire operating cost is generated from the tariff collected from users. (ii) Regarding Capex, the GPs contribute 15% and BGs contribute 10% in cash. KRWSA provides 75% of the capital cost as grant through Bank funding. (iii) The assets are jointly owned by GP and BGs, while technical support for design and implementation is provided by KRWSA. (iv) KRWSA has also successfully tested the ‘Bulk Water Model’ wherein KWA is paid for water supplied at one outlet while BGs take distribution responsibility and cost recovery. This model is being followed in 3 Multi GP schemes, and 15 Bulk water schemes.

4.2.2 Impact of 2018 Floods

The flood in August 2018 has severely affected water supply services crippling access to safe drinking water during and after the flood. Total damage to the water supply subsector is estimated at Rs. 492.3 crore, 77% of which is to shallow dug household wells, 11% to KWA rural schemes, and 6% each to KWA urban schemes and Jalanidhi schemes.

Many water supply schemes were damaged mostly due to silting of sources, damage of intake structures, pump houses and distribution networks, and damages of other structures. Damage has been reported in 108 urban and 372 rural schemes under Kerala Water Authority (KWA), and 583 rural schemes under the Jalanidhi project.

The KWA estimates 58% reduction in daily production during peak flood period, indicating that approximately 50% to 60% of piped water users (20% of the State's population or 6.7 million people) have been affected. This has been gradually restored to pre-flood status.

Damage and Loss – As per the Kerala Floods 2018 Post-Disaster Needs Assessment (PDNA), the total damage and loss, and recovery needs for this sector estimated to be as follow –

Damage (Rs. crore)	Loss (Rs. crore)	Total Effect (Rs. crore)	Total Recovery Needs (Rs. crore)
492	349	841	766

It is reported that 3,20,026 shallow wells have been damaged in the six worst affected districts,[72]directly affecting more than 1.4 million persons; the structural damage occurred to the inner linings, parapet walls and aprons of these wells. Water in many shallow wells was contaminated. Some of the wells have since collapsed during the cleaning process, due to over-pumping whilst emptying the well. Amid disruptions to routine operations, the LSGD was able to issue cleaning guidelines for wells, as well as certifications for cleaned wells, in support of restoring services. Cleaned wells took time to stabilize their physical water qualities, which means people relying on these wells had to look for other water sources. This created additional demand on piped water systems already damaged and with compromised capacity, or on emergency water supply. The Status report on the cleanliness drive carried out by LSGD reports that out of the 3,20,026 wells damaged, 3,00,956 were cleaned. (94%). Out of this, 17% were reported to be dewatered and super chlorinated.

Many rural colonies, which are in low lying areas, including those where Scheduled Castes and Scheduled Tribes communities lived were inundated during floods for many days resulting in contamination of groundwater. Floodwaters affected drinking water sources and sanitation facilities, putting citizens at serious health risk. In Kerala, majority of the households do not have water supply and thus access to drinking water and water for domestic use has become a challenge, particularly for women who take care of water needs for the families.

Additionally, at many locations along the rivers of Kerala, permanent and temporary cross and check dams are constructed for irrigation or water supply intake, often without regard to the resulting obstruction of higher discharge which can increase river levels upstream and cause unwanted flooding. For example, the drainage channel system of Kuttanad is poorly maintained and silted, thus reducing drainage discharge capacities towards the Thottappally Spillway which itself has limited capacity of 380 m^3/s.

Immediate Recovery Efforts: Despite being severely affected by the disaster, KWA continued to supply water in low lying areas in Kuttanad for several weeks because the wells were contaminated. About 1.1 lakh jerry cans of 15 litre capacity each were distributed to households for storing water. Around 1,000 water purifiers were supplied free of cost.

Some preliminary recovery activities as suggested in the PDNA include- in the short-term, mitigating the heavy dependence on shallow wells and build resilience in household dug wells. The departments of water and health, together with LSGD, could form a joint mechanism to rehabilitate/improve wells, setting clear

[72]*Flood Sanitization status in LSGIs as on 20 september 2018.*

guidelines to ensure that the investment serves the objective. The out-of-order water systems under KWA, Jalanidhi, and LSGB, or those that are operating at a reduced capacity, should be repaired and made flood-resilient. In medium-term, a range of sustainable and disaster-resilient technical options could be explored to improve safe water access. A water-quality surveillance system could be set up and led by the WASH coordination platform and could include private and institutional water quality laboratories. The data should be stored digitally, accessible by all the stakeholders. A critical check of the required capacity in the location vis-à-vis supply opportunities would avoid unnecessary excessive costs for overcapacity and unsustainable over-pumping, especially for systems managed by water utilities, communities or LSGBs. In the long-run, a set of water governance rules could be developed that build upon the integrated water resource management, and eco-sensitive and sustainable solutions. This RKDP further develops on the suggested sector recovery activities proposed in the PDNA through detailed analysis of the root causes and through consultations with public and relevant stakeholders.

4.2.3 Major Legacy and Current Issues

1. Policy gaps: The State water policy (2008) does not envisage any target for PWS coverage, or service delivery parameters, including hours of supply, quantity of supply and metering. However, the State has an objective of 100% coverage at 100 lpcd for rural and 150 lpcd for urban areas as reported by KWA. If the projects in the pipeline are completed, the supply capacity will be increased to 176 lpcd, which is quite high to meet the targets and needs to be reviewed taking into consideration the uneven spread across the State.
2. Limited co-ordination among sector institutions: With different sector institutions operating under different models, there is limited planning and co-ordination among KWA, KRWSA, and LSGD. Also, ownership by local governments is reportedly limited due to inadequate technical and financial capacity and lack of incentives to improve connections and service delivery.
3. Weak regulation and monitoring: A number of agencies including KWA, KRWSA, ULBs and GPs are currently providing services with fragmented responsibilities and weak regulatory systems. The GPs and ULBs promote small water supply schemes mainly to address issues in summer months when most wells go dry. Together with Jalanidhi schemes, most of these schemes remain in the hands of beneficiaries with no backstopping support (technical or financial) or monitoring by any agency. Following point may be added “The existing norms and rules on rain water harvesting is loosely implemented and not monitored. The development of natural spring-based water sources which also needs adequate emphasis.
4. Little investment on supporting Self-Supply: More than 60% of the population is dependent on dug wells for drinking water, making it the dominant water service delivery of the State. However, there are little institutional investments to make these dug wells sustainable and sanitized.
5. Build-forget-Rebuild approach to infrastructure: The lack of any financial support, beyond contributions by local communities, results in several schemes slowly becoming defunct. Also, performance monitoring has not been taken up to better understand the scheme level issues. Life cycle cost approach to asset management be followed recognizing water as an economic good reconciling the reality that people particularly the poor are paying more by way of coping costs, when there is service delivery failures.
6. Lack of clarity on revenue enhancing programme: As per KWA estimates, the State has an installed water treatment capacity of 3016 MLD, but only about 26088 MLD of water is being produced. The KWA is adding another 1832 MLD of treatment capacity from ongoing schemes. Given the excess

capacity issues, there is lack of clarity on the strategy for revenue enhancing programme through increasing collection efficiency, tariffs, use of subsidies from State budget, etc. Also, policy changes would be required in the connection policy, including subsidies, to raise demand for household connections, etc.

7. Contamination of water sources: As per IMIS database maintained by GoI's MDWS, and based on a sample study, around 95% of the sources are contaminated. Of these, 85% of sources have bacteriological contamination and 15% have chemical contamination. Coliform contamination is found mostly in the well water and surface sources (95% of the sample) and limited in PWS (1% of the sample). Boiling of water is the standard practice of treatment adopted by most households in Kerala. About 85 % of the households boil water and around 8 % of the households use water filters or purifiers (NFHS 2016). The system in place to carry out the sanitary risk assessment of the dug wells is inadequate. The current process of monitoring and surveillance is fragmented and not participatory in nature. Private dug wells are outside the ambit of the existing surveillance systems lead by KWA.

8. Water Charges / Tariff: The policy aims that the water charges shall be fixed in such a way that they cover at least the O&M charges for providing the service, while subsidy for the poorer sections will continue. Kerala follows a block volumetric tariff structure for charging for water, with the lowest block for domestic users starting from 5 KL, and the rate ranging from Rs. 4 /KL to Rs. 50 KL. GoK has made water free for BPL families consuming less than 15 KL per month. While the water tariff for KWA is fixed by the State government, it is not built on full cost recovery principles and the State budget has not always provided subsidies on an assured and timely basis, with a negative impact on KWA's financial position.

9. Low O&M cost recovery: KWA has estimated that O&M cost per KL of water is around Rs. 24, whereas average revenue is Rs. 16 per KL. The gap weakens the financial sustainability of the institution and the considerable investments in water supply unless key reforms are implemented to enhance revenue and operational efficiency. There is need for transparent subsidies, as full cost recovery through tariffs is unlikely. Also, most cities and villages have about 40 to 45% Non-Revenue Water.

Cost of production	Rs. 24 per KL
Revenue from sale of water	Rs. 16 per KL
Loss	Rs. 8 per KL

10. Source sustainability risks due to climate variability: Declining ground water levels and high variation of rainfall over the years have increased vulnerability, with many dried wells getting inundated during the floods. Several small schemes in rural areas are dependent on local sources like open wells. These small schemes need to be connected to surface water supply schemes for secured water supplies during summer.

11. Inadequate monitoring of sector performance: The sector information is presently scattered among different institutions with no standard mechanism or benchmarking to monitor the performance on service delivery. KRWSA has recently developed a monitoring system for service delivery for its schemes and this can be scaled up across the State.

The Following issues need urgent attention: (a) identifying a menu of different institutional and service delivery models, (b) incentivizing service delivery improvements and infusing business sense, (c) addressing the staff costs including pay revisions and pension liabilities, (d) addressing depreciation cost of assets created, (e) convincing trade unions which protect service conditions, salaries and pensions, (f) building capacity of ULBs and GPs, (g) levelling playing field for financially viable and not so viable schemes,

(h) addressing water pricing in a holistic manner, including different tariffs in different local bodies with political acceptance.

4.2.4 Proposed approach to Resilient Rebuilding

Following are the critical needs and priorities for the Water Supply Sector:

- A systematic approach is needed to convert household open wells to safe and protected water sources.
- Rather than institutional focus, there needs to be holistic approach to "water". Setting up of a State Level WASH platform, integrating the efforts institutions mandated to work on drinking water, sanitation, Solid and Liquid Waste management and Hygiene promotion. It needs to encompass surface water treatment and supply, dug wells, natural springs, rain water harvesting, SLWM and the SBCC campaign required for active public participation and ownership. Terms of Reference for such a coordination platform need to be prepared detailing the roles and responsibilities of different agencies. It should include development of integrated plans, performance monitoring, integrated data collation and sharing and regulatory systems.
- An integrated and participatory approach to "Drinking water quality monitoring and Surveillance" needs to be put in place.
- Increasing accountability of Water Supply agencies, including performance-based financing and service delivery-based contracts, using service level benchmarks provided by the Ministry on quantity, quality, O&M cost recovery, Non-Revenue Water, establishment of robust grievance redressal mechanism etc.
- Ring-fencing Water Supply operations for greater transparency and better understanding of efficient and loss-making schemes.
- Exploring institutional and service delivery models for improving commercial orientation and financial sustainability.
- Revising volumetric tariffs to improve revenue stream, taking into consideration affordability limits.
- Incentivizing efficient operations and reducing subsidies, especially power subsidies.
- Increasing customer orientation by improving MIS, citizen charter and Grievance Redressal Mechanism.
- Auditing of assets from climate change perspective to ensure that the designs of all ongoing and proposed works are built with resilient measures based on the lessons learnt.
- Better understanding of financial aspects, including costs, revenues, tariffs and subsidies.

4.2.5 Specific Interventions

Following are the proposed Investments in Water Supply over next five years:

1. KWA has proposed additional investments of Rs. 3,388 crores and KRWSA has proposed additional investment of Rs. 870 crore mainly to enhance number of connections and service standards, thereby also improving the revenue base of KWA and KRWSA. Summary of these proposed investments are given below.

- Urban: KWA proposes to build 10 new WTP schemes covering 10 municipalities with treatment plants and distribution components, with an estimated cost of Rs. 800 crores. Seven existing schemes require distribution components worth Rs. 276 crore, while production and transmission components have been completed. Eight schemes require transmission and distribution components worth Rs. 649.00 crore, while production components have been completed. Thus, the total proposed investment in urban areas is Rs. 1725 crore. While these schemes are predominantly urban, they will also supply water to some GPs.
- Rural: 12 schemes require distribution components worth Rs. 570 crore, while production and transmission components have already been completed. 17 schemes require transmission and distribution components worth Rs. 1093 crore, while production components have been completed. Hence the total proposed investment by KWA in rural areas is Rs. 1663 crore. In addition, KRWSA proposes investments worth Rs. 870 crore, for which KWA will provide bulk water supply, while KRWSA will build capacity of local governments and community organizations to manage distribution networks.

2. These investments in urban and rural areas will make use of about Rs. 3000 crore worth assets, which were already created and underutilized. It is proposed to complete these investments in the next two to three years. It is also proposed to adopt advanced technologies in the distribution network and metered house connections aiming for achieving NRW benchmarks. These investments will mostly cover places declared flood affected, benefitting about 4.4 million people living in 26 ULBs and 160 GPs.

Table 19: Water Supply Actions and Results Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Policy /Regulatory/Institutional				
The GoK has adopted a strategy and a time-bound action plan to strengthen policy and institutional framework to improve accountable and efficient services for water supply management which are resilient to disasters and impacts of climate change. Establishment of an intersectoral WASH coordination platform at State level GoK adopts policy and institutional framework for accountable and efficient water supply services (urban and rural) including MIS and Grievance Redress Mechanism and Citizen Engagement Programme.	X X	.		Increased coverage and improved quality of water supply management services in urban and rural areas. **Baseline** (January 2019): Inadequate policy and institutional framework for WSS sector. **Target** (June 2021): (i) Improved Water Supply services for at least

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
		X		XX% targeted people; (ii) NRW reduced to at least 30%; (iii) O&M cost recovery increased to at least 70%; (iv) Annual Performance Report and Citizen Report Cards publicly disclosed.
Chart out a strategy for ensuring the quality of drinking water from dug wells and natural springs that is participatory in nature Design an institutional framework to implement the strategy	X	X		Panchayat wise digital inventory of dug wells and spring sources (geo coded) with sanitary risk assessment scores
Setting up of WASH sectoral coordination platform.	X			System in place for carrying out participatory water quality monitoring and surveillance system.
Investment				
Water Supply by KWA			X	3.7 million additional population benefitted in 26 ULBs and 99GPs with enhanced service delivery.
Water Supply by KRWSA			X	0.7million additional population benefitted in 61GPs with

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
				enhanced service delivery.

Table 20: Proposed Investments of Kerala Water Authority (Water Supply)

Urban /Rural	Description/ Activity of the Investment	Time Period	Districts benefitted	No of Schemes	Additional Population benefitted	Potential WS connection	No of Benefitted LSGD	
							Urban	Rural
Urban	New Schemes including WTP and distribution systems (for 10 Municipalities)	3-4 years	Municipalities (districts): Kanjangadu, Neeleswaram (Kasaragod), Pyyoli (Kannur), Koduvalli, Mukkam (Kozhikode), Kottakkal , Valanchery (Malappuram), Cherpullassery (Palakkad), Vadakkanchery (Thrissur), Erattupetta(Kottayam),	10	400,000	80,000	10	
	Ongoing Schemes: Distribution components (Production and transmission components already complete)	2 years	1 scheme each in Alleppey, Kottayam, Ernakulam and 4 Schemes in Palghat	7	141,732	29,350	7	6
	Ongoing Schemes: Distribution components (Production components complete and transmission components ongoing)	2 years	1 scheme each in Kollam, Malappuram, Calicut, Wayanad, Kannur, Kasaragod and 2 schemes in Idukki	8	1,236,539	133,200	9	13
	Sub total			**25**	**1,778,271**	**42,550**	**26**	**19**

Urban /Rural	Description/ Activity of the Investment	Time Period	Districts benefitted	No of Schemes	Additional Population benefitted	Potential WS connection	No of Benefitted LSGD	
							Urban	Rural
Rural	Ongoing Schemes: Distribution components (Production and transmission components already complete)	2 years	1 scheme each in Kasaragod, Kottayam, Palakkad, two schemes each in Thiruvananthapuram, Ernakulam and 5 schemes in Kollam	12	786,254	99,950		32
	Ongoing Schemes: Distribution components (Production components complete and transmission components ongoing)	2 years	1 scheme each in Ernakulam, Kasaragod, Kottayam, Malappuram, Thiruvananthapuram, two schemes each in Kannur, Palakkad, Thrissur and 3 schemes each in Pathanamthitta, Kollam	17	1,197,909	134,600		48
	Sub total			**29**	**1,984,163**	**34,550**	**0**	**80**
	TOTAL of KWA proposed			**54**	**3,762,434**	**477,100**	**26**	**99**

Table 21: Proposed Investments of KRWSA (Water Supply)

Urban / Rural	Description/ Activity of the Investment	Time Period	Districts	No of Schemes	Additional Population benefitted	Potential WS connection	No of Benefitted LSGD	
							Urban	Rural
	Post construction O & M support to the community Schemes	5 years	8 districts					
	Support to revitalize nonfunctional decentralized RWSS based on							

Urban / Rural	Description/ Activity of the Investment	Time Period	Districts	No of Schemes	Additional Population benefitted	Potential WS connection	No of Benefitted LSGD	
							Urban	Rural
	the study proposed							
Rural	New Scheme: Cheekodu Multi-Village scheme to provide distribution and house connections using DBO approach	2-3 years	Malappuram	1	101349	20270		7
	Nedumbasseri and three other GPs - Water Augmentation and house connections (with bulk water from KWA)	2-3 years	Ernakulam	1	49496	9899		4
	Providing 1,25, 000 household connections in rural in about 50 GPs where treated water is available (with bulk water from KWA)	2-3 years	8 districts	50	540000	108000		50
	Total KRWSA				**690845**	**138169**	**0**	**61**

4.2.6 Technical Studies and Assessments

Table 22: Water Supply List of Studies

Activities	0-6 months	0-18 months	18 months & beyond
Policy and Institutional			

Activities	0-6 months	0-18 months	18 months & beyond
Preparation of Policies and Institutional Programme for Water Supply:		X	
(a) Institutional roles and responsibilities and performance standards;		X	
(b) Analysis of ring-fenced administrative units of KWA;		X	
(c) Service delivery models for local bodies and KWA;		X	
(d) O&M Programme including tariff and subsidy analysis;		X	
(e) M&E, Citizen Engagement and Grievance Redressal Programme.		X	

4.3 Sanitation

4.3.1 Introduction

Kerala is the third fastest urbanizing State in the country (AMRUT, State Annual Action Plan, Govt. of Kerala, 2015). The reclassification of rural to urban due to shift in employment from agriculture to other categories of employment also contributes to the high urbanization rate. About 17% of Kerala's 35 million population reside in 87 municipalities and 6 corporations, 65% in towns with populations between 20,000 and 100,000 and 35% in towns greater than 100,000 (Joint Development Needs Assessment Report, World Bank and ADB, September 2018). The level of urbanization among the districts is uneven, with six districts (Ernakulam, Thrissur, Kozhikode, Kannur, Alappuzha and Thiruvananthapuram) having urban population more than 50%, four districts with medium level of urbanization (25 – 50%; Kollam, Malappuram, Kasaragod and Kottayam) and four with low levels of urbanization (<25%; Palakkad, Pathanamthitta, Idukki and Wayanad), AMRUT, State Annual Action Plan, Govt. of Kerala 2015. However, the infrastructure facilities, especially sanitation, available to the population in general do not vary much between rural and urban areas. It is of note however, that as per the last round of the National Sample Survey, some households in Kerala, particularly SC and ST households are more likely to practice open defecation than others. So, while only 2 % of Kerala's population on average practices open defecation, it is more prevalent among ST and SC households – nearly 14% of tribal households practice it, and 8% of SC households engage in open defecation.

Kerala's Key Projects and Programs in Sanitation

Waste to Energy Plants: The GoK, through LSGD, is in the process of implementing an integrated Solid Waste Management solution for major cities which envisages to setup and operate Waste to Energy Plants of minimum 5 MW capacity in seven sites across the State through Public Private Partnerships under 'Design Build Finance Operate and Transfer (DBFOT)' model. The projects will be implemented in seven locations with beneficiary local governments grouped into clusters. KSIDC is the Nodal Agency for the selection of the private partner and has initiated a global competitive bidding for Kozhikode, followed by bidding for other six locations namely Thiruvananthapuram, Ernakulam, Thrissur, Palakkad, Malappuram and Kannur.

Haritha Keralam (Green Kerala Mission) is an Umbrella Mission integrating components of Waste Management, Organic Farming, and Water Resources Management. It has an ambitious outlook to address the issues of piling waste, drought, and health hazards due to pesticide treated vegetables. It has three Sub-Missions:

1. On Sanitation & Waste Management- Household level segregation and safe disposal of organic waste through feasible options like composting, biogas, arrangements for institutional waste disposal, re-use, recycling and safe disposal of non-degradable and electronic waste.
2. On Water Resources Rejuvenation & Conservation- Rejuvenation of tanks, ponds, streams and rivers. Conservation of water and ensuring its timely availability for domestic and agricultural use.
3. On sustainable agriculture- Promotion of organic agriculture to produce safe to eat vegetables and fruits.

Suchitwa Keralam. Having achieved ODF status, the Suchitwa Mission now focuses on next generation sanitation issues such as solid and liquid waste management and promotion of green protocol for reduction of disposable and single use materials. Suchitwa Mission extends technical support to Local Self Government Institutions in identifying issues, suggesting mitigation measures, preparing Detailed Project Reports (DPRs) for construction of new waste treatment plants, up-gradation of solid waste management facility, establishment of plastic shredding units, etc., for the management of non-biodegradables including e-waste, development of sanitary landfill, community level composting/biogas units and development of Regional Sanitary Landfill. The annual budget outlay for Swachh Bharat Mission is Rs. 183 crores including SBM and State contribution for *Suchitwa Keralam of* Rs. 52.5 crore (Source: Suchitwa Mission).

Policies and Guiding Principles

In addition to The Kerala Water Supply and Sewerage Act, 1986, **the Kerala State Sanitation Strategy** prepared with GIZ assistance and approved in August 2015 provides the policy framework for sanitation services. The policy, modeled on the lines of the National Urban Sanitation Policy, articulates a vision to safely manage Kerala's solid and liquid wastes, with the following goals*:*

- Ensure all human excreta and liquid wastes are safely managed (sanitation intervention are appropriate; attention to operation and maintenance)
- Enhanced awareness and sustained behavior change
- Improved institutional governance and enhanced human resources for citywide sanitation

Notable amongst the missing elements in the policy are:

- Technical, institutional and service delivery options for state-wide coverage
- Clarification of ULB responsibilities
- Infrastructure deficiencies and CAPEX and OPEX required to address the gaps
- Prioritization and phasing of investments to achieve the vision / goals of the sanitation policy
- Role for private sector participation

Integrated wastewater and septage management guidelines, also prepared by GIZ, provide a path to operationalize the state sanitation strategy. These guidelines provide options for citywide integrated wastewater and septage management services, technical options (limited to wastewater), financial (limited to source of funds, viability gap funding), operations and maintenance and regulation. The draft guidelines are in the process of being finalized in the next two to three months.

Policy on Solid Waste Management. To address challenges of waste management, the GoK released a State Policy on Solid Waste Management on September 13, 2018, providing broad strategy to achieve the vision of "a healthy, prosperous and resource efficient society in which waste are reduced, reused, recycled and prevented wherever feasible and beneficial and disposed-off in an environmentally safe manner", with the following guiding principles.

- Waste will be considered as a resource
- 3R principle of Reduce, Reuse and Recycle will be embraced
- Polluter pays principle will be adopted
- Responsibility of citizen to the waste he generates and right of the society to have hygienic environment will be protected

Institutions for Sanitation

Although the 74th Constitutional Amendment (1992) devolved powers and responsibilities for sanitation to local government bodies, they continue to lack autonomy in functioning and are financially dependent on the State government. Infrastructure is developed by a State Water Resources Department and sometimes handed over to the ULBs and GPs to maintain. Multiple State-level agencies dominate sanitation provision and there is little coordination, resulting in fragmentation of functions and responsibilities and lack of accountability for services. Following are the key institutions involved with sanitation activities:

(i) ***Suchitwa Mission*** under the Local Self Government Department is responsible for providing technical and managerial support to the Local Self Governments of the State. It is also responsible for conceptualizing, action planning, conducting creative workshops, organizing training programs, initiating sector related studies, initiating action research, and conducting monitoring in Waste Management Sector. The Mission is also the Nodal agency for implementing Swachh Bharat Mission (Urban), Swachh Bharat Mission (Rural) and Communication and Capacity Development Unit (CCDU) in the State. Suchitwa Mission is planning to develop two septage treatment facilities as training facilities to raise awareness and build acceptance for septage management in the State.

(ii) ***The Kerala Sustainable Urban Development Project*** (KSUDP) under Local Self Government Department is an initiative of the Govt. of Kerala and ADB is a special purpose vehicle (SPV) to implement urban infrastructure services in a sustainable manner. The KSUDP is also designated as the State Level Nodal Agency for the GoI programs –Smart Cities Mission and AMRUT. While KSUDP has experience in planning and implementing sewerage systems, it does not have experience in septage management facilities.

(iii) ***The Clean Kerala Company Limited*** has been set up under the LSGD with the objective of ensuring hygiene management through innovative methods and public and private sector participation. The company aims to ensure comprehensive waste management through disposal/reuse of plastics, e-waste and other solid dry waste reject from the Municipal solid waste stream. Suchitwa mission has put forward a proposal to make Clean Kerala Company to implement and manage the pilot septage treatment facility and take a larger role in the management of septage treatment facilities.

(*iv)* ***Impact Kerala Limited*** under Transformation Kerala Limited was constituted in 2018 by GoK to implement major infrastructure projects in Local Self Government sector. This agency is responsible for key areas of sanitation and hygiene including Septage / Fecal Sludge Management, Liquid Waste Management, Modern Slaughter houses /fish markets and Modern Crematoriums. However, this being a new organization, it needs considerable strengthening of institutional systems and human resources.

(iv) ***The Kerala Water Authority***[73] (KWA) is the primary institution for the development and regulation of water supply and wastewater collection and disposal in Kerala. By legislation, its mandate includes preparation, execution, promotion, operation, maintenance and financing of schemes, monitoring quality, fixing tariffs, etc., for drinking water supply and wastewater disposal. The KWA has executed schemes in both rural and urban areas in the State, operations and maintenance of most of these schemes, and planning, implementation and O&M for the few facilities created for wastewater treatment in two ULBs. In addition, it has been a primary stakeholder in the execution of wastewater treatment plants in Sabarimala and Guruvayur. In other ULBs where wastewater treatment facilities were proposed under ADB-assistance, the execution of the project rests with the KSUDP and the facilities are expected

[73] Established by an ordinance in 1984 and subsequently legislated by the Kerala Water Supply and Sewerage Act, 1986.

to be handed over to the ULBs. Clarity of roles vis-a-vis the KWA, ULB and the KSUDP in terms of development of wastewater treatment and disposal has yet to be ascertained.

Institutions for Solid Waste Management

With the 73rd and 74th constitutional amendments, the GPs and ULBs are mandated with the responsibility for Solid Waste Management. The local governments are supported by Local Self Government Department (LSGD) and SPVs like Kerala Suchitwa Mission, Haritha Keralam Mission, Clean Kerala Company, Kerala Sustainable Urban Development Project (KSUDP) and Kerala State Industrial Development Corporation Limited (KSIDC) are involved in planning and implementing waste management programs and projects.

4.3.2 Impact of 2018 Floods

The damages in the SWM subsector is estimated at Rs. 251.13 crore, about three-quarters of which is due to the destruction of household-level SWM units. The total loss in the SWM subsector is estimated at Rs. 74.4 crore, of which 45% is attributed to household-level cleaning, another 31% to disposing of animal carcasses, and the remaining 24% spent by urban and rural administrative bodies on cleaning public areas.

Although Kerala achieved the Open Defecation Free (ODF) status in Rural areas in 2016 and Urban areas in 2018, the collection and treatment of wastewater and septage is limited. An estimated total of 95,146 household latrines have been substantially damaged due to recent floods, including 83,506 toilets in rural areas and 11,640 toilets in urban areas, depriving about 400,000 people of sanitation services. Household latrines have suffered the main brunt of the disaster. Invariably, the septic tanks and leach pits were the most damaged in terms of structural stability and functionality. Excessive de-sludging was needed too. No damages were reported for the piped sewage treatment systems which cover a small proportion of the population. The recent flood affected drinking water sources and sanitation facilities have serious health risks as most people (62%) use shallow wells for drinking water.

In Kerala, majority of the households have pit/septic toilets (on-plot Sanitation), which has become a major source in contamination of groundwater during floods. It is also an inclusion challenge, as many of these septic tanks tend to be cleaned by people from lower castes. The disaster raises the need for climate resilient superstructure designs[74] and containment systems including septic tanks and pits[75] with customized designs for water-logged areas. Given the high dependence of households on on-site sanitation (78%; 57% septic tanksand 21% on pits; Census 2011), low levels of sewerage systems (partial coverage in Thiruvananthapuram and Kochi), limited septage treatment facilities (one operational in Kochi), there is growing interest in septage management with eight plants under construction and more planned to improve sanitation services across the State. The technical understanding of “septic tank” in the public is also a challenge. The 2nd generation issues of an ODF state like Kerala pertaining to the quality of toilet substructure affecting the quality of ground and surface water has not been studied. As such there are no reliable data collated on the type of toilet substructure adopted by the HHs in general as well as in the difficult terrains. The current standard of latrine design and subsidies associated with them would need to be revised. This, in turn, would have social and financial implications, as costs of septic tanks or raised latrines with above-ground pits are substantially higher. Furthermore, damaged

[74] The UN Post Disaster Needs Assessment (August 2018) highlighted the need to build flood resilient toilets suited to the Kerala context

[75] The UN Post Disaster Needs Assessment (August 2018) also suggested a campaign to be led by Suchitwa Mission along with Local Self Government Departments to replace all pits (21% as per Census 2011) with septic tanks that are resilient to floods and reduce risks of ground water contamination.

superstructures pose the risk of injuries and compromise privacy, particularly of women. The impact on septic tanks and leach pits exposed long-term vulnerabilities in terms of ground water contamination, vector breeding and releasing pathogens into the environment.

Damage and Loss – As per the Kerala Floods 2018 Post-Disaster Needs Assessment (PDNA), the total damage and loss, and recovery needs for this sector estimated to be as follow –

Damage (Rs. crore)	Loss (Rs. crore)	Total Effect (Rs. crore)	Total Recovery Needs (Rs. crore)
147	48	195	289

Some preliminary recovery activities as suggested in the PDNA include - Flood-resilient latrines could be designed with water-sealed septic tanks, and all damaged latrines should be rehabilitated or replaced following this design. Increased costs may be a challenge for creating demand, but the government may encourage suppliers with regulatory and financial incentives. The Suchitwa Mission could hold awareness campaigns for the public on the importance of the latrine model. Financial compensation should be considered for at-risk and low-income households who will require retrofitting of latrines. The SWM systems could consider a decentralised approach and follow the principles of reduce, reuse, and recycle. An interim coordination mechanism for water supply, sanitation, and SWM could be established, serving as a technical actor, and taking on board civil society actors, international agencies or advisory companies. Establishing off-site and decentralised faecal sludge management is a priority due to the substantial number of household toilets with septic tanks and the limited capacity of sewer systems in the State. Setting up decentralised SWM systems could be taken up as part of the building back better strategy for a green and eco-resilient Kerala. A WASH sector coordination platform could be established under the WRD or LSGD, where all actors and stakeholders are represented. Ultimately, solid and liquid management systems could have a state-level strategy and system, which further builds upon the principles of 'waste to energy' and 'waste to resources'. This RKDP further develops on the suggested sector recovery activities proposed in the PDNA through analysis of the root causes and through consultations with public and relevant stakeholders.

4.3.3 Major Legacy and Current Issues

Contamination of ground and surface waters is a serious concern in Kerala. Notable among the reasons for widespread contamination are siting and poor construction of septic tanks and pits, which have the potential to cross-contaminate ground water by pathogenic bacteria, viruses, and several more complex multicellular organisms. Studies[76] have indicated that more than 90 % of the shallow dug wells are affected with bacteriological contamination in Kerala. Also, some studies[77] indicate that 56 % of the contamination cases are due to unscientific construction of latrines, 11 % due to animal sources and 33 % due to both

[76] Harikumar PS. 2016. Water quality management of Kerala- Issues, Challenges and Solutions, Rep. Working Group on Environment, Kerala State Planning Board. p. 9.

[77] Harikumar PS and Kokkal K. 2009. Environmental monitoring programme on water quality. Kerala State Council for Science, Technology and Environment, Govt, of Kerala. 174p

latrine and animal sources. Additionally, indiscriminate disposal of emptied septage for want of treatment facilities has the potential for environmental degradation.

The situational diagnostic reveals the following:

(i) Access *(household/community sanitation):* According to Census 2011, in urban areas, 2.6% of households had no toilets in their households. About 0.9% of urban population depended on community / public toilet, and 1.7% defecated in the open. In rural areas, 6.8% of households had no toilets in their households. About 1.2% of rural population depended on community / public toilet, and 5.6% defecated in the open.

Under SBM a total of 37,207 individual household toilets and 3,449 toilet seats in community toilets were constructed, ensuring universal sanitation access and rural Kerala being declared "open defecation free" in 2016 and urban Kerala in 2018. However, the floods of 2018 led to 11,640 toilets in 44 ULBs and 83,506 toilets in Gram Panchayats being rendered dysfunctional or destroyed (Suchitwa Mission).

(ii) Collection and Treatment*:* Having addressed universal access to household sanitation, there is need to address the full cycle of sanitation from collection to treatment and disposal. While 8% of the urban households are connected to sewers[78], 78% of urban households are dependent on on-site sanitation comprising 57% septic tanks and 21% pit latrines, which are usually cleaned by persons belonging to lower caste groups. As reported by Suchitwa Mission, around 48 % of the rural households have septic tank (again, appropriate septic tank technologies may be compromised) while others are mostly leach pit latrines (single pit or two pits).

(iii) Sewerage Systems*:* Sewerage systems are presently limited to Thiruvananthapuram with 37% spatial coverage and 91,300 connections, Kochi with 3% spatial coverage and 4,500 connections (State Annual Action Plans 2015 – 16, Govt. of Kerala, 2015) supported under the ADB funded Kerala Sustainable Urban Development Programme (KSUDP)[79]. Planned investments in Thiruvananthapuram, Kollam, Alappuzha, Kochi, Thrissur, Palakkad, Kozhikode and Kannur will help create 29.77 MLD sewage treatment plants with potential to benefit 1.14 million. The existing and planned investments will meet 20% of the sanitation needs of the State.

Although sewage treatment plants of 107 MLD and 5 MLD are functional in Thiruvananthapuram and Kochi, they are operating at 51% and 60% of plant capacity mainly due to limited sewer network coverage and/or reluctance of households to connect to the sewer networks, having invested in on-site sanitation systems like septic tanks. Households are required to pay Rs. 1,000 for a sewer connection, bear the plumbing cost and road restoration charges to connect to the sewer network. In addition, households are required to pay the sewerage charges (10% of water charges, applicable in Thiruvananthapuram). The sewerage charges meet 25% of the sewerage system (network + sewage treatment plant) operation and maintenance cost, while the rest is met through state subsidies.

(iv) Non-network sanitation: As the available and planned sewerage infrastructure has been established to meet adequacy of only 20% urban households, other households in urban and rural areas rely on on-

[78]While the Census 2011 enumerated 518,633 households connected to piped sewer systems across all villages and towns in Kerala, this is believed to be an over-estimate. Sewer systems with treatment plants are reported only in Thiruvananthapuram and Kochi Municipal Corporations, with 52,000 and 2,6500 connections respectively in 2017. Also, the number of connections in Thiruvananthapuram have increased after 2013 when the new STP was commissioned.

[79] ADB -Project Completion report 2018 and information collected from KSUDP

site sanitation where waste water is primarily disposed to septic tanks and pits[80] within the house compound premises. Septage management - emptying the filled up septic tank, transport and treatment of the sludge - is primarily viewed as a private operation in Kerala. In most cases, the construction and maintenance of septic tanks is entrusted to private agencies. The services towards emptying of septic tanks as and when required by households is mostly provided by the private sector, with some of the larger ULBs also operating septage-emptying trucks.

An evaluation of the status of septage generation and management in Kerala (Economic Review, 2017-2018) indicates that the excreta confinement capacity of septic tanks and latrine pits vary considerably depending on the terrain, land availability, and financial aspects of the household. For instance, the size of the septic tank in individual houses ranges from 1 to 4 m^3 and that in a public office premises or apartment buildings from 10 to 100 m^3. Generally, the frequency of emptying septic tanks varies from 2 to 10 years depending on the volume, usage and awareness of the need for desludging. The latrine leach pits are emptied once in 10-20 years when the pits get filled and become unusable. Generally, in low lying and coastal areas, the depth of the leach pit is restricted due to groundwater table and desludging becomes necessary in shorter frequency. The total volume of septage/faecal sludge that needs to be emptied from septic tanks or leach pits every day in Kerala is estimated at about 7,966 m^3. It is also estimated that urban areas in 6 of the 14 districts (Trivandrum, Alappuzha, Ernakulam, Thrissur, Kozhikode and Kannur) account for 70 % of daily septage clearance demand. In other districts, the generation is far higher in rural areas compared to urban areas.

The mechanical desludging operations currently remove about 500 m^3/day of septage/fecal sludge in the State. A septage treatment plant of 100 m^3/day capacity (constructed under KSUDP) functional at Kochi and the sewage treatment plant at Thiruvananthapuram receive part of the septage/fecal sludge for co-treatment with sewage. Additionally, 8 septage treatment plants, each of 100 KLD capacity, are planned in Kollam (3 plants) and one each at Alappuzha, Guruvayur, Thrissur, Palakkad and Kannur under AMRUT. Though the treatment plants when completed and operational have a potential to benefit 2.9 million people taking into consideration cities and villages within 10 kms for economical transport of septage to treatment facilities, the benefit to cities where these interventions are planned is 1.3 million or about 30% of all urban households. Although households on an average pay Rs. 3,000 - 4,000 for emptying septic tanks, the emptied septage, for want of treatment facilities, is discharged illegally contaminating ground and surface water sources.

Opportunity for Private sector participation: Informal private sector mostly provides for emptying and conveyance of septic tank / pit contents across the State. Taking into consideration about 60% of households dependent on septic tanks, a potential business of Rs. 342 crore is available.[81] However, there is need to regulate this sector and enable incentives to prevent indiscriminate dumping of emptied septic tank / pit content. There is also opportunity for private sector to operate and manage septage treatment plants, piloted by LSGD (Suchitwa Mission / Clean Kerala Company / Impact Kerala). The learnings could be replicated across the State for planned and proposed septage treatment facilities. Private sector could also play a role in the management of lift stations (sewer networks) and sewage treatment plants.

[80] According to the Kerala State Sanitation Strategy about 97 % of urban households in the state have a toilet within their residential premises. Of these, 57 % are connected to septic tanks, and 22 % to pit latrines. Households with a connection to a centralized sewer system comprise about 14 % of the population.

[81] Considering 20% serviced through network systems, an emptying frequency of once in 5 years and emptying charge of Rs. 3,000/emptying.

Solid Waste Management

Challenges: Total solid waste generated in Kerala is 3.7 million tons annually which includes 1415 tons per day (tpd) of waste generated by six City Corporations, 4523 tpd by 87 Municipalities and 4106 tpd by 941 Gram Panchayats. In addition, Kerala annually generates around 38100 tons of slaughter waste, 83000 tons of hospital wastes and 71,000 tons of industrial hazardous waste. Managing this huge quantity of waste has been recognized as a major challenge for the State. Absence of disposal and recovery facilities have adverse impacts on environment and public health with increasing incidence of communicable diseases. It also affects tourism by adversely affecting aesthetic and hygienic environment.

For the past three years, a good lot of campaign and action programmes had been undertaken all throughout the State for creating awareness among public and promoting them to use decentralized waste management systems covering segregation of waste at its source, decentralized management of biodegradables at homes or in community composting units. Remarkable efforts were undertaken for removing solid waste dumps from the streams and rivers, where it was obstructing the natural flow. Preliminary systems for collection and safe disposal of various types of non-biodegradable waste were also tried out in many LSGIs. However, furthering these efforts and sustaining the results is challenge of the day.

Thus, while ongoing efforts are visible to enhance infrastructure facilities for sanitation and waste management in Kerala, the sector has the following challenges:

- August 2018 floods damaged / destroyed 11,640 toilets in 44 ULBs and 83,506 toilets in Gram Panchayats which when reconstructed need to be flood resilient.
- Kerala needs more septage and sewerage treatment plants. Currently only .07% of grey water generated is being treated and put into reuse.
- Septage treatment plant of 100 KLD capacity operational in Kochi. 8 septage treatment plants each of 100 KLD capacities planned under AMRUT, which can cater to 30% of urban households. Resistance from residents to sewage / septage treatment plants hindered efforts to improve sanitation as per ADB project completion report, July 2018.
- Emptying, collection and conveyance of septage mostly provided by the private sector and some ULBs (especially larger ULBS)
- Lack of clarity in roles and responsibilities of institutions in the delivery of sanitation and waste management services.
- Lack of clarity amongst ULBs and private sector septic tank emptying operators in collection, conveyance and disposal.
- Resultant pollution of water bodies and open areas due to unsafe disposal of fecal waste after emptying from septic tanks.
- Decentralized management of bio-degradable wastes, grey water treatment and collection, segregation and safe disposal of non-degradable waste from domestic sector, commercial institutions and public spaces.
- Proven and economic technology options for centralized management of solid waste, suitable for the specific features of the State.
- There is no institutional set up to address the issue of E waste.

4.3.4 Proposed approach to Resilient Rebuilding

Strengthening Sanitation and Waste Management Programme: The GoK needs to strengthen the State sanitation strategy, including integrated wastewater and septage management guidelines, for increasing coverage and improving services (Urban and Rural). Suggestions include the following:

1. Clarification on roles, responsibilities, and service delivery models
2. Role for private sector participation
3. Options and approaches for expanding household connections to sewers
4. Recommendation of sewage treatment and septage technologies with low land use and energy foot print
5. Models for septage treatment including co-treatment of septage in sewage treatment plants, cluster approaches for servicing cities / towns, standalone septage treatment plants
6. Amendment of ULB rules and regulations to facilitate scheduled desludging
7. Estimating the financing requirements including CAPEX and OPEX
8. Preparing a Road-map for Implementation

4.3.5 Specific Interventions

The total investments required for septage management in urban and rural areas over next five years is estimated as Rs. 2750 crores which is likely to generate a business opportunity of Rs. 942 crores, detailed below.

Urban: About 20% households in urban areas are likely to access sewerage systems taking into consideration existing and planned investments. It is therefore important to address the faecal sludge management requirements of remaining 80% households (1.14 million) through septage management facilities involving collection, transportation and treatment. This is likely to generate a potential business opportunity of Rs. 342 crores[82] through private service providers over next five years, using existing and planned treatment facilities. The investment required to create facilities to treat this waste would be around Rs. 1000 crores[83].

Rural: As per report of Suchitwa Mission, around 48 % of the rural households have septic tanks while others are mostly leach pit latrines (single pit or two pits). Starting with an estimate of about 30% of rural households requiring septage management services over the next five years (2 million households), it would generate a potential business opportunity of Rs. 600 crores for collection and transportation of faecal sludge. The investments required to create facilities for treating this waste would be about Rs. 1750 crores.

[82] Servicing onsite units once in five years @ Rs. 3000
[83] Estimated per capita cost of treatment is Rs. 1750

Table 23: Water Sanitation Actions and Results Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Policy /Regulatory/ Institutional				
The GoK has adopted a strategy and a time-bound action plan to strengthen policy and institutional framework to improve accountable and efficient services for sanitation and waste management which are resilient to disasters and impacts of climate change and are sensitive to the needs of populations like the SCs and STs who lack sanitation services more than others. Kerala's State Sanitation and Waste Management Strategy and Programme adopted by the GoK.	X	X		Increased coverage and improved quality of sanitation and waste management services in urban and rural areas. **Baseline** (January 2019): Inadequate policy and institutional framework for Sanitation sector. **Target** (June 2021): (i) Improved Sanitation services for at least XX% targeted people.
Setting up of a inter sectoral WASH coordination platform of all govt stakeholders working in drinking water supply, sanitation, waste management and hygiene domain.	X			Integrated information and data base on WASH. Better institutional collaboration.
Twin pit/Septic tank/Bio-digester toilet to be made mandatory depending on terrain conditions such as deepwater table area, low lying land, water-logged areas etc. Scientific study on mapping the appropriate toilet technology specific to the region.	X X	X		Sustainable toilet substructures address the issue of ground and subsurface water contamination. Sanitization of dug wells
Investments Planning				
Sanitation infrastructure for septage management (Rs. 2750 crores)			X	80% of the urban population and 30% of rural population access safe fecal sludge management

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Sanitation- Collection and transportation of septage (Rs. 942 crores Investment programme with additional funding to be established for storm water drainage in ULBs. Current issues identified	X		X	Improved connectivity of primary, secondary, and tertiary drainage systems to prevent clogging and pollution of water bodies

4.3.6 Technical Studies and assessments

The list of studies to be carried out to support the above policy, institutional and investments activities is provided below.

Table 24: Water Sanitation List of Studies

Activities	0-6 months	0-18 months	18 months & beyond
Policy and Institutional			
Preparation of Policies and Programme for Sanitation and Waste Management:		X	
(a) Institutional roles and responsibilities and medium-term programme		X	
(b) Cost-effective sewerage and septage management programme and service delivery models		X	
(c) Solid waste management programme		X	
(d) M&E, Citizen Engagement, and Grievance Redressal Programme		X	

4.4 Urban

4.4.1 Introduction

Kerala has been urbanizing more rapidly than the national average. In ten years (2001-2011) the percentage of urban population nearly doubled, with an Annual Growth Rate of urban population of 6.5%. This makes Kerala the second most rapidly urbanizing state in India, with 65% of the population concentrated in mid-small sized cities (20,000-100,000 people) and the remaining 35% are in bigger cities (100,000+ people).

Though the population density of the State as a whole is high among Indian states, the population density of urban agglomerations in Kerala is less when compared to UAs of other States. Population density variation is seen within the urban agglomeration also. The analysis of change of population of the core and fringe of urban agglomerations in Kerala shows that the core is either in stagnation stage or even exhibit negative growth, whereas fringes grow at a higher rate. The fringe areas of the urban agglomerations are having lower density than the core and the fringe areas are in a transitional stage (in to the density of the core). This indicates the scope for further densification of the urban agglomerations of the State.

Kerala is one of the leading states in the implementation of 74th CA, but access to basic services at the ULB level continues to be a challenge. Following the 73rd and 74th CAs, in 1994 Kerala passed the Panchayat and Municipal Acts mandating the establishment of panchayats (rural local bodies) in the rural areas and municipalities in the urban areas, and devolving 26 out of 29 functions, and 17 out of 18 functions respectively. Despite Kerala's decentralized service delivery set-up and progress on reforms, the State has not yet been able to tap on the potentials of rapid urbanization nor turned its cities into key economic drivers. According to Kerala's 2016 AMRUT State Action Plan and 2014 ASCI report, the coverage of all urban services including access to drinking water supply, waste water management, solid waste management, storm water drainage and municipal roads are below acceptable limits. In terms of access to piped water supply, only 35% of the urban households have access, which make it the fourth lowest state of the country at 50% coverage of the national average (from Census 2011) and the supply to households is limited to an average of 3-6hrs a day. Access to piped sewerage network remains in the range 5-30% across ULBs, with a substantially high dependency on soak pits/septic tanks for which there is no proper fecal sludge management system. Likewise, the solid waste management services are very limited - almost all the ULBs are lacking sustainable treatment and disposal facilities with partial waste collection systems. Inadequate waste water management and solid waste management services are not only affecting the quality of life in urban areas, but also the water bodies surrounding the urban areas (back waters), which are valuable cultural and heritage assets of huge economic value as a core tourist attraction. Likewise, unplanned and inadequate storm water drainage systems limit the city's ability to face and manage flash flood events, which are on the rise due to erratic monsoon patterns.

On the fiscal side, local government finances have been expanding in the last decade, but municipal revenues are far from being sufficient for addressing the priority basic municipal investment needs, let alone building climate resilient infrastructure. Over the last decade, municipal finances in Kerala have grown at 14.5% (CAGR) for the 2004/5-2013/14 period (Oommen, 2015). Going forward, ULBs in Kerala are slated to receive approx. Rs. 18,000 crore over the period 2015-21 including transfers from 14th CFC, 5th SFC and national urban programs supporting selected ULBs in Kerala (2 ULBs through SCM and 9 through AMRUT). Despite these increases, in terms of discretionary transfers ULBs in Kerala receive on average, a per capita allocation from the Fifth SFC and 14th CFC (two primary sources of discretionary

grant allocation) of Rs. 1,400, which is around one third of the per capita allocation to the panchayats (Rs. 4,095). Hence, the discretionary funds available to ULBs for addressing their investment needs are far less than as compared to panchayats. As such the 5th SFC recognized this and has argued that due to the rapid urbanization in Kerala and increasing pressure to expand municipal infrastructure, more priority should be given to the allocation of resources to ULBs. The total estimated investment need for core municipal infrastructure is approx. Rs. 45,500Crores over the next 5-7 years to be able to provide municipal services in all the urban areas[84].

Sanitation is recognized as a major challenge in the urban areas in Kerala owing to various geographical and demographical challenges like high population density, scarcity of land required for centralized technical solutions, high ground water table and lack of social acceptability to allow development of large-scale treatment and disposal facilities. Urban sanitation also suffers from multiple issues at the policy level relating to lack of multi-year strategic investment planning, lack of adequate and steady capital funding, and technological, operational, and capacity constraints at the local level. The sanitation problems emerged in a strong way in the aftermath of the recent floods when the toilets, septic tanks and leach pits suffered widescale damages due to poor quality of construction and there was a widespread increase in surface and ground water pollution affecting the availability of drinking water supply. Lack of solid waste facilities and treatment also contributed to the floods and many waste treatment and water treatment plants were damages. Overall, the urban sanitation problems have led to widespread public health, environment and social hazards in the State, and have gained priority in terms of the challenges to be addressed with an innovative and comprehensive approach as a part of the Rebuilding Kerala Initiative.

4.4.2 Impact of 2018 Floods

The current situation of Kerala's municipal service delivery is also being increasingly affected by numerous natural disasters and cities need to build better systems of planning and implementing climate resilient infrastructure. The vulnerability of the State was exposed in August 2018 when Kerala suffered widespread floods affecting 5.4 million people. The floods exposed the vulnerability of the urban areas to natural disasters resulting from numerous factors such as settlements of habitations in disaster prone areas, lack of proper urban/spatial planning frameworks that; and poor quality of municipal infrastructure being built by the local governments; inadequate drainage infrastructure and a very limited and provision of solid and liquid waste services and infrastructure.

4.4.3 Major Legacy and Current Issues

In addition to the infrastructure and service delivery shortcoming in sanitation, the urban sector at large encounters several policy challenges, many of which have already been identified by the Fifth State Finance Commission report. For RKI to accomplish its mandate of 'build back better,' a series of transformative urban sector reforms will have to be addressed to shift the way in which ULBs deliver services, including the following key aspects:

- ***Flexibility in planning guidelines***: The State annual budget provides approximately 25% of the total expenditures to local governments as plan funds to be used for local development and service delivery purposes. The current allocation system that has organically evolved during the last two decades

[84]Preliminary estimates based on demand projections for the core municipal infrastructure (includes drinking water supply, waste water management, solid waste management, storm water drainage and municipal roads) needs in all ULBs.

prescribe the earmarking of most planned funds among several sectors without leaving much space/flexibility for the ULBs to undertake capital expenditures, according to the needs and priorities of the citizens. This excessive earmarking that applies across the board to all LGs regardless of their specific characteristics and needs have resulted in severe allocation inefficiencies.

- ***Enabling multi-year, large infrastructure planning:*** The annual planning and budgeting process wherein the plan funds are allocated and disbursed on an annual basis, combined with the fragmentation of resources due to earmarking, constraints the ULBs from identifying and prioritizing multi-year critical infrastructure investments which are needed to address 'lumpier' investment gaps in sectors like transportation, sanitation, that may require more comprehensive, mid-term solutions. Currently, fund allocation for capital projects divides investments into several hundred micro size projects that can be implemented at the ward level in a short period of 4-6 months. The preparation of Capital Investments Plans shall be based on long term district plans and master plans, with a corresponding budget allocation, presents a solution to start addressing this issue.
- ***Promoting linkages between annual plans and master and district development plans:*** Plan funds are disbursed and utilized as per the annual planning guidelines, with no mandatory provision to link the annual plans and investments with the long-term investment plans stipulated by the urban master plans or district development plans. This has two major implications – firstly, the investment planning doesn't have a long-term/medium term horizon and secondly, the lack of enforcement of the master plans had led to widespread urban sprawl and unmanaged construction in hazard prone areas, which has proven to be extremely dangerous and vulnerable to natural disasters such as the floods of August 2018. Long delays in the preparation and notification of master plans and their lack of funding also contributes to the weakness of the State's mid to long term planning. The same goes for the coordination with the current district planning exercise that is starting to be put in place in a few districts. There are no binding regulations that link the district with the annual plans, to ensure proper coordination between the capital investment plans of the districts and those of the ULBs. Allocation of plan funds is not based on long term district plans and master plans and this has resulted in non-implementation of long-term infrastructure projects.
- ***Addressing key human resource gaps:*** ULBs lack critical manpower and expertise in core functional areas like governance, financial management, engineering and urban development, which restricts their capacity to better plan, identify, prioritize, design, execute and manage municipal infrastructure. Limited use of innovative technologies adds to the problem as many functions that are manually implemented, could be automatized. The reskill and redeployment of exiting staff who are either idle or lack capacity can also help to address the HR deficit at the ULB level. The governance systems are also weak at the local level especially on the financial management, procurement, contract management, front line service delivery and local administration aspects, which are areas where appropriate skills need to be developed.
- ***Technical guidelines to promote quality and resilience:*** One of the key issues at the local level that came to surface during the floods is the poor quality of infrastructure developed by ULBs. In addition to the local capacity constraints, one of the critical policy constraints behind the poor qualify infrastructure is the lack of robust technical design guidelines, service standards and construction codes for infrastructure and buildings required in the context of Kerala and the enforcement at the local level. Firstly, the existing guidelines and codes are very fragmented and inadequate. Secondly, many of them, have been developed at the national level without the proper customization for the Kerala context. Thirdly, most of the municipal engineers are not aware of the such codes/guidelines

or if they are aware, they do not comply with those due to lack of expertise and weak accountability/monitoring systems.

- ***Enhancing role of district stakeholders***: District level agencies and stakeholders play a critical role in the whole plan approval process for ULBs through District Planning Committees (DPCs). However, their mandate beyond the plan approval is limited and the HR capacity at the district level to monitor the implementation of the Plans is also inadequate. District agencies and stakeholders have a large role to play in integrating plans across jurisdictions and also in conceptualizing inter-ULB initiatives. While district stakeholders are closest to the ULBs and have an active participation in the local development matters, the mechanism for inter-ULB planning and oversight are weak.
- ***Administrative Review***: The existing Government procedures and practices developed when the current levels of technology, people participation or specialization were not available. New developments in these fields can change the functioning of urban local bodies and make them more effective. In addition, numerous rules and regulations have organically grown through the years, many of which are now obsolete. Therefore, it is necessary for the Government to review the administrative functioning of urban local bodies considering the present tools available and also future opportunities. Through this review and reform, the Government can decide goals for use of technology, modernize organization structure and procedures, and to clarify the governments interface with civil society.
- ***Enhancing the financial sources for urban service delivery***: Despite the recent increase of transfers going to the ULBs, there is still a huge investment gap that calls for improvements in local taxation (mainly property taxes) and the mobilization of alternative sources of financing such as land value capturing. Instead of an incremental approach, it is necessary for the Government to take stock of the overall resource requirement of ULBs considering the need to achieve service level benchmarks and formulate an urban infrastructure financing and resource raising policy; and set targets for revenue improvement.

4.4.4 Proposed Approach to Resilient Rebuilding

In the context of the challenges identified in the urban sector, the proposed sector strategy comprises 3 key pillars: (i) transformative policy and regulatory actions to be undertaken by the State government for the strengthening the urban planning, plan allocations, governance and service delivery systems; (ii) institutional reforms, capacity development and organizational strengthening interventions at the district and local level; and (iii) investment support for immediate priorities such as urban sanitation (liquid and solid waste) that need to be addressed through dedicated additional funding beyond the existing plan funds, as a part of Rebuilding Kerala Initiative.

The proposed sector strategy will anchor the interventions to be supported by the World Bank through a programmatic engagement comprising both (i) the proposed Resilient Kerala Programme (Development Policy Loan) and (ii) the Kerala Urban Service Delivery Project (KUSDP, Investment Project Financing).

4.4.5 Specific Interventions

Table 25: Urban / Rural Actions and Results Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Policy/regulatory				
Revise the decentralized plan guidelines to (a) reduce fund fragmentation and (b) enable the planning process at ULB level to identify and prioritize multi-year projects based on long term plans Decision taken by LSGD to revise the annual decentralized planning guidelines. Approach paper finalized for revising the annual planning and budgeting framework at the State and local level to (a)avoid fund fragmentation owing to excessive earmarking in plan funds and to enable multi-year investment planning, jointly by LSGD and State Planning Board. Revised annual planning guidelines formally notified. Process for identifying city level multi-year priority projects notified. Implementation of the annual planning guidelines at the local level, including a provision for the identification and planning of multi-year investments.	X X X	 X X	 X	Improved investment planning for identifying and prioritizing multi-year, long term investments for critical municipal infrastructure development.
Settlement policy has to be formulated at the State level. Decision taken by the government to prepare settlement policy. Formulation of settlement policy Implementation	X X	 X	 X	Sustainable Planned development
Preparation of GIS based District plans, Master Plans, Interim local development plan and highlighting multiyear projects in that for (1) enabling ULBs to improve the effectiveness and				Risk-informed urban planning lead to better

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
implementation ease of decentralized planning process; (2) developing enforcement framework at state, district and local level and (3) undertake disaster risk informed spatial and land-use planning in urban/rural areas in consideration of the terrain (high-land, mid-land and low-land) , and monitor compliance (4) on the prospect of urban compaction and reducing urban sprawl. Decision taken by LSGD to revise the urban planning framework (including act and guidelines) for addressing the issues relating to preparation of robust master plans, Interim local development plan and effective enforcement of master plans to regulate development in hazard-prone areas. Clarify the procedures for linking the District Disaster Management Plans with the master Plans. Action plan finalized for revision of the urban planning framework of Kerala based on detailed review and assessment of existing planning systems and procedures. TCP Act amendment to ensure the preparation, notification and enforcement of plans in a time bound manner. Government shall have powers to override the approval process of the master plan, if the LSGI s are not taking timely decisions for a planned development. Paddy and wet land act has to be amended to contain urban Sprawl and protect paddy and wet lands New master plans and Interim local development plans that are sensitive to the needs of groups such as women, elderly, children, migrants, PWDs to be prepared based on amendment of the act and new guidelines.	X X X	X	X	disaster preparedness from planning, service delivery and emergency response perspective.
Establish a robust regulatory framework for ULBs to improve the quality and resilience of municipal infrastructure. Municipal infrastructure manual draft prepared based on review of existing technical guidelines, service standards and gaps identified from urban resilience and disaster risk reduction perspective	X X			Improved quality of municipal infrastructure being developed, with high level of resilience

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Final municipal infrastructure manual approved by GOK and formally notified for adoption and compliance at the local level. Capacity building and training support to be provided to ULBs to adopt and follow the design guidelines and standards for execution of municipal infrastructure projects.		X	X	to natural disasters.
Necessary changes in building rules to contain urban sprawl, planned development and mitigate disasters. Provisions for construction of buildings on hilly terrains, water logged areas etc has to be incorporated in the building rules Higher FAR values permitted for the entire State as per building rules to be reduced and FAR values shall be based on master plans so that road widening, Transit oriented development, land pooling schemes etc can be implemented. Access to buildings has to be increased for all occupancies and high-rise buildings. Revise building rules.	X X	X		Planned development
Strengthen the building plan approval system at the local level Government decision issued to revise the building plan approval by LSGD Revised building plan approval guidelines prepared, approved and notified by GOK. e-governance systems to be designed for implementation at the local level – for ensuring full compliance with new building rules and transparent procedure for building plan approval system.	X X	X	X	Improved quality of building construction and better compliance with building codes.
Conduct an administrative review at the ULB level Government decision issued to undertake an administrative review at the ULB level Complete administrative review and recommendations to the Government	X X	X		Improve the administrative procedures at the ULB level including use of technology and specialization.

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Government action taken report on administrative reforms and issue of required legal amendments, regulatory orders and guidelines.			X	
Strength Public transportation system and promote non-motorized transport systems. Prepare Policy/Guidelines for Public transportation system, promote non-motorized transport system for LSGIs and ensure that transportation is accessible to vulnerable populations like the elderly and persons with disabilities. Develop standards for implementation at local level.	X X	X		Improved public transportation systems thereby reducing congestion and pollution.
Institutional				
Strengthen the role of districts in urban planning, investment planning and project implementation supervision for improved municipal service delivery through line departments Necessary legislation and ensuing Government Orders issued outlining the role of district stakeholders for ensuring robust urban planning and good quality infrastructure. Line departments shall prepare projects based on Long term plans prepared for the LSGIs Detailed guidelines issued to districts and ULBs on the institutional roles and responsibilities for urban planning, design and implementation supervision of critical municipal infrastructure projects. Cloud data sharing platform created to enable sharing of data and to avoid duplication of studies among line departments and inter-ULBs. Additional manpower to be deployed at the district level commensurate with the assigned roles and responsibilities.	X X	X X	X	Improved accountability and monitoring systems for ensuring better compliance with urban planning and infrastructure development guidelines leading to improved quality of services and better urban management.
Strengthen the municipal cadres for deploying adequate human resources at the local level.	X			Improved capacity at ULB level to deliver services at the

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Key gaps, in non-technical as well as technical expertise, identified and revised municipal cadre structures finalized to address the identified gaps. List of skilled labourers such as electricians, plumbers etc. to be prepared by each ULB. Municipal cadre structure revised and notified. Roles and responsibilities of the Director of Urban Affairs defined. Recruitment, transfer, and reskill of personnel for the sanctioned positions to be initiated by State PSC. Dedicated institute for promoting action researches in urban development established.	X X	 X X	 X X	local level in an operationally sustainable manner.
Ensure technical support for ULBs in planning process for effective formulation of multi-year projects and dissemination of information of long term plans, disaster prone areas, heritage areas etc to the public Publish the plans for public awareness		X X		
Investments				
Long term Urban infrastructure financing, resource mobilization and revenue improvement policy. Government Decision to formulate a policy for financing long term urban infrastructure requirements and resource mobilization with focus on implementation of development projects envisaged in Master Plans and Interim local development plan. Fixed percentage of Plan funds also shall be allocated for multi-year infrastructure Projects. Report and recommendations to the Government on a) Long term urban infrastructure financing requirements, b) resource mobilization policy including State support to urban investments and c) revenue improvement targets at ULB level (including for property tax and land value capture)	X X	 X		Investments in local urban infrastructure enhanced

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Revise the Municipal Act and give ULBs for freedom to increase its property taxes and levy additional sources of revenue, such as cess for services, land value capture and tax increment financing Issue of Government policy for a) State support to urban infrastructure financing, b) enabling regulations for municipal land value capture, commercial borrowing and revenue improvement and c) targets for municipal revenue improvement		X	X	
Dedicated state level investment programme with additional funding to be established for providing access to resilient urban sanitation in ULBs. A new state resilient urban sanitation investment programme to be notified with additional funding support earmarked for ULBs as a part of Rebuilding Kerala Initiative(RKI), over and above the existing plan funds. The programme should follow an incentive approach to get stronger commitment from ULBs. Resilient urban sanitation investment programme to be designed with the help of the World Bank financing support. Implementation of the sanitation investment programme with the help of World Bank support through KUSDP.	X X	X	X	Improved public health and environment outcomes through improved sanitation services in urban areas with STPs at community level or ULB level.
Investment to address urban heat island formation. Identified urban heat islands through studies. Immediate remedial measures adopted such as green embankment protection, conservation and revival of existing water bodies. Guidelines to promote green buildings. Greening of urban areas by increased vegetation.	X X	X X	X	Reduced temperatures in urban areas.
Investment support to LSGD and ULBs to prepare and notify risk-informed master plans with hazard/risk mapping	X			Better levels of disaster

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Dedicated funding support to be budgeted for LSGD to prepare risk-informed GIS based master plans at the district/city level, which are also sensitive to the needs of vulnerable groups. GIS based risk informed master plans to be prepared for cities	X	X	X	preparedness in urban areas.

4.4.6 Technical Studies and Assessments

Table 26: Urban List of Studies

List of studies	0-6 months	0-18 months	18 months & beyond
Policy			
Urban planning framework review and assessment for Kerala, and options paper for restructuring the same.	X		
Review of existing annual plan guidelines, identify the key issues with empirical evidence and preparation of revised annual plan guidelines	X		
Review and assessment of the existing municipal infrastructure guidelines and building codes, and preparation of draft resilient municipal infrastructure manual for core municipal services and buildings.	X		
Formulation of indices to be included in the guidelines for the preparation of an Urban Development Master Plan in specific conditions of Kerala, based on the global best practices.	X		
Formulation of general guiding norms for conceiving the approach to be followed by the local self-governments in public service delivery through various options like • Direct LSG level services • Services being provided by State Departments of agencies • Services being provided by private entrepreneurs (e.g., city gas, cable services etc.)	X		

Study of the suitability of 'Waste to Energy Plants' as well as other various global best practice models for the Municipal Solid Waste Disposal specific to the Kerala conditions.			
Administrative review of local body functioning including use of technology, organization structure, procedures and guidelines, citizen and citizen group participation	X		X
Institutional			
Review of the existing municipal service cadre structure, need gap assessment based on existing HR in ULBs and provide options for restructuring the municipal service cadre and for direct contracting			X
Investments			
Urban sanitation investment needs assessment for ULBs in Kerala.	X		
Technological solutions assessment for solid and liquid waste management in urban areas in Kerala.	X		
Technological solutions assessment for storm water drainage in ULBs.	X		
Identification and assessment of urban heat islands and proposing remedial measures.	X		
Preparation of master plans based on GIS and risk-informed approaches for select 10 cities	X		
Urban infrastructure financing requirements, resource raising and revenue improvement study (including Land Value Capture, Own Revenue Improvement and Commercial Borrowing)			X

4.5 Roads and Bridges

4.5.1 Introduction

The floods of 2018 led to heavy damages to the roads sector. According to preliminary assessments of the PDNA, the roads sector has the highest sectoral recovery costs. Roads in around 12 of the 14 districts reported landslides, earth slips, debris flow and rock falls. Idukki, Kottayam, Pathanamthitta, Kozhikhode, Malappuram districts were significantly impacted. High quality and durable road infrastructure is a prerequisite for social, economic and industrial development any state. Tourism is one of the mainstays of Kerala's economy, contributing 10%of the Gross State Domestic Product. The State caters to 75% of the all India tourist footfall as per 2016 Statistics. The current transport infrastructure of the State consists of 2.05 lakh km of roads, 1588 kms of railways, 1687 km of inland waterways and 18 ports and 4 International Airports with road dominating among all available transport modes. Having a good road transport infrastructure and services is key to promote tourism and seamless passenger and freight movement[85].

4.5.2 Impact of 2018 floods

Given the difference in geographical terrain across the State, the nature of disaster and impacts are varied. The flood diagnostic and inundation maps presented in the JRDNA under 'Kerala Flood and Landslides' indicate that the majority of the flooding occurred in areas around the backwaters and the lower reaches of the rivers where river bank heights were lower; adjacent flat areas became waterlogged to exceptional levels of up to 1–2 m. The central mid lands and coastal plains witnessed massive floods from overflowing rivers/canal owing to reduced carrying capacity of rivers, lakes, wetlands and porous land. The roads in the seven districts of Alappuzha, Thrissur, Ernakulam, Kozhikode, Malappuram, Kollam and Kottayam sustained such flood induced damages, due to an absence of an integrated urban floods risk management[86].

District Name	Damage Estimate for SH & MDR INR (Mn)	Total SH & MDR (KM)	Damage INR-Mn/km	% of Total Damage Cost
Thiruvananthapuram	1842	2557.73	0.72	2.41%
Kollam	2059.4	2202.87	0.93	2.69%
Alappuzha	7647	1472.33	5.19	10.00%
Pathanamthitta	6066.4	2031.37	2.99	7.93%
Kottayam	7928.5	3456.21	2.29	10.37%
Idukki	21360.9	2867.37	7.45	27.93%
Ernakulam	5068.6	3085.28	1.64	6.63%
Thrissur	5145	2064.22	2.49	6.73%
Palakkad	4409.9	2184.69	2.02	5.77%
Wayanad	5580.8	1029.31	5.42	7.30%
Malappuram	3761.7	2680.15	1.40	4.92%
Kozhikode	2966.2	2454.65	1.21	3.88%
Kannur	1526.5	2265.24	0.67	2.00%
Kasaragod	1111.13	1460.66	0.76	1.45%
Total	**76474.03**	**31,812**		

Source : JRDNA-2018 and State Economic Review 2016

In the middle and upper reaches of the rivers, waterlogging was less although damage did occur in areas where strong currents and flood discharges, in excess of full bank flow, impacted road structures. The forceful water currents of the river along with debris washed away road embankments, seeped into pavement layers in absence of surface and sub-surface drains, caused the erosion/damage of bridges, cross structures and protection works, etc. Various

[85] *Ref: Kerala JRDNA-2018 WB/ADB, PDNA 2018-UN, CWC 2018 Flood Reports*
[86] *References: State Economic Review 2016/2017, By Kerala State Planning Board and Stakeholder Discussions*

incidents of landslides linked to canal/river bank erosions, water table draw-downs, pore pressure building, and piping effects within unstable slopes were also reported in the eastern highlands. Damages due to landslide/slips along roads primarily occurred in four hill districts of Idukki, Wayanad, Pathanamthitta and Palakkad.

As per the JRDNA and PDNA, about 2,004 km of SH and 13,246 km of MDR across 14 districts suffered varying degree of damages constituting around 48% of the total PWD SH & MDR network. The NH wing has estimated damages of about 580 km of NHs resulting in a damage estimate of Rs. 85.4 Bn. The six most affected districts were Idukki, Wayanad, Alappuzha, Pathanamthitta, Thrissur and Kottayam. The PDNA assessed the total sector recovery needs comprising of damages to NH, SH, and MDR roads to the amount of Rs. 8,558 crore.

Immediate Recovery Efforts – The urban department allocated Rs. 12 crore in 2018-19, and Rs. 18 crore for 2019-20 for roads to be repaired or reconstructed. Another Rs. 20.14 crore has been allocated for house construction activities. As of January 24, 2019, the total fund allocated for restoration projects to all the districts amount to Rs. 33.44 crore.

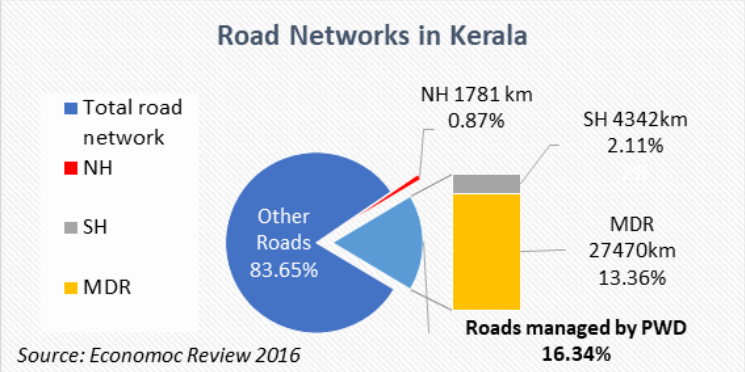
The Public Works Department (PWD) has accorded Administrative Sanction for works worth Rs. 2,764 crore by rearranging its current year's budgetary resources for reconstruction of roads. The department has also issued a new administrative sanction worth Rs. 371 crore for the repair of roads and bridges under NABARD assisted RIDF, in addition to the works sanctioned by the NABARD earlier this financial year. Following table shows the post-flood recovery works carried out by the PWD –

Table 27: The Post-Flood Recovery Works Carried Out by the PWD

Category	Repair and Maintenance (Km. roads)	Resurfacing (Km. roads)	Culverts	Bridges
Non Plan	4429	0	656	127
Plan	0	844	0	0
NABARD	0	0	0	0
Sabarimala Package	427	375	0	0
Total	4856	1219	656	127

As suggested by the PDNA, recovery activities could include - short-term activities aimed at restoration of traffic and arresting further asset deterioration, much of the work has already been successfully carried out by the State in affected regions. Medium to long term activities would be founded in the principles of 'Build Back Better' with disaster and climate resilience approach to rebuilding activities. Activities could focus on required technical assistance to assess the vulnerability associated with road networks; specifically, on geo-hazard and flooding risks, and developing climate-proof framework. Activities could also include better GIS mapping of the highway networks, with details of the river systems, geo-hazard zones and micro-climates. This RKDP further develops upon the suggested sector recovery activities proposed in the PDNA through analysis of the root causes and through consultations with public and relevant stakeholders.

4.5.3 Major Legacy and Current Issues

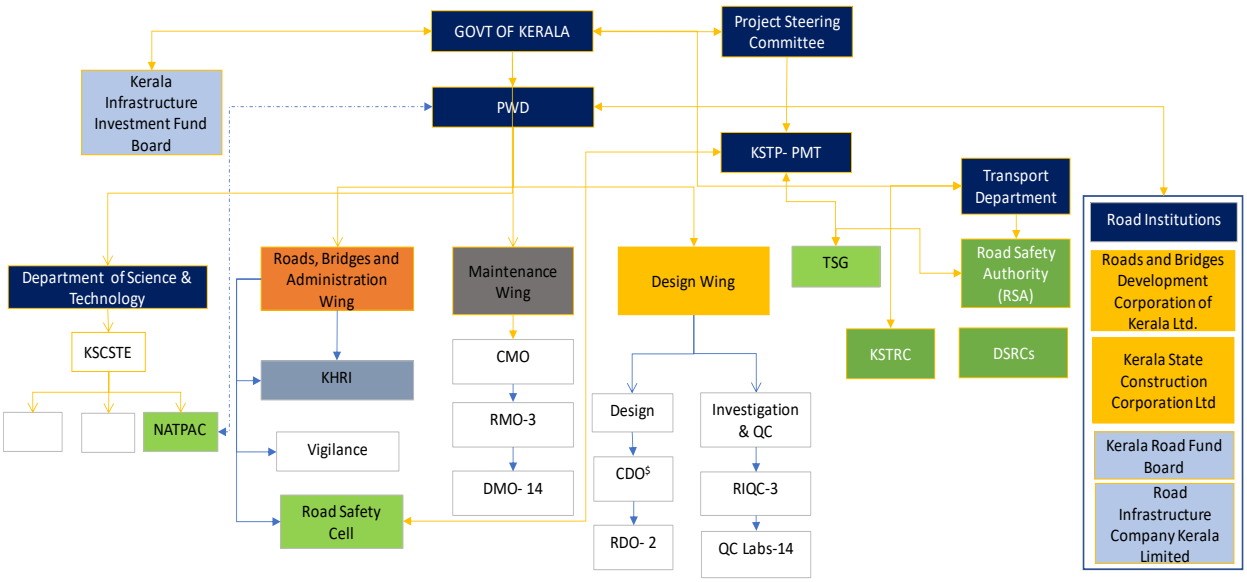


Inadequate capacity to meet the growing demand: Kerala's "rurban" development, widely scattered habitation with a less obvious rural urban divide have contributed to roads being pre-dominant mode of transport. It caters to 75% of freight and 85% of passenger mobility share. The State has a dense road network. At 528.8 km/100 sq.km it is much above national average of 387 km/100 sq.km. Out of the total 2.05 lakh-km of road network, the primary road network of the State consists of 1782 km of National Highway (NH) roads, 4341 km of State Highway (SH) roads and 27,470 km of Major District Roads (MDR), and roughly constitutes 16% of the total road network and carries about 80% of road traffic and is the mainstay of all economic activities. This primary road network has come under increasing pressure from growing population and rapid traffic growth at around 12-14% annually and is struggling to keep pace with the economic aspirations of the State. Out of 4,342 km of State highways, around 70% are still single-lane with 54% in poor condition. In case of NHs, 12% of the road network have 4 lane capacities while remaining roads have two lane or intermediate lane capacity.

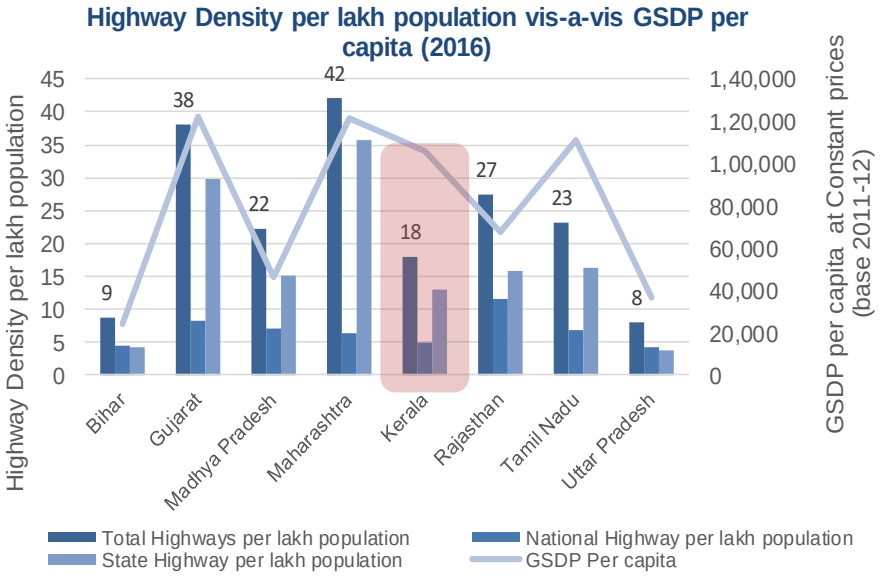
Multiple institutions and lack of coordination among them - The SH and MDR network in the State is primarily managed by the Roads and Buildings (R&BD) wings of the Public Works Department (PWD), while the National Highways are managed jointly by NHAI and Ministry of Road Transport Highways through the NH Wing of PWD. Further, there are many special purpose vehicles, companies and statutory bodies formulated to manage primary road assets under PWD such as KSTP, KCCL, KRBC, KRFB etc. Most of these bodies tap the same funding sources, thus competing among each other and creating uncoordinated approach for asset development and management. Apart from lack of convergence, the State institutions also lacks approach towards full-scale e-governance and efficient management systems and processes, access to market finance and alternate revenue sources like land value capture financing, advertisements, congestion fees for urban roads. Besides, the State so far has not established a coordinated approach in state transport infrastructure policy and planning involving key sectors like PWD, Railways, State Ports, Coastal Shipping, Inland Waterways, Airports Authorities and Transport Department[87].

[87] *Under KSTP-II, Institutional Component C, 12 months (study + implementation) for establishing a "Centre of Excellence" for Road Sector has been commissioned. The primary objective of the study is to carry out a sector diagnostic and outline a best possible Institutional Road Map for PWD and Road Institutions to effectively deal with various sectoral themes like Quality Assurance, Planning & Design, R&D, Road Safety, Road Asset Management and Climate Resilience. The Consultant to explore the pros and cons of setting up a "Virtual Centre of Excellence" which can act as a "think tank" for the sector and help in integrated planning and policy making.*

Figure 29: Institutional Engagement in Roads



Need for updated master plan and need for implementation capacity to lower ecological footprint – Traffic is growing at the rate of 10-11% annually. The length of road per lakh population is 615.5 km. NH carries 40% of the total traffic, SH & MDRs, carries another 40% of the road traffic. The strategic road network (SRN) for the State road network was identified with help of study by RITES which concluded in 2001 and a supplementary study completed by Scott Wilson in 2004, screening 2962 km of roads (26 State Highways with total 1038 km, 58 MDRs with total length of 1122 km and 85 hill highways including 16 missing links with total length of 802 km). Of the 2160 km of network excluding the hill network, the Scott Wilson study classified 1458 km, 607 km and 95 km as High, Medium and Low priority for development. In 2013, CDM Smith also carried out an exercise to strategize the use of 8,500 km of important roads which were taken by PWD from the Panchayats and classified as MDRs. Beyond this the State has no other road development updates or strategies in place. Further there is lack of:



a) Fully integrated GIS based Road Maintenance Management System to capture pavement related data inputs and establish linkages with HDM 4 software which needs to feed into Road Maintenance Management Planning System;

b) Long term performance-based management contracts for strategic road assets;
c) Capacity of state level contractors leading to implementation challenges. The major challenges of the local contractors lie in the limited ability to execute value engineering techniques, climate proofing and adaptation, green and resilient designing, adoption of state-of-art modern and green construction technologies, experiences in managing new contract types like EPC, Design-Build, OPRC, poor workmanship, implementation of work zone and environmental safety standards which are critical to reduce overall impact on environment and ecology during recovery and rebuilding of road infrastructure under RKI;
d) Participation of National contractors in state infrastructure projects owing to poor investment climate.

Low Capital Outlay and Access to market Finance – Traditionally, capital expenditure in Kerala in terms of % GSDP is less than other states in the country. While most of the better performing states in terms of infrastructure[88] have a Capex to GSDP ratio in 2013-14 in excess of 5, Kerala managed a 1.79 ratio. Bridging the financing deficit and finding innovative means of financing were key needs that led to revamping of KIIFB in 2016, through an ordinance which allowed it necessary administrative and financial autonomy to access alternate investment funds (AIFs) like InVITs, IDFs, masala bonds, diaspora bonds. The public budgetary sources that were made available to them included i.e. 10% of MV tax and 100% of State Road Cess. The Recent road sectoral budget for FY 18-19 was Rs. 1284 crore. with roughly Rs. 90.8 crore allotted to NH development and maintenance and rest to SH and MDR, which translates into a meagre to Rs. 0.5 Mn per km for NH and Rs. 0.35 Mn per km for SH & MDR. Another big concern of the state in improving the capital outlay in the sector has been a lack of a state road tolling policy. Kerala Tolls (Amendment) Act, 1986 provided the basis for Tolling of standalone Bridge projects, however owing to recent public protests tolling of these bridges' projects has also stopped. The Kerala Road Fund (KRF) Act of 2001 provided a framework to introduce concession specific user charges/tolling for road projects but it failed to materialize a single BOT- Toll project in the State. Kerala Road Fund Board (KRFB), constituted under KRF, has developed a number of Annuity based City Roads Improvement projects in Trivandrum, Kozhikode and recently signed a contract for Alappuzha City. However, in spite of such a long-standing presence in Kerala, KRFB is yet to create a policy/framework that taps into revenue options such as congestion charges, advertisement revenue, land value capture through traditional means like betterment levy, increases in stamp duty or revenues from utility ducts sharing etc. in order to finance city road improvement projects.

Insufficient public transport service - As of 31st March 2017, 44,291 buses have valid registration of which around 25,000 buses ply on road primarily catering to inter and intra city travel demand. KSRTC has a fleet strength of 5,795 (which has remained stable in size for the past 6-7 years), operating 5,047 schedules on 7,548 routes. Thus, there is increased share of private operators within cities. However, KSRTC continues to maintain the monopolistic position in providing intra-city and state passenger mobility services as these routes are nationalized. The concept of shared route permits with private operators for intra-city services has been initiated in recent past and is at early stage of evolution. Consequently, the concentration of two- and four-wheelers has increased many folds and is considered to be the main cause of traffic congestion in the cities and state road network. Insufficient public transport service also contributes to excess carbon emission as well as places an additional load on existing road infrastructure.

High climatic risk and disaster-prone areas - The road network of the State is prone to natural disaster due to unique terrain features – such as highlands, rolling hills & mountainous terrain, mid-lands and

[88] As per white paper on State Finance, June 2016

coastal plains. The hilly areas are vulnerable to landslides often caused due to intense rainfall during monsoons. The states face two bouts of monsoons (South west and North -East in a year starting June ending November) witnessing high rainfall intensity. Similarly, the coastal areas are susceptible to coastal flooding, cyclones and inundation from sea water. During 2018 floods and landslides, around 48% (in kms) of the total state road network was reported damaged mainly due to floods, landslides, earth slips, soil movement and rock falls. Flood inundation maps show that the majority of flooding occurred in the areas of back waters and lower reaches of the river. In the middle and upper reaches the flooding was less, but damage did occur in the areas where strong current and discharges were in excess of full bank flow, damaging road infrastructure. Additionally, there is no integrated urban floods risk management or GIS based vulnerability and risk mapping of the asset stock of the State to prepare project specific mitigation efforts or a resilience framework for roads.

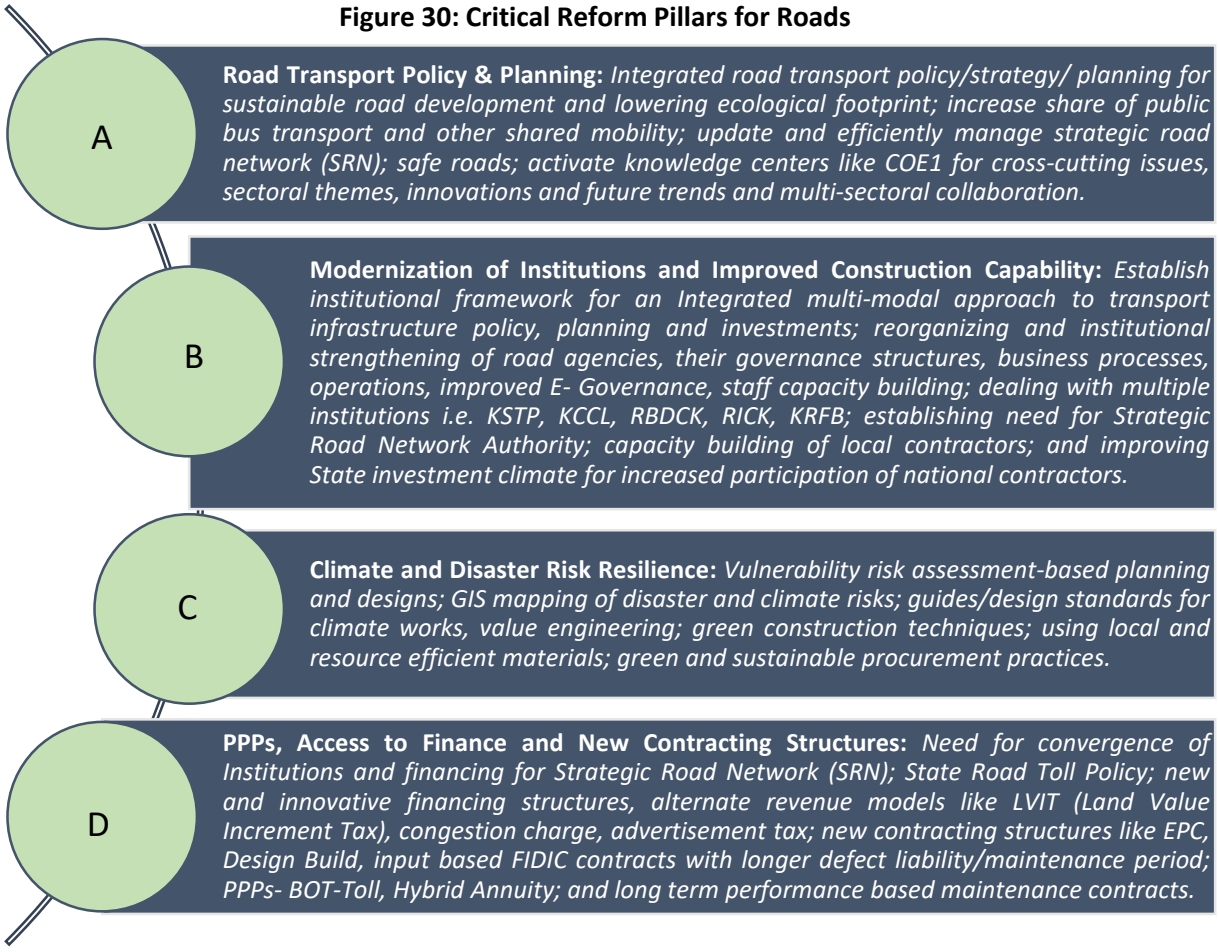
Road Safety – Road Safety has been a perennial challenge for Kerala. In 2016, there were 39,420 road accidents, 4,287 deaths, and 44,108 injuries which translated to high accident severity index of 12.8 deaths per lakh population. Between 2015 and 2016, the State recorded a 20% increase in road accidents. The major road safety challenges include increase in the share of 2W & 4W vehicle registrations (2Ws are extremely vulnerable to accidents), conflicts of vehicle movements on narrow un-divided roads, high roadside frictions from abutting land-use, high percentage of two-wheelers in the modal share (road traffic), lack of safe mobility facilities for vulnerable road users, in-adequate enforcement and lack of a multi-sectoral approach to deal with road safety. As part of KSTP-I, in 2007 Kerala became the 1st state in India to statute a Road Safety Authority (RSA) headed by the Transport Minister and in 2009 Kerala created a dedicated Road Safety Fund. However, KRSA have not been very active in identifying and implementing multi-sectoral road safety projects in the State. As part of KSTP-II, the Road Safety Component focused on implementation of a Safety Corridor Demonstration Project (SCDP) for 80 km state road network and adopting the learnings in 10 small corridor demonstration projects identified across the State with a focus on improving road safety through multi-sectoral interventions with the help of an earmarked “Challenge Fund”. The State has delayed implementation of SCDP which is still underway. This show a lack of institutional commitment to such a multi-sectoral approach to implementing road safety projects. As part of re-instating the institution of KRSA, KSTP-II funded the establishment of a Technical Support Group (TSG), hiring of few eminent experts in the field of Road Safety to function as secretariat of KRSA. However, unless ownership is taken by KRSA this may not very successful arrangement. Recently, the State MVD launched “Safe Kerala” programme based on the success of “Safe Sabarimala” with the objective of curbing road accidents and fatalities and inducing disciplined road culture in the State. The initiative primarily focuses on strengthening the enforcement wings of the motor vehicle department with modern control rooms in each district, 24/7 patrol and enforcement through appropriate resources and tools (such as radar fitted interceptors with Lux, Alco and Sound meters, patrol vehicles and surveillance/speed cameras). Although, this is a good initiative there is a need to establish protocols for adopting duty of care in tackling overlapping enforcement functions between the Police and the Transport Department and establishing a collaborative framework across PWD, Health and Education Departments for developing and managing a Safe Road Network in the State.

4.5.4 Proposed approach to Resilient Rebuilding

Roads are the primary mode of transport in Kerala and would continue to remain so in the envisioned recovery and rebuilding time-frame of “New & Green Kerala” under RKI. As the State embarks on this esteemed vision, the future of transportation mobility needs to be well-tailored towards sustainable, greener road transport with low ecological footprint. Thus, while developing new /re-

building roads there is a need to focus on multi-modal integration, improve productivity of current road assets, outline strategy to shift to low carbon emission vehicles and fuel technology, increase modal share of efficient public buses and shared transport mobility, and build an overall climate and disaster resilient road asset stock. Some of these aspects needs multi—sectoral intervention/involvement i.e. Transport Departments, KSRTC, other State Transport Departments, LSGD as well as necessary political buy-in and community level participation. In light of this, the road sector modernization plan for RKI has identified four critical reforms pillars A, B, C and D as shown in the figure:

Figure 30: Critical Reform Pillars for Roads



RKI interventions aim for a Safe, Green, Resilient, and Seamlessly Connected Road Network for All by 2030. The road network will be planned, developed and managed following four globally accepted mobility attributes i.e. equitable, efficient, safe and climate responsive with the help of supportive policy, regulations, institutional and governance structures and reforms within an overall aim to achieve economic efficiency with lower ecological footprint for a Greener Kerala under the Rebuilt Kerala Initiative.

The various immediate and phased interventions in terms of line activities and outcomes are presented in tables later in the chapter. This has been carefully conceptualized as action agendas covering policy, legislations, regulations and institutional reforms. There is also a need to include cross sectoral linkages for achieving optimum results and utilization of resources for which supporting institutional frameworks

have also been recommended. Since the roads sector has the highest recovery costs, phasing of activities should be done in such a manner so that parts of the sector which would enhance resilience building are prioritised.

4.5.5 Specific Interventions

Table 28: Roads Activities to be Taken up for Sector Reforms

Activities	Description
Policy /Regulations **Supporting Framework**	**Develop a State Road Transport Strategy/Master Plan (0-18 months)** aimed at an optimal use of different modes (road, rail, inland waterway, ports) and enhance passenger mobility with efficient public bus transport services. The Strategy/Plan will articulate a roadmap for a demand-driven balanced transport modal share in the State. It will include feasibility evaluation of providing separate exclusive two-wheeler/ three-wheeler lanes in urban stretches of core network roads. The master plan will articulate strategy for efficient fleets, fuel technology, smart infrastructure access, smart truck parking management, monitoring and enforcement of weights, and the use of ITS/ICT to ensure the compliance with infrastructure and regulations. The Road Master Plan shall update available PWD information from prior Strategic Road Network (SRN) studies of 2001, 2004 and 2013, GIS information and road network investments under KSTP- I&II, LSGD and other state- funded projects. Road Master Plan will identify the new list of Strategic Road Network (SRN) and also 2-3 major multi-modal corridors with high freight traffic volumes, potential new growth nodes, and the large number of urban choke points which need de-congestion.
Policy /Regulations **Supporting Framework**	**Develop an Institutional Road Map for PWD Road Asset Management (0-6 months)**: The Centre of Excellence" (COE) for Road Sector Consultant hired under KSTP-II shall carry out a diagnostic review of current institutional arrangements for Road Asset Management in PWD and provide an institutional road map for asset management of SRN and Non-SRN networks and implementation of other best practices. On the basis of updated Road Master Plan and SRN, PWD shall decide on next steps for efficient asset management of PWD road network.
Policy /Regulations **Supporting Framework**	**Organize study/exposure visits (0-6 Months)** of PWD staff to states like Andhra Pradesh, Tamil Nadu, Chhattisgarh that have successfully implemented projects on EPC, PPPs, Long Term Performance based management contracts. The team will prepare study visit reports, initial action plans for various new forms of contracts, detailed contract structures for rolling out PBMC for initial set of PWD roads. Prepare terms of reference for engaging a Consultant to advise on New Contract Models and PBMC.

Activities	Description
Policy /Regulations **Supporting Framework**	**A Road Maintenance Management System (RMMS) shall be developed (0-18 months)**. To begin with, it may cover SRN with established protocols to periodically collect and update the data required for RMMS. The option of using advanced Road Survey Vehicle like ROMDAS/Network Survey Vehicle (NSV) and vehicle mounted Falling Weight Deflectometer (VMFWD) for data collection shall be ascertained. PWD may also decide to procure a ROMDAS/Network Survey Vehicle for the State with at-least 5 years Annual Maintenance Contract (AMC). A well-informed decision to be taken based on sound cost-benefit analysis, evaluation of pros and cons for allowing hiring by other states road agencies on rent. A team of PWD engineers from Maintenance Wing shall be trained on data collection techniques, operation of NSV/RODMAS. As part of the operationalizing Road Asset Management Cell/Wing, institutional responsibility matrix, data collection frequency and formats, framework for Annual Maintenance Budget Planning for SRN and Non-SRN to be clearly established. Bridge Maintenance & Management System (BMMS) to be established in PWD. The system will periodically collect and update the data required for BMMS system to work, this will include the acquisition/leasing of Mobile Bridge Inspection Unit. The newly formed Bridges Wing to be made responsible for updating the data and using the BMMS system, preparing budget requirements as well as health monitoring requirements with the help of instrumentation in case of under-performing bridges.
Policy /Regulations **Supporting Framework**	**Evaluate State's preparedness for PPP, New Contract Model and Tolling (0-6 Months)**: Carry out diagnostic review of state experience so far in implementing PPPs, national and international best practices on PPPs and contract models that can relevant for the State and explore possibility of road tolling policy and its framework clearly articulating political risks and also innovative financing tools. This will include exploration of possible enforcement of fees/ penal charges / multiple use per day charges etc., with IT enabled systems for strict compliance of rules ensuring efficient use of road infrastructure.
Policy /Regulations **Supporting Framework**	**Explore possibility of rolling out Performance based maintenance contracting** (PBMC) **0-18 Months** for asset management. This would analyse the current procurement and contract management framework for road asset management / maintenance and explore the opportunities and constraints for moving towards a long-term performance-based asset management framework aided by a multi-year budgeting framework in PWD. The study would also look into the opportunities for embedding emergency response modules as well as well as incentive structures to promote resource efficiency, use of new and green technology processes and local materials. Formulating capacity building measures for the local construction industry using the long-term performance-based maintenance framework would also be a desired outcome of this study. Award balance of KSTP I, II **(18 Months and Beyond)** and other recently completed road projects build using planned funds on PBMC
Policy /Regulations **Supporting Framework**	**Identify projects which can be implemented on new/alternative contract models** (**0-6 Months**) as evolved from the study i.e. Item Rate with increase in defect liability period, EPC, Design-Build for Bridges/Special Road Infrastructure Projects, Input based contracts with longer Defect liability/maintenance period, BOT-Tolls, Hybrid Annuity etc.
Policy /Regulations	**Comprehensive disaster and climate risk assessment of PWD Road Network (0-6 Months)** including geohazard, flood and erosion and storm surge vulnerability and prepare climate and disaster proofing framework /strategy for the State including multi-criteria decision-making tools

Activities	Description
Supporting Framework	to consider realignment options to avoid higher disaster risks, possibility of alternate transport modes like water-ways, ropeways for last mile connectivity etc. The study should also identify need for multi-disciplinary approach to climate resilience building, funds needed to cover additional climate proofing costs, funding lines i.e. climate funds, need for new procurement principles like Green Procurement Principle (GPP) or Sustainable Procurement Principle (SPP) for climate works. **Engage with State GSI, State Geological Programming Board (SGPB) for multi-sectoral landslide investigative analysis (0-6 Months)** for vulnerable PWD road asset stocks in the Eastern Highlands and explore possibility of implementing community driven technology based early warning systems (EWS) for highly vulnerable zones. **Explore Bio-engineering and scientific afforestation programs for State Hill roads (0-6 Months)** and demonstration projects related to soil conservation, land stabilization programme along road corridors with Department of Soil Survey and Conservation
Policy /Regulations **Supporting Framework**	**Develop GIS mapping for floods, landslides, geo-hazards along with mapping of all major rivers/canals (0-18 Months)** with OFL/HFL, urban areas with population details for entire PWD road network. **PWD Policy and Manuals updated** with specific technical guidelines/circulars for value engineering applications, resource efficiency in design and construction techniques and incorporating resilience. It covers new forms of contracts and procurement processes like GPP and SPP for climate works. **1 or 2 pilot projects implemented for real-time Early Warning Systems (0-18 Months)** **1 or 2 pilot Bio-engineering, afforestation, soil conservation and land stabilization projects are implemented along vulnerable corridor (0-18 Months)**
Policy /Regulations **Supporting Framework**	**Plan and Execute "Advanced Seminars on various up-coming sector topics" (0-6 Months):** These advanced seminars to target participation of industry, academia, domain experts, material and suppliers/manufacturers from India and abroad. The Seminars shall consider screening and selection of "peer review papers" for brain storming break-out sessions on various sub-themes. An indicative list of topics that can be covered include: 1. Advanced Planning and Design of Road Assets and Climate Proofing; 2. Sustainable Road Development in the State with a focus on climate proofing of Hill Roads; 3. New Models of Contracts for development and maintenance of road assets and PPPs in Road Sector; 4. Future of Road Geometrics for the State based on equity principle. Space for public transport users, NMTs, priority bus corridors. The key take-ways from the Advanced Seminars to trigger policy actions, change in regulations for promotion of new approaches to planning, green construction technology, reduce-recycle-reuse to drive resource efficiency and lowering ecological footprint. At-least 2 Advanced Seminars to be targeted in this period and the next 2 can be rolled in the next phase **(6-18 Months)**
Policy /Regulations	**Deepen existing engagement for associated Policy Frameworks (0-6 Months):** Transport Department has signed MoU with WRI-India on 10th December 2018 to help them in the following i.e. Policies, Frameworks & Action Plan for Electric Vehicles, Transit Oriented

Activities	Description
Supporting Framework	Development (ToD) in the State, Public Transport Policy for the State. Transport Department. The engagement needs to be well coordinated under multi-stakeholder framework including RKI Mission to deepen the understanding on the current state of passenger mobility demand in state breaking it up into intra-city, inter-city and inter-state and providers with broad scanning of permit information and discussions with KSRTC and private operators.
Institutional	**Constitute a multi-disciplinary "Road Transport Sector Modernization Task Force" (0-6 Months)** comprising of following members Principal Secretary-PWD, PD-KSTP, CE-R&B, CE-NH, CE-KSTP, ED-RSA, CE-LSGD, CEO-KRFB, Director & Jt. Secretary level officers from Transport, Inland Water, State Port Departments and KSRTC. A number of sub-groups shall be created to anchor various internal studies, workshops, advanced seminars, TAs funded by multi-laterals and bi-laterals, develop and administer policy, regulatory and institutional reform agendas for approval of the Task Force. Sub-groups are encouraged to have members from Industry, academia, research organizations and civil society. For some of meetings the National Transport Agencies should also be invited.
Institutional	**Review and enhancement of the e-governance tools in PWD (0-6 Months):** Focusing on the existing e-governance tools in PWD including GIS, Road Maintenance Management System, Financial Management System and Project preparation and engineering design system (PRICE) to enhance their efficacy and sector wide application, improved inter-system integration and opportunities for integrating climate and disaster risk assessment. Crowd sourcing of data and strengthening the monitoring and user feedback loops would also be covered under this initiative.
Institutional	**COE Consultant prepare diagnostic review and institutional road plan for various sector themes (0-6 Months).** The study to develop "blueprints" of different COE structures that can be operationalized in the State and to focus on key aspects such as mission/role, business plan/strategy, funding and collaborative linkages with government, other sector-stakeholders and academic/research institutions with various maturity models.
Institutional	**Develop consensus of PWD and State Cabinet for establishing a "Centre of Excellence" for the Road sector with necessary administrative and financial autonomy (0-18 Months).** "Centre of Excellence/s" shall be implemented with constitution, development of in-augural 3 Year programme of technical activities, operational targets, progress and impacts and monitoring indicators.
Institutional	**Development of Institutional Strengthening Action Plan (0-18 Months) :** Institutional Reforms study covering review of current main functions, organizational structure, resources and circumstances of the respective Road & Bridge Wings / major units of the PWD to identify the scope for fruitful short-to-medium term actions on reforms, rationalization and/or strengthening in each Wing / major unit's capacity and management; and subject to the PWD senior management's decisions on the Study findings and recommendations, assist the Department in launching short-to-medium-term Action Plans for each R&BD Wing, and other non-statutory and Statutory Road Institutions like KRDCL, KRFB and KSCCL. Also, critically evaluate the pros and cons of constituting a body corporate like "Strategic Road Management Authority" by hiving of PWD.
Institutional	**Improving Contractor Capacity and PWD Works Monitoring Tools (0-6 Months):** A series of workshops (two at-least) may be considered for improving Contractor Capacity to implement road projects on EPC, lower impact on ecology, improved workmanship and quality of construction, implementation of work zone safety and health standards, environmental

Activities	Description
	safeguards, labor management issue, on how to roll out effectively PRICE systems for works management payment, how PWD can use modern ITS tools for work supervision, and what are key enablers to attract national contractors to bid for RKI projects, market reach outs and communication strategy.
Institutional	**Develop a Contractor Performance Rating Framework (0-18 Months)** and Institutional Mechanism for annual rating of contractors including guidelines for black-listing and debarment owing to poor performance.
Institutional	**Additional capacity building measures including exposure visit (0-18 Months)** to best practices in other states and countries, organizing workshops and training for PWD staff with guest lecturers, faculties on various topics DPR preparation, Bridge Health Monitoring. Explore use of KHRI Training facilities for the same.
Investment	**Detailed Project reports (DPRs) 0-6 Months** for about 800 km prepared: The DPRs for prioritized roads to be prepared using a landscape approach which would include assessment of geo hazard and flooding / erosion risks as appropriate. Preparation of DPRs would include detailed road pavement investigation following modern methods e.g. Falling Weight Deflectometer tests, topographic surveys using LIDAR or equivalent technology, detailed soil investigation for pavement, structures and embankments and hydraulic discharge calculation for cross drainage and road side drainage. All DPRs would have to have specific focus on resilient construction technology and material and resource efficiency measures. All DPRs must be ground-truthed jointly by the local PWD Engineers and KSTP PMT. Close scrutiny of DPRs is essential to ensure quality, safety and resilience. Provision for road safety audits to be included during planning, design and construction stage.
Investment	**Develop contract packages 0-18 Months** for bidding and award of about 800 km of prioritized projects. Rationalize choice of contracting models to be applied to each package and take approval from PWD. Select 2-3 Authority's Engineer/Construction Supervision Consultant depending on the no of contracts and proximity of the project roads for grouping it under a single AE/CSC.
Investment	**Development and Investment Plans for SRN is prepared (18 Months and beyond)** Initiate Feasibility Study/DPRs to be undertaken for 2-3 major multi-modal corridors with high freight traffic volumes identified under Revised Road Master Plan. These studies shall use modern planning and design tools like Artificial Intelligence (AI) big, Satellite imagery etc.

Table 29: Roads Actions and Results Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Policy /Regulations Supporting Framework				
Develop a State Road Transport Strategy/Master Plan	X		X	An overarching strategy in place for multi-modal transport infrastructure policy, planning and development, modernization of transport fleets and fuel technology with

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
				an overall aim to reduce transportation costs (passenger and freight) to the State economy by 50%. Road Master Plan is updated and revised Strategic Road Network (SRN) is identified for investment plan outlays. All LSGIs shall have a definite road hierarchy plan based on planning standards
As part of the operationalizing Road Asset Management Cell/Wing, institutional responsibility matrix, data collection frequency and formats, framework for Annual Maintenance Budget Planning for SRN and Non-SRN to be clearly established. Bridge Maintenance & Management System (BMMS) to be established in PWD.		X X		The entire Strategic Road Network (SRN) is planned, budgeted, developed and maintained based on functional Road Maintenance Management System. Attention will be given to construction and maintenance in hilly areas where tribals reside. Non-SRN also has scientific budget allocation framework based on protocols established by Road Maintenance Wing. Health monitored for all major bridges of PWD road network with the help of a well-developed maintenance framework with clearly established funding lines for all.
Evaluate State's preparedness for PPP, New Contract Model and Tolling	X			At-least 800 km of the Strategic Road Network (SRN) is developed using new contracting models, toll policy developed and applied on important freight corridors. At least 25% of the Primary Road Network (PRN) is brought under the long-term performance based contracting framework, with built-in emergency response module.
PWD Policy and Manuals updated Comprehensive disaster and climate risk assessment of PWD Road Network Pilot Bio-engineering, afforestation, soil conservation and land stabilization projects are implemented along vulnerable corridor	X X	X		Network wide climate and disaster resilience framework developed and applied with new budget lines. GPP and SPP procurement guides are adopted for Climate Works. Improved resilience of Hill roads with emergency response mechanisms with community operated EWS. Policy on Bio-engineering, afforestation, soil conservation and land stabilization programmes for Hill Roads framed.

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Development and Investment Plans for SRN is prepared. Initiate Feasibility Study/DPRs to be undertaken for 2-3 major multi-modal corridors with high freight traffic volumes identified under Revised Road Master Plan. Studies shall use modern planning and design tools like Artificial Intelligence (AI) big, Satellite imagery etc.			X	Policy outlined for implementing modern tools in planning; application of value engineering and resource efficiency; green construction techniques; climate proofing of road works with detailed protocols for different categories of risks and vulnerability; safe and equitable road geometrics which accord higher road space for public bus transport, NMTs for various classified PWD road network i.e. SRN- SH, MDR, Non-SRN-SH, MDR
Comprehensive disaster and climate risk assessment of PWD Road Network strategy for the state including possibility of alternate transport modes like water-ways, ropeways, etc. for last mile connectivity. Constitute multi-disciplinary "Road Transport Sector Modernization Task Force"	X	X		Integrated Transport mobility established in all million plus cities. Increase share of efficient, low emission public bus transport (private and public) to 70% in the SRN.
Institutional				
Constitute a multi-disciplinary "Road Transport Sector Modernization Task Force" (0-6 Months) comprising of following members Principal Secretary-PWD, PD-KSTP, CE-R&B, CE-NH, CE-KSTP, ED-RSA, CE-LSGD, CEO-KRFB, Director & Jt. Secretary level officers from Transport, Inland Water, State Port Departments and KSRTC			X	Establish Institutional framework to drive a multi-modal Transport policy, planning and budgeting established in the State for e.g. committee of Secretaries of State Transport Infrastructure-related State Departments through Executive Order.
Develop consensus of PWD and State Cabinet for establishing a "Centre of			X	"Centre of Excellence" for Road Sector constituted. COE matures into a think tank providing advisory support to road and

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Excellence" for the Road sector with necessary administrative and financial autonomy				other transport agencies in the State for Integrated Transport policy, planning and adoption of best practices and emerging trends.
Development of Institutional Strengthening Action Plan. Institutional Reforms study covering review of current main functions, organizational structure, resources and circumstances of the PWD to identify the scope for fruitful actions on reforms, rationalization and/or strengthening			X	Rationalize institutional fragmentation in the road sector and consolidate PWD. In case, institutional reforms study outputs indicate need for a "Strategic Road Network Authority" to be carved out of PWD with re-allocation of mandates for greater Efficiency, and effectiveness developing, financing and manage SRN and there is cabinet approval for the same, SRNA should be established as a body corporate with necessary administrative and financial autonomy.
Improving Contractor Capacity and PWD Works Monitoring Tools. A series of workshops (two at-least) may be considered for improving Contractor Capacity to implement road projects. Develop a Contractor Performance Rating Framework and Institutional Mechanism for annual rating of contractors	X	X	X	Capacity of local contractors developed, 10% of Local contractors transition to national level contractors with improved Financial Capacity. Established National level contractors start participating in State Projects. Contractor Rating Framework developed and institutionalized by PWD.
Detailed Project reports (DPRs**)** for 800 km prepared: DPRs for prioritized roads to be prepared using a landscape approach, including assessment of geo hazard and flooding / erosion risks. Develop contract packages for bidding and award. Initiate Feasibility Study/DPRs to be undertaken for 2-3 major multi-modal corridors with high freight traffic volumes identified under Revised Road Master Plan	X	X		A minimum 800 km of safe, green, climate resilient and equitable road network developed. DPRs and Investment Plans ready for 2-3 major multi-modal corridors.

The various activities identified in the table above are to be carried out by PWD in collaboration with Transport Department, KSRTC, Other State Transport Agencies, Soil and Land Survey Departments. Some these activities would require further organized studies which will form TAs which can be supported by multi-lateral/bi-lateral agencies. The list of such studies is presented in the table following:

4.5.6 Technical Studies and Assessments

Table 30: Roads List of Studies

List of Studies	0-6 months	0-18 months	18 months & beyond	Oversight#
Policy / Regulations				
Developing an Integrated Road Transport Strategy and Updated Road Master Plan for Strategic Road Network (SRN)	X			PWD-R&B Wing, GIS Cell, Transport Department, Other State Transport Agencies
Data Collection and Development of RAMMS (To begin with SRN)			X	PWD Maintenance Wing & GIS Cell
Climate Change and Disaster Risk Vulnerability Assessment of PWD Road network- A sample of 1000 km from most vulnerable districts from distinct climate regions to be studied to articulate the strategy.	X			PWD, Irrigation, GSI, water Resources and KSTP
Developing Performance based contracting framework for asset management, new forms of work contract like Item Rate with increased Defect liability period, EPC. Design Build for Bridges etc.			X	PWD R&B Wing & KSTP
Study of PPPs in Road Sector in Kerala, Road Tolling Policy and access to Alternate Revenue Streams and market Finance	X			KSTP, KRFB, KIIFB
Strategy for Enhancing public bus Transport on State Road network with focus route rationalization, bus contracting models for inter-city operations, transport tax reforms, parking policy and dealing with urban congestion	X			Transport Department/KSTRC/PWD/ KSTP
Institutional				
Institutional development Study for PWD Road and Bridge Wings articulating the pros and cons of a separate Strategic Road Network Agency,				PWD Wings & KSTP

List of Studies	0-6 months	0-18 months	18 months & beyond	Oversight#
need for convergence of various Road Institutions clearly indicating issues like competition for funds and strategic projects			X	
Review and enhancement of the e-governance tools in PWD with support in procurement of hardware. Engage a Consultant to prepare GIS maps of PWD road with assets like bridges, culverts, buildings, rivers, canals with geo-hazard and inundation maps. The map should provide high-level information on road specific natural hazards and climate risks for planning. [89]			X X	PWD R&B Wing & GIS Cell Irrigation, GSI, Water Resources, LSGD
Investments				
Detailed Project Report for 800 km of Prioritized Roads with help of 4 Consultants (Two existing KSTP consultants to be used, Tender process for selection of 2 additional Consultants under process)	X			PWD R&B Wing & KSTP
Mix of all				
Other Supports in terms of workshops, advanced seminars, study visits to other States, individual consultants for drafting of technical guides/manuals, training of PWD staff	X	X		PWD Wings, SPVs, KRFB & KSTP

 # All the TAs to have an oversight of multi-disciplinary "Road Transport Sector Modernization Task Force" and their sub-groups constituted under the same.

[89] PWD to whether use paid version of Google Map or field data collection for entire PWD network using NSV/RODMAS as part of Revision of Road Master Plan and SRN.

4.6 Transportation

4.6.1 Introduction

Kerala comprises of 1,588 km of railway line, 2.29 lakh km of road, 4 international airports, 18 ports with 585 km of coastal routes and 1,687 km of inland waterways. Roads in Kerala play an important role due to the linear structure along with the diversity in topography. The Transport department of Kerala has multiple subordinate agencies under its administration as shown below.

Table 31: Subordinate Agencies under the Transport Department of Kerala

Department	Role
Public Works Department	The Roads and Bridges wing of the PWD is mandated for looking after the State Highways, MDR, District roads in the State
Kerala State Road Transport Corporation (KSRTC)	PSU that is responsible for the passenger transport operations in Kerala
Motor Vehicles Department (MVD)	Responsible for matters pertaining to Enforcement of the Motor Vehicles Act and Rules, Registration of vehicles, Collection of taxes and fees
State Water Transport Department	Responsible for regulation of the inland navigation systems and provides for inland water transport facilities
Kerala Rail Development Corporation Limited (KRDCL	Responsible for the development of railway infrastructure development in Kerala. It is a JV with the Indian Railways
Kochi Metro Rail Ltd (KMRL)	SPV owned by Central and State Government for the construction of the Kochi Metro Rail Project

The State Public Works Department (PWD) and Transport Departments are the two principal administrators and regulators of road transport infrastructure and systems. The major function of Transport Department is to operationalise provisions of Motor Vehicle Act 1988 and Central Motor Vehicle Rules (CMVR) 1989 i.e. driving license issuance, trainings, vehicle registrations, vehicle inspection & testing services, issuance of route permits and vehicle taxations. The Transport Department also acts as a secretariat with administrative control of several line/subordinate departments like:

- Kerala Rail Development Corporation Limited (KRDCL)
- Kerala State Road Transport Corporation (KSRTC)
- Kerala Transport Development Finance Corporation (KTDFC)
- Motor Vehicles Department (MVD)
- State Water Transport Department

Additionally, the State's three-tier governance system places Local Self Governance Department as the umbrella organization responsible for provision of road transport infrastructure in urban and rural areas through Urban Local Bodies (ULB) and Panchayat Institutions.

Thus, the Transport Department will be the key agency to execute all proposed Transport sector reforms such as improvement of:

- Bus transport-vehicle and fuel technology;
- Public transport services and associated infrastructure;
- Vehicle taxation to drive a green transport;
- Technology for safer roads, safer vehicles with revamped inspection and testing regimes, as well as, prepare an integrated transport planning framework to reduce sectoral carbon footprint;
- Coordinated State Transport Infrastructure policy and planning (coordination with other Transport agencies is required);
- Integration of public transport modes (requires coordination with LSGD institutions and other transport institutions).

Road Network

National Highways (NH17, 47, 49, 208, 212, 213, 220, 47A and 47B)[90] are the primary network carrying about 40% of the road traffic and the state highways and Major District Roadways (MDR) the secondary road network carries another 40 % of the traffic. Nearly less than 10% of the road network carries 80% of the traffic. A majority of the roads in Kerala are single lane roads in the State. About 1.63 lakh km of roads are administered by the various local governments of which a majority of them are black topped.

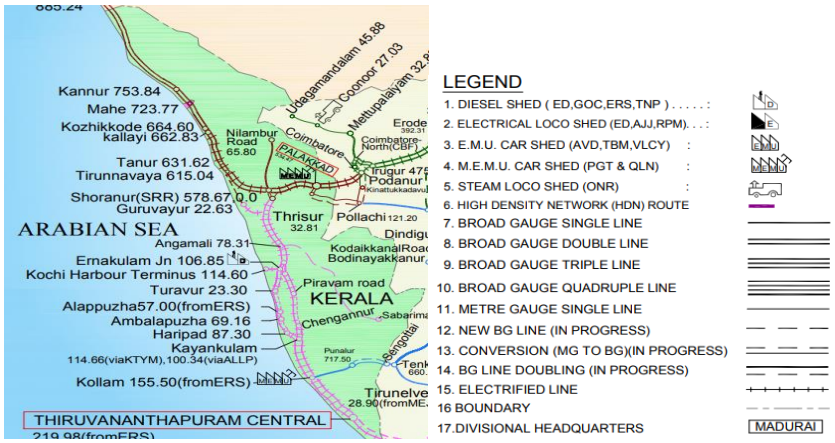
Railways

The next important mode of transport is the Railways. The State has a total railway track of 1,588 km operating between 1,257 km route length which carries about 4.76 lakh passengers daily. There are about 200 railway stations and totally 156 express and 109 passenger trains operating daily. Kerala tops in rail electrification with about 83.54% coverage of electrification[91]

[90] Economic Review 2018, GoK, pg. 381

[91] Can Karnataka catch up in railway electrification? https://www.thehindu.com/news/national/karnataka/can-karnataka-catch-up-in-railway-electrification/article22267876.ece (Accessed on : 25,Jan,2019)

Figure 31: Railway Network of Kerala



Source: Southern Railways, 2015

Metro Rail and LRT

Kochi Metro Rail, operational from June 2017 connects rail, road and water transport facilities. Connecting 16 stations with a network of nearly 20 km. In addition to that Light Metro Rail, a mass rapid transportation mode has been proposed across Thiruvanthapuram and Kozhikode. In addition to that a water metro has been proposed in Kochi which envisages a route length of 76km across 16 routes covering 38 jetties.

Inland Water System

Kerala has a well-connected inland water system covering 1,687 km to connect the 40 rivers. The existing systems includes-West Coast Canal system with length of about 560 km. Starting from Kovalam in the south and extending up to Hosdurg in the north. Within this, the Kollam- Kozhikode stretch (328km) is already designated as National Waterway-3 (NW-3) along with Champakkara (14 km), Udyogamandal canals (23 km), Alapppuzha- Changanassery (28 km), Alappuzha- Kottayam- Athirampuzha (38 km) and Kottayam- Vaikom (42 km). However, the inland water system has seen reduction in passenger over the years. The west coast canal fell into disuse because of competition from road and rail transportation and lack of maintenance. Despite the State having more than 1,680km of waterway network only 20% of them are in a usable condition.

Figure 32: Inland Waterway Network, Kerala

Airports

Kerala has four international airports in Kannur, Kozhikode, Thiruvananthapuram and Kochi serving over 8 lakh domestic and 50 lakh international passengers every year.

Motor Vehicles[92]

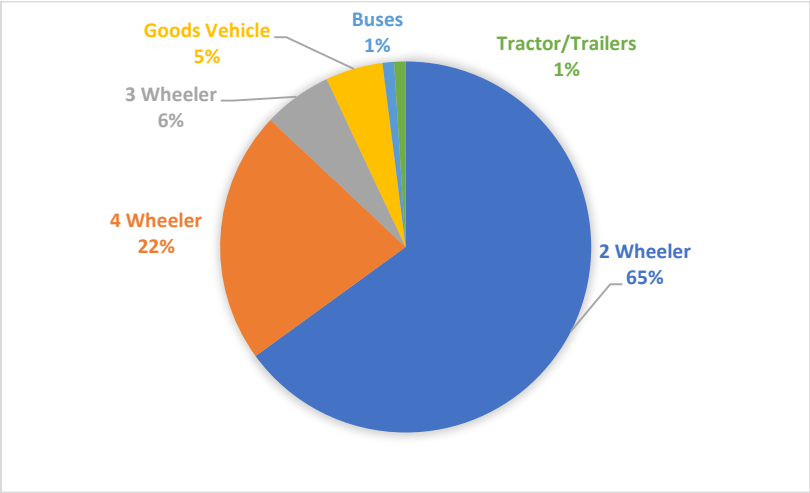
Kerala has 120.42 lakh registered motor vehicles as on March 2018. For the last two decades it has experienced a compounded annual growth rate of above 10 %. The number of vehicles per 1,000 population for Kerala as on March 2018 is 361. Personal vehicles have recorded a faster growth rate over the previous year.

The highest vehicle population has been recorded in Ernakulam District with 17,96,868 vehicles (14.9%) followed by Thiruvananthapuram with 15,23,414 (12.7%). Wayanad District has the lowest number of 1,76,093 (1.5%) vehicles. The mismatch between growth in motor vehicles and the capacity augmentation of roads has resulted in increasing traffic congestion and road accidents throughout Kerala. Major schemes implemented by Motor Vehicles Department are road safety measures, establishment of vehicle testing stations and modernization of check posts. Department has started driver testing tracks at Chevayoor (Kozhikode), Elavayoor (Kannur) and Parassala (Thiruvananthapuram). The works of three

[92] Economic Review 2018, GoK

tracks, one each at Muvattupuzha, Muttathara and Monuppally are going on. Radar surveillance system (Speed Camera System) was installed at Palakkad, Thrissur, Kollam, Kottayam, Ernakulam and Kannur. A new initiative by the department is 'Third Eye Enforcement". Through the scheme, the public can assist the enforcement team of the department by capturing and sending the traffic violation in terms of video clips, images etc. in real time through an exclusive public web portal. Road Safety suggestions/feedbacks from the public are also incorporated in this project.

Figure 33: Percentage distribution of Motor Vehicle, Kerala 2018



Source: Economic Review 2018, Kerala

4.6.2 Impact of 2018 Floods

The weather pattern, high population density as well as geographical location make Kerala highly susceptible for natural disasters. The steep gradient along the Western Ghats, geographical location along the long sea coast as well as the ever-changing dynamics of climatic conditions act as a risk factor for disasters. Along with these the other biggest risk factor is the high population density in the State. In this context it becomes important to look at one of the recent floods in the State that has had a devastating effect on the lives and livelihoods of the people in Kerala.

According to the PDNA for Kerala conducted by UN, ADB, WB and EU; between July and August 2018, the State received a cumulative rainfall that was 42% more than the normal rainfall causing one of the worst ever floods faced by it. The torrential rains triggered nearly 341 landslides across the states with district Idukki one of the worst hit districts. 1,259 villages out of 1,664 villages in these districts were affected by the floods. The post flood impact analysis indicates heavy damages due to land slide/slips in the roads in four hill Districts of Pathanamthitta, Idukki, Wayanad and Palakkad, whereas roads in the seven Districts of Alappuzha, Malappuram, Kollam, Ernakulam, Kozhikode, Thrissur and Kottayam have sustained flash floods, erosion, water stagnation and other flood induced damages.

The transportation sector was one of the worst hit sectors during the folds causing a standstill in the Kerala. According to the Road and Buildings Wing, Public Works Department, Government of Kerala there has been damage of about 580 km of National Highways, 2,004 km of State Highways and 13,246 km of Major District Roads across the 14 districts in Kerala.

Table 32: Length of Roads Severely Affected/Destructed (district-wise) due to the Floods

District	Road Length Affected (in km)	age %
Alappuzha	544.17	37%
Ernakulam	2140.89	27%
Idukki	3064.01	77%
Kannur	969.95	8%
Kasaragod	503.51	10%
Kollam	712.26	13%
Kottayam	1255.62	19%
Kozhikode	998	21%
Malappuram	947.37	12%
Palakkad	1327.48	23%
Pathanamthitta	549.04	12%
Thiruvananthapuram	677.48	15%
Thrissur	925.25	20%
Wayanad	634.86	2%

Source: PWD, Government of Kerala

The waterlogging due to the heavy rains caused the road and rail traffic to be worst hit. There was a collapse of the public transportation in many parts of central Kerala. Additionally, there was a halt in the Southern Railways and Kochi Metro as the waterlogging on the tracks affected the signalling. The waterlogging in Kochi Airport also led to the shutdown of the airports.

Given this context it becomes important to understand how we can mitigate this situation by developing a resilient transportation system in the State. Proper siting of critical transport nodes like airports are crucial in building resilience.

Role of public transit agencies in emergency management: Public transit agencies have a history of providing assistance during crisis situations, performing vital services such as evacuation of victims and transport of emergency personnel and materials. In the aftermath of major disasters, public transit systems have often supplemented or replaced damaged or blocked roadways that are impassable, maintaining mobility for residents and for repair and recovery workers. Therefore, these are a critical

infrastructure especially in the case of evacuations and connectivity to essential services such as hospitals, etc. Multi-modal transit systems create alternative means of travel if the predominant means of transportation (roads) is damaged.

4.6.3 Major Legacy and Current Issues

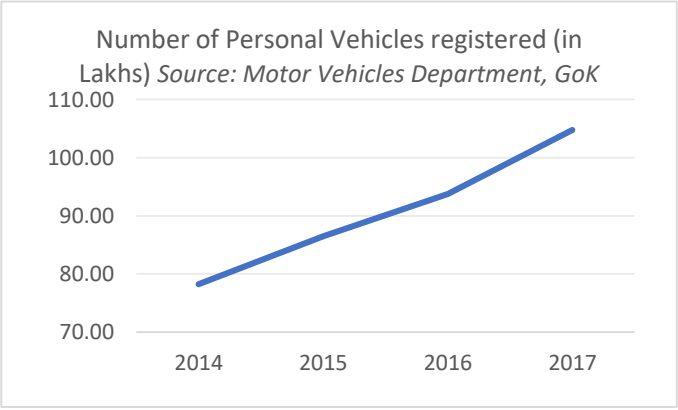
Kerala is one of the well-connected states in the country having a road density of 590.14 km / square km which is much higher than the national average of 387 km/square km[93]. Additionally, it has an inland water transportation system and well- connected rail and airport system. But despite that a multitude of factors pose as a challenge to the transportation in Kerala. These factors can be broadly categorized into climatic, topological and demographic factors that can contribute to the problems in transportation sector.

Table 33: Factors that contribute to challenges in the transportation sector

Factors	Problem in Kerala
Topological	Kerala has an extremely hilly terrain nearly 90% of the terrain is hilly which acts as a challenge for the transportation sector
Climatic	Kerala has a wet and humid weather and also faces the challenge of increase in sea level due to climate change
Demographic	Kerala has witnessed increased rural urban continuum over the years. The increased rate of urbanization added an immense pressure on the existing infrastructure and resources.

4.6.3.1 *Increasing trends in personal vehicle registration*

Indian cities are currently witnessing increasing ownership of private vehicles and decreasing use of public and non-motorized transport[94]. National level statistics show that share of the Public transport has fallen from 60-80% in 1994 to 25-35% in 2018 while the share of private vehicles has increased by 33% from 2016 to 2017[95]. In 2017-2018, 87% (104.78 Lakh) of the new registrations were that of personal vehicles[96].



[93] Economic Review 2018, GoK, pg. 380
[94] Moving Forward Together, Niti Aayog 2018
[95] Booming sale of cars, bikes slams brake on public transport, http://timesofindia.indiatimes.com/articleshow/65649614.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst) (Accessed on: 24 Feb 2019)
[96] Motor Vehicles Department, Government of Kerala

With the increase in share of private vehicles, there has been an increase in congestion, fuel bills, carbon footprint and accidents. Similar trends are noticed in the State, too. As State income levels rise more residents buy personal vehicles. There is an ever-increasing vehicle population that taxes the already dense road network, triggering an increase in congestion, carbon emissions, and negatively impacting climate change. There is a disproportionate investment in public transport infrastructure and efficiency of the carrying capacity of public vehicle.

4.6.3.2 *Deficient state-wide public bus transport systems and supporting infrastructure*

According to the Kerala State Planning Report 2017-28, as of 31st March 2017, 44,291 buses had valid registration of which around 25,000 buses are on road with majority of its operating in urban areas. Kerala State Road Transport Corporation (KSRTC) owns a fleet strength of 5,795, operating 5,047 schedules on 7548 routes. The number of buses required per 1,000 people depends on a variety of features including mode share, people's tendency to take bus journeys, average length of travel, effectiveness of bus system, etc.; however, the typical range is between 0.5 and 1.2 per 1,000 population[97]. In Kerala's case that would be in a range of about 17,500 to 42,000 required buses for a population of 35 million. In Private sector operated buses have a dominant share in intra-city services, with intra-state services being mostly nationalized and operated by KSRTC. Considering that fleet owned and operated by KSRTC have remained stagnant over last 6-7 years it can be concluded the share of bus transportation in the state road network has been decreasing which is not a healthy sign for State's aspiration for green economy.

4.6.3.3 *Poor quality and lack of incentives to use public transportation*

By better developing the quality of public transport available, as well as creating regular passenger interchanges through well-designed, multi-modal transit terminals Kerala can aim to properly connect and increase the coverage/ease of use of the public transportation network. Ensuring that all modes are seamlessly connected to each other (physically as well as through the same e-ticketing system) will nudge a modal shift in commuters as their confidence in reliable, end-to-end public transport options increases. This is a friction point that usually causes a breakdown in the utility of pure public transportation dependency. Other options to increase incentives for public transportation include subsidies or an increase in taxation of private vehicles. These will contribute to a modal shift, at the very least encouraging existing and future car owners to use their cars less and consider alternative means of transportation that may be cheaper and more convenient. Future investments in roads and the core Strategic Road Network (16% of the total road network, carrying about 80% of road traffic), could support the public transportation agenda by infrastructure investments and dedicated public transport corridors. Vytilla Mobility Hub in Kochi is the first of its kind in the State to form a Special Purpose Vehicle (SPV) – Vytilla Mobility Hub Society – for the execution of a Mobility Hub. An SPV had already been formed in Kottayam and the land acquisition process is at advanced stage for the construction of Kottayam Mobility Hub. Integrated Multi Modal Transit Facility is also recommended at major Cities such as Kozhikode, Thrissur, Kollam and Thiruvananthapuram.

[97] Note: This ratio may be dated as it was current as of 2006.
https://ppiaf.org/sites/ppiaf.org/files/documents/toolkits/UrbanBusToolkit/assets/1/1c/1c7.html

4.6.3.4 *Lack of investment in public transportation infrastructure*

The State has been spending substantial funds on widening and improvements of the roads for increasing the carrying capacity of the roads, the budgeted expenditure for Roads and Bridges in 2018-2019 was 1.45 lakhs (8% more than 2017-2018)[98]. Though the expected benefits are considerable, urban planning practices prove that widening of roads in proportion to the increasing the traffic volume is not effective in decreasing congestion, in fact it often encourages an increase on use. Therefore, instead of increasing capacity of the already dense road network, it is worth exploring smarter ways to consolidate and move people, as well as ways to encourage and incentivize a public modal shift and behavioural change from private vehicles to public transportation that has a higher passenger capacity per vehicle.

4.6.3.5 *Inadequate augmentation of road infrastructure*

Kerala has a unique topology which can act as a hindrance to the transportation systems. About 90% of the State has a hilly terrain because of which there are very narrow single lane roads present in the State. According to the Kerala State Planning Board Report of 2018, almost 90% of the roads are single lane. There is inadequate width to address the existing level of traffic in the State as only 25% of the roads have four-lane or two-lane capacity roads and the remaining have single or intermediate lane capacity. In case of National highways there is only 12% of the roads with four lane capacities. The bulk of the interstate and inter city traffic is carried by the National and State Highways which are only 8% of the total network. Thus, this acts as a challenge for the transportation sector[99].

4.6.3.6 *Opportunity for growth in rail*

The railway lines in the State run straight lengthwise connecting all the major towns and cities in Kerala. The State has a rail network of 1,257 km route length with a total track length of 1,588 km, operating under the control of Palakkad and Thiruvananthapuram Railway Divisions. The Palakkad Division operates 76 express and 49 passenger trains, carrying 2.16 lakh passengers per day while Trivandrum Division operates 80 express trains and 60 passenger trains every day, carrying 2.6 lakh passengers daily[100]. Both these Divisions together contribute about one-third of the total revenue earnings of Southern Railway. The rail sector has not shown much growth over the years. There are about 200 railway stations in the State that connect most of the major destinations within the State. Given Kerala's linear form and numerous large urban centres there is the potential to increase rail capacity by constructing a high-speed railway corridor through the State.

4.6.3.7 *Reduced dependence on the inland water network*

Even though Kerala has a water network of more than 1680 km only 20% of it is in a usable condition. There are about 81 passenger boats operated in this system. Most of the feeder canals and waterways suffer from navigational hazards like shallow depth and narrow width of channel during dry weather, siltation, bank erosion and absence of infrastructural facilities like jetties/ terminals and inadequacy of navigational aids. Because of these conditions this is not adapted as a preferable mode of transportation by the citizens.

[98] Economic Review 2018, GoK, pg. 379
[99] Economic Review 2018, GoK, pg. 381
[100] Economic Review 2018, GoK, pg. 394

4.6.3.8 *Unorganized Intermediate Public Transport (IPT)*

IPT modes consist of taxis, auto-rickshaws and minibuses/ tempos. Being an unorganized transport sector (free entry in the market), IPT modes continue to play an important role in providing first mile and last mile connectivity (10% share) due to their speedy and timely availability and ability to penetrate into every nook and corner of the region they are serving. It also provides job opportunities for the weaker sections of the society. The advent of online taxi aggregators in the IPT sector have heralded an open competition with auto-rickshaws and Motor Vehicles Department has taken the initiative to implement GPS tracking systems to monitoring the system. There is an opportunity for e-autos/taxis to assist with last-mile issues.

4.6.3.9 *Poor Non-Motorized Transport (NMT)*

As part of City Development Plan, pedestrian facilities and amenities have been provided along major corridors of Thiruvananthapuram, Ernakulam and Kozhikode Cities. All other cities in Kerala lack pedestrian facilities and amenities. The existing pedestrian network (and public transportation system) lack providing proper access to elderly population or differently abled peoples. The share of cycle trips is on the decline owing to advent of fast-moving vehicles and lack of facilities for cyclists like cycle track, cycle repairing facilities etc.

4.6.3.10 *Congestion in the metropolitan areas*

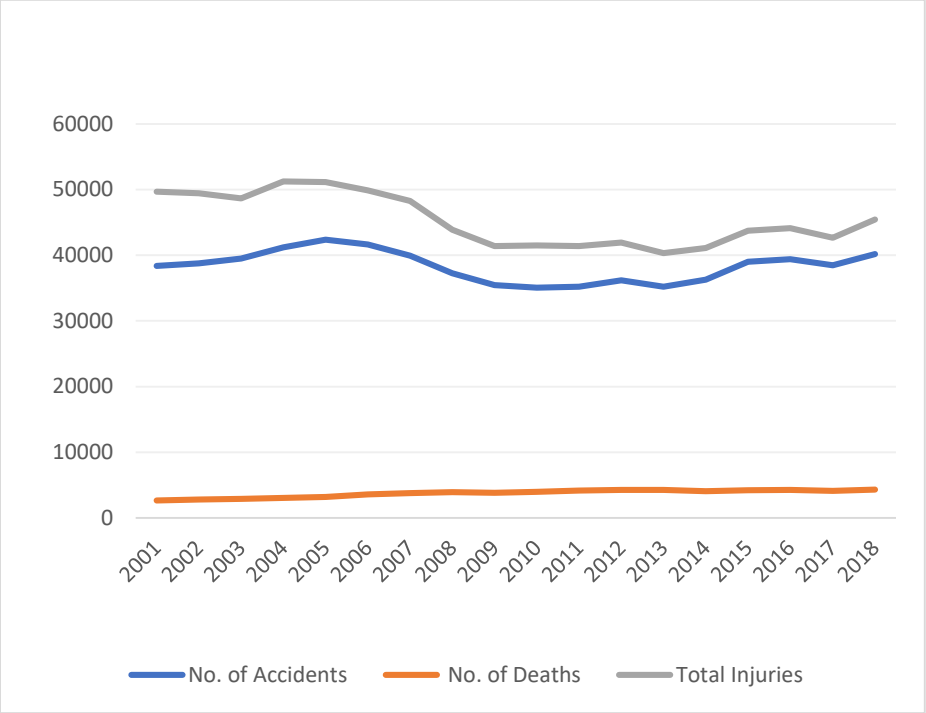
Kerala is one of most urbanized states in the country with nearly 48 % of its population living in urban areas spread across 87 municipalities and 6 corporations[101]. The cities lack integrated and strategic public transport planning resulting in high level urban congestion, emissions and loss to economy. The transport sector in Kerala is highly dependent on fossil fuels and is one of the major sources for air pollution, especially greenhouse gas emission, which needs to be controlled and reversed.

4.6.3.11 *Road safety*

Road Safety has been a perennial challenge for Kerala. The number of road accidents, major injuries and deaths due to road accidents has been increasing over time. According to the statistics published by Kerala Police in 2018, there were 40,181 accidents, 4,303 fatalities and 45,458 injuries which translated to high accident severity index of 12.8 deaths per lakh population. Statistics indicate that lack of enforcement is one of the leading causes of road accidents and needs a targeted action plan. The MVD department has recently launched "Safe Kerala" programme based on the success of Safe Sabarimala with the objectives of curbing road accidents and fatalities and to induce a disciplined road culture in the State. The initiative primarily focuses on strengthening the enforcement wings of the motor vehicle department with modern control rooms in each district, 24/7 patrol and enforcement through appropriate resources and tools (such as radar fitted interceptors with Lux, Alco and Sound meters, patrol vehicles, surveillance/speed cameras).

[101] Census of India, 2011, GoI

Figure 34: Road Accidents in Kerala



Source: Department of Police, Government of Kerala

4.6.4 Proposed Approach to Resilient Rebuilding

Kerala is turning the crisis into opportunity by taking strategic preparedness and adaptation in the form of transport resilience. Transportation resilience refers to the ability of transport system to operate, function and enable people to move or commute around, in the contempt of one or major obstacle. Currently, Kerala has multiple departments/agencies executing multiple modes, the State needs to incorporate transport resilience in their transit agency policy, planning, asset management, capital investment, maintenance and respective operations–along with the safety, security and customer focused services. The resilience can be focused from two broad perspectives i.e. operational resilience and infrastructure resilience. 'Operational' resilience is rooted in customer focus and endeavours to keep services running safely, even under adverse circumstances. On the other hand, "infrastructure" resilience is rooted in the agency's physical planning, material and asset management framework.

Both 'operational' and 'infrastructure' resilience ensures to absorb the effects from disturbances that are caused due to several reasons and safeguards operational continuity or at least minimize the damage and help recuperate quickly. The resilient planning perspective of Kerala needs consideration of the following levels.[102]

1. Individual Level: Transport resilience at individual level will ensure that people can get around if the person's vehicle breaks down, or if the person is injured, becomes disabled, or suffers a loss of income

[102] What is transport resilience? https://rideamigos.com/transportation-resilience/ accessed on 22 February 2019.

2. Community Level: Transport resilience at communities' level will ensure, that the public transits are accessible or there are alternatives, and that traffic can continue to move despite of accidents, emergencies, seasonal construction projects, or special events
3. Design Level: Transport resilience at design level, will ensure that the transportation systems have specific built-in features to deal with extreme levels of demand and critical, unexpected problems
4. Economics Level: Transport resilience at economics level will ensure that transportation system will continue functioning even if an important resource, such as oil or gasoline, becomes unavailable or prohibitively expensive
5. Strategy Level: Transport resilience at strategy level will ensure that the transportation system is created to accommodate future growth and possible changes for future usage or access patterns

Figure 35: Transport Resilience perspectives

In an article of TRB 'Resilience in a Transport System- A Whole System Approach' by Ryan Martinson[103], the author discussed about the resilience value and how it is significant to gauge resilience in the system. Attempt has been made to review the resilience values in respect to Kerala.

Table 34: Resilience in Kerala's Transportation Sector at a State and ULB Level

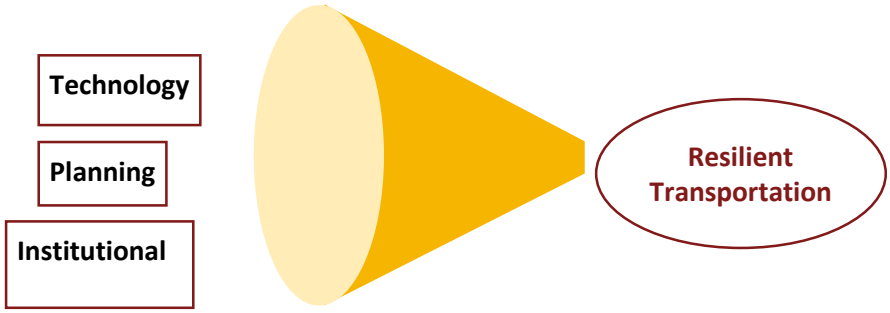
Resilience Value	Possible outcome in Kerala's Transportation sector at state and ULB level
Diversity	Land-use Transportation Planning Multimodal transportation planning
Ecological variability	Agencies to adopt Environment Management System
Modularity	Improving Street network and accessibility Improving First Mile and Last Mile Connectivity
Acknowledging slow variables	Long term planning to cater the traffic and transportation need for coming 10-15 years. Phasing out Transportation Planning

[103] Resilience in a Transport System- A whole System Approach; Transportation Systems Resilience- Preparation, Recovery and Adaptation, TRB, November 2017, Pg. 13

Resilience Value	Possible outcome in Kerala's Transportation sector at state and ULB level
Tight feedbacks	Piloting projects to test potential outcomes Monitoring and evaluation programs feeding into new development and planning procedures
Social Capital	Place-making- Connecting communities Meaningful engagement with stakeholders
Innovation	Intelligent Transport Management System Transport Demand Management
Overlap in Governance	Stronger emphasis on participatory planning and community engagement Regulative frameworks/ guidelines Policy intervention
Ecosystem Services	Equitable allocation of mobility investment Life-cycle cost accounting or full cost accounting that aims for include more externalities associated with infrastructure

The subsequent sub topics illustrates some of the Resilience Value- 'diversity' and 'modularity' as part of 'Resilient Transport Planning for Kerala'. Followed by 'innovation' as part of 'Technology as a tool for Resilient Transport', and finally 'Overlap in Governance' as part of 'Single Statutory Authority for Resilient Transport'. While the remaining resilience values have be addressed as part of the sub-topics below.

Figure 36: Conceptual representation of Resilient Transport



4.6.4.1 *Resilient transport planning for Kerala*

Key objectives: To increase the market share of environmentally sustainable modes of transport, by offering convenient, comfortable, and economic public transportation options. Increase efficiency and long-term sustainability of transportation provisions for citizens by 2030, taking into account ecological, social and cultural perspectives. In turn reducing congestion and increasing mobility.

Guiding Principles:

1. Resilient Transportation: Increasing the strength, connectivity and options provided by public transportation, thus creating a network of public transportation systems that rapidly regain function after disruptions or disasters.
2. Efficient and Effective Systems: Improving journey times, connections, quality, and reliability.
3. Green, Climate friendly, and Environmentally sustainable: Reducing negative environmental impacts on air quality, greenhouse gases, fuel consumption, noise, etc.
4. Prioritizing Equity: Planning with accessibility and social inclusion in mind (of elders, differently abled, socio-economically disadvantaged, etc.)

Key elements of approach:

- Making connections: Multi-modal transportation systems that are integrated physically and through the ticketing system. All public transportation should build upon itself (e.g. connect buses, metro, rail, water networks, IPT and NMT, etc.). This will allow peopled to move easily between systems and contribute to realizing the full potential of public transportation.
- Addressing infrastructure gaps and points of friction in the existing system.
- Revamping the Bus System: Increase the functionality, desirability and profitability of buses for the public users as well as the State.
- Safety: Reducing accidents and improving security
- Technology: Tools such as ICT to allow for real-time tracking, ease of payment, mining big-data to create more efficient transportation routes, etc.
- Finance: Improve transport economic viability for business users and transport providers, to improver transportation economic efficiency for consumers, and to provide wider economic benefits through service.
- Public Communication Strategy: After creating a revamped public transportation system there should be communication on how public transportation can be a reliable, convenient, comfortable, and even economic alternative to the car.
- Integration with Land-use policy: To ensure that transport and planning work together to support more sustainable travel choices and reduce the need for travel through strategic land-use codes.

Major transportation planning aspects such as, 'Land use and transportation planning, Improving Street Network- Accessibility, Integrated Multi Modal Public Transport System and First and Last mile connectivity' has been reviewed for Kerala. The approach has been divided into two parts; 1. 'People Centric Planning' and 2. 'Transport Resilient Planning'. The 'Transport Resilient' considerations have been further reviewed under 'Infrastructure' and Operation' perspective.

Table 35: Aspects of Transportation Planning

Land Use and Transportation Planning	
People centric planning	**Transport Resilient Planning**
Integrate the land-use and transportation planning- to enhance community development Consider long term sustainability by altering the urban structure Reduce and redistribute the transportation demands that are concentrated to city centre, to sub city/ satellite city/new business centre etc. Adapt Travel Demand Management tools and etc. Focus on Public Transport, ToD, NMT, and safety features	**Infrastructure Perspective;** Build network type compact city - multi zonal, multi nuclear urban structure etc. to reduce and distribute the pressure Reduce development in high risk areas; and re-focus investments in "high and dry" areas that have the potential to increase economic opportunity[104] Incorporate Environment Management System and other tools to plan a robust, flexible and responsive system Ensure stakeholder/agencies/departments to commit to resilience goal from time to time Ensure well-functioning drainage system **Operation Perspectives** Enhance the power system (used for the operations of transportation system) Ensure robust control- communication- location system, that addresses critical operations of transportation system Ensure planning and management of railroad track maintenance equipment, crane, ambulance etc.
Improving Street Network, Accessibility- Infrastructure	
People centric planning	**Transport Resilient Planning**
Improve street network connectivity to help reduce the volume of traffic and traffic delays on major streets (NH17, 47, 49, 208, 212, 213, 220, 47A and 47B, other arterials and major collectors)	**Infrastructure perspective**; Plan a quality infrastructure to withstand the adverse calamities economically or handle sudden demand

[104] https://www.100resilientcities.org/planning-for-resilience-innovative-land-use-policies-for-building-a-resilient-city/

Improve street network connections within individual developments, between developments, and by having a well-planned collector road network to compliment the arterial highway network Improve rural-urban street network connectivity and quality Improve the built and design quality of streets Equity in road infrastructure- for motorized, NMT and pedestrians Encourage short block lengths, numerous three and four-way intersections, and minimal dead-end Increase the effective RoW- with proper road design elements to cater the existing and future demand Adapt design, innovative solutions and technology for traffic calming Develop Local Area Access Plan (LAAP)	Ensure alternative routes and provision of broadcast during evacuation or emergency Ensure infrastructure upgradation (for instance raising the level of the road or switching from unpaved to paved roads) Increase the frequency of maintenance of road and supporting infrastructure Ensure well-functioning drainage system Reinforce slopes **Operation perspective;** Ensure signage and appropriate design element to manage traffic volume Adopt ITMS for real time information to the commuters, about weather, alternative route, traffic congestion, or display/convey of important messages Implementing traffic rules to make sure the most important vehicles can go through while others can take an alternative route
Integrated Multi Modal Public Transport System	
People centric planning	**Transport Resilient Planning**
Interlink various transport modes from user point for seamless travel Ensure physical integration facilitating direct, comfortable, convenient, safe access to public transport (providing safe, direct road crossings, tree-shaded paths, refreshments, cycle/vehicle parking, access points and pavements for differently abled Ensure fare integration—enabling unified payment system Ensure route integration—facilitating logical interchange points where passengers are able to transfer from one vehicle or mode to another conveniently and safely Ensure information integration—enabling a 'one-stop-shop' for public transit users, cyclists,	**Infrastructure perspective;** Agencies/departments to follow Emergency Preparedness Planning and Procedure- Assess the economic, social, environment and energy dimension from safety and security perspective for all individual modes and interchanges Agencies to upgrade infrastructure and revise operational procedure when needed **Operation perspective;** Ensure sub-stations/ generators for power supply to be elevated above the flood levels and remote safe house, outside flood prone areas. To be operated by mobile command

and walkers to gain journey information using these modes Ensure institutional integration—ensuring that different public transit providers see themselves as part of a network and provide links to other types of transit, walking, and cycling[105]	Provision of shade, shelter and protection for commuters at interchanges during emergencies and otherwise Ensure action plan to move transits to a safe, elevated location, outside flood prone areas in the hour of need to lessen the damage Adaptation of smart and fully integrated ITS solutions – for operators and passengers
First and Last mile connectivity	
People centric planning	**Transport Resilient Planning**
Reduce the gap (travel time/distance) between destination and public transit node, effectively and efficiently Organize the Intermediate Para Transit Ensure accessibility and connectivity for pedestrians, cyclist and other Non-Motorized Transport users Consider Local Area Access Plan (LAAP) Consider efficient use of technology to eliminate first mile and last mile issues	**Infrastructure perspective;** Ensure alternative routes for ease of accessibility Ensure infrastructure upgradation – including road network and drainage Increase the frequency of maintenance of internal roads and collector roads Ensure clean and efficient drainage system Reinforce slopes **Operation perspective;** Consider efficient use of technology to eliminate first mile and last mile issues Focus on signage and way finding-Agencies to carefully present information, focusing on clarity and simplicity

4.6.4.2 *Technology as a tool for resilient transport*

Kerala's transport sector needs a better integration and application of technology for efficient, effective and real time management. Effective traffic management using ITMS can reduced congestion, leading to reduced journey times, fewer delays and increased free flow of traffic around the city. It also improves the air quality as a result of less congestion and the associated pollutants which impact on health. It also

[105] Multi Modal Transport in a Low Carbon Future
https://www.dimts.in/download/Multi_Modal_Transport_in_a_Low_Carbon_Future.pdf

impacts the accidents through more effective traffic signaling and the introduction of more advanced safety mechanisms for pedestrians. By supporting the free-flow of traffic and lowering congestion, the ITMS would also create reserve capacity in the system, for use in the event of sudden shocks or calamity. ITMS assist operators in predicting and managing problems, ensuring quicker response times and increasing preparedness, by drawing a greater wealth of data from the entire network. The integrated nature of this system offers a range of benefits that would be precluded from a disconnected or un-integrated system. These includes;

- Greater capacity for control and manipulation by operators, greater ease of product integration
- Greater capacity for data gathering and analysis and an increased opportunity for modal shift
- Traffic and transport simulations
- Advanced traffic management and bus operation systems
- Smart traffic signals
- Digital cameras for street surveillance
- Gprs, and advanced communication equipment

The transport management system would integrate a modern Urban Traffic Control (UTC) system with modular sub-systems, such as;

- Real-time control of traffic signals from one central location using a UTC system
- Fiber optical connections or wireless mobile networks combined with Internet Protocol (IP) technology to transfer encrypted data from the controller to the central system. This would also distribute real-time traffic information to Variable Messaging Signs on the roadside, as well as TV, radio, and mobile applications
- Induction loops, radar, magnetic sensors or Passive Infrared (PIR) to detect traffic volume and speeds including in some cases, vehicle types
- Automatic Number Plate Recognition (ANPR) systems to identify the travel time of vehicles across a specific distance
- Variable message signs (VMS) including full-matrix LED displays to distribute information to travelers about travel times and conditions on the route.
- Geo-referencing using data from devices installed across the city – including on vehicle counts, speed, parking space utilization and weather – to map network conditions in real-time using Geographical Information Systems (GIS)

ITMS offers a variety of technological solutions to the growing surface transportation and traffic problems. The implementation opportunities are not just limited to traffic congestion control and information, but also applicable for road safety and efficient infrastructure usage.

In the context of Kerala, ITMS could be unveiled in city bus systems in order to bring about a new generation of comfort buses that facilitate connected inter and intra city public transportation. It can help city bus agencies rebrand as a high-tech reliable, efficient, and comfortable form of public transportation. ITS can be adapted in various forms to enhance the performance and the level of transit services to passengers, thus attracting them towards public transport. At the same time, technology can significantly

enhance operational efficiency. The technology could be used for the various uses within the day-to-day urban bus transport operation (largely data collection, electronic-ticketing, and communications), as well as for analytics and subsequent real-time updates (of scheduling/dispatch, headway modifications, responding to passenger demand, implementing traffic signal priority for public vehicles, etc.).

4.6.4.3 *Single statutory authority for resilient transport*

Kerala to have a special single statutory authority for urban transport similar to UMTA (Urban Metropolitan Transport Authority,) that will coordinate all the urban transportation functions, such as- policy formulation, strategic planning and programming, project preparation and approval, project implementation, operations and management, regulatory, funding and research and development- both private and public. The far-reaching role will be to ensure the resilience measures- effective implementation and executed on ground. The special single statutory authority for urban transport should evolve with time and can be set-up (a) through an executive order; (b) under the provisions of an existing Act; (c) by its own special Act.

Roles of special single statutory authority for urban transport[106]:

- Assist and advise government on urban transport matters
- Prepare, adapt and administer urban transport policies, strategies, standards and guidelines for the urban area under its jurisdiction.
- Prepare a multi-modal transport master plan integrated with land use
- Prepare a Comprehensive Mobility Plan (CMP)
- Prepare a detailed multi-year programme for urban transport
- Monitor and audit compliance with the Transport Master Plan, the CMP and the Multi-year Programme
- Approve urban transport projects and activities
- Promote development of integrated facilities and systems for urban transport
- Oversee operation of integrated facilities and systems for public transport
- Contract public transport services so as to provide mobility and integrated public transport
- License (issue permits for) public transport services
- Monitor and advise on fees and charges for roads, public transport, parking, and other public transport facilities and services and regulate fares for urban bus services
- Enforce regulations for which UMTA is responsible
- Fund, or arrange / recommend / approve funding for, urban transport infrastructure in whole or in part
- Monitor and Audit use of UMTA funding
- Maintain records relating to urban transport, including details of projects, services, funding, and public transport safety
- Develop and manage local performance indicators for urban transport
- Monitor and advice on public transport safety
- Conduct research, studies, education and awareness about good practices in urban transport

[106] Developing Operations Documents For Urban Metropolitan Transport Authority (UMTA) And Urban Transport Fund (UTF) PC1B 1, MoUD, GoI

The comprehensive role would be to prepare, adapt, administer and communicate the 'urban transport resilience' -policies, strategies, standards and guidelines for the urban area for Kerala and ensure enactment and effective application within time frames (e.g., immediate and short-term operations and response versus long range systems and capital planning).

4.6.5 Specific Interventions

Emergency Management Plans

Institute Emergency Management Plans for Public Transit agencies to determine how and when they can provide assistance to emergency response, while keeping their personnel, passengers, and resources safe. Establish connections to police, fire, and other emergency response agencies.

High speed corridor- A socio- economic development tool for Kerala

The high-speed corridor connecting the districts of Kerala longitudinally will act as a growth engine for the socio- economic development of the entire state. It will act as a social cohesion among residents as it connects the entire state and promotes a sense of togetherness, by bringing distant populated areas close together. From the planning point of view, it will facilitate new growth of multi zonal, multi nuclear urban structure in and around, to reduce and re-distribute the pressure from the existing urban spaces. From the resilient point of view, the corridor will open avenues to connect "high and dry" areas that are safe and have the potential to increase socio-economic opportunities of the State. Integrating the multimodal transportation along the corridor will create ripple of growth and facilitate better connectivity with the surrounding. From a connectivity point of view, a high-speed corridor will connect the airports, health facilities, institutions, cultural amenities, and commercial nodes.

Along with the social benefits, the corridor will also stimulate long term economic benefits - encourage commercial and industrial growth in, around and along the corridor. This will create employment opportunity and also widen employment opportunity. Besides connecting the entire State, it will also reduce the travel time, improve energy consumption, encouraging high density, mixed-use, and real estate development along the corridor and around the transit nodes. It will also foster economic development in tier-II & III towns along the corridor and also create new growth centers. The corridor will also expand tourism opportunities. Overall, the high-speed corridor will integrate the districts that can function as a single stronger economy.

Figure 37: Characteristic and conceptual diagram for transport resilient high-speed corridor

Table 36: Transportation Actions and Results Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Policy / Regulatory				
Institute Emergency Management Plans for Public Transit agencies	X			Public agencies provide assistance to emergency response. New connections established to police, fire, and other emergency response agencies

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Comprehensive Transportation Strategy/ Master Plan developed on the development potential of an integrated multi-modal transport system.	X	X		Comprehensive long-term plan for integrated transportation systems through the State. Less dependence on private vehicles.
Institutional				
Establishment of a Transport Sector Reform Group in the Transport Secretariat that includes a broad list of issues like Public Bus Transport Policy, Congestion Charge policy in Cities, Road side Advertisement and Parking policy (to ensure adequate and disciplined parking and thereby ensure road safety), Bus Route Rationalization, Private Bus Contracting Models, State logistics policy, safe Sabarimala etc.		X		Strategies to solve some of the outcomes pertaining to some of the issues pertaining to transportation can be achieved
Modify the Kerala Metropolitan Transport Authority Bill to incorporate aspects regarding: • The bye laws, rules and laws to be merged with KMTA needs to be identified • In terms of funding there needs to be a mention of the funds ratio or the details regarding funds allocated by the State Finance Commission reports • More details regarding the integrated public transport needs to be mentioned		X		Make the KMTA similar to the UMTA and the various deficiencies in the same have been overcome
Approval of the Kerala Metropolitan Transport Authority Bill which is similar to that of the Unified Metropolitan Transport Authority			X	Create a unified KMTA along the lines of UMTA as prescribed by the National Urban Transport Policy 2006

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Capacity building and Reskilling of department officials with the latest transportation.	Ongoing			Officials are skilled with the necessary skills that can help in better planning for the cities
Investments Planning				
Action plan prepared for enhancing public bus Transport on State Road network with focus route rationalization, bus contracting models for inter-city operations, transport tax reforms, public transportation subsidies, and dealing with urban congestion.		X		Action plan prepared, with potential for phased interventions.
Study of existing land-use transport Scenario- - demographics, employment characteristics, identification of other upcoming developments in the area, existing and proposed land use, current challenges, best practices, institutional structure, policy, pipelined projects, assess existing public transit, review of contextual and planning issues as well as a detailed investigation of transit service and infrastructure.	X			Analytical observation of existing situation, identifying the gaps, gauging the potential need of high speed corridor
Preparation of conceptual plans of high speed corridor on the basis of a 10-year projection		X		Holistic understanding of long term need
Valuation of existing & required infrastructure, assessment of net required infrastructure, from the point of view of optimal re-deployment of existing resource		X		Valuation and feasibility of the project
Draft feasibility report of high-speed corridor for Kerala		X		Feasibility Report
Conduct a stakeholder meeting		X		Stakeholder consideration

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Final Report on high speed corridor for Kerala			X	Final Report
Formation of SPV for project implementation			X	Plan Implementation
Analyse and operationalise pilot schemes for Intelligent Transport Management Systems, targeting one or two areas (such as bus network efficiency, or congestion control, etc.)			X	Best practices for future implementation.

4.6.6 Technical Studies and Assessments

Table 37: Transportation List of Studies

List of Studies	0-6 months	0-18 months	18 months & beyond
Policy / Regulations			
Developing an Integrated Road Transport Strategy for connected multi-modal transportation systems through the State. Plan should take a long-term approach to catering to transit demands.		X	
Institute Emergency Management Study for Public Transit agencies to determine how and when they can provide assistance to emergency response	X		
Study of opportunity for PPPs in Transportation Sector in Kerala	X		
Strategy for Enhancing public bus Transport on State Road network with focus route rationalization, bus contracting models for inter-city operations, transport tax reforms, public transportation subsidies, and dealing with urban congestion	X		
Analysis of potential of Land Value Capture as revenue generation for public transportation investments		X	
Investment			
Strategy for operationalizing an Intelligent Transport Management System		X	

List of Studies	0-6 months	0-18 months	18 months & beyond
Study on revenue generation potential of implementing Land Value Capture for public transportation investments	X		
Preparation of feasibility report of high-speed corridor on the basis of a 10-year projection		X	
Mix of All			
Other Supports in terms of workshops, advanced seminars, reskilling of departments, study visits to other States, individual consultants for drafting of technical guides/manuals, training of PWD staff	X	X	

4.7 Forestry

4.7.1 Introduction

Kerala has a forest area of 1524.41 sq. km., or approximately 29% of the total area of the State. Of this, 9339.18 sq. kms. are reserve forests, 1,900.98 sq. km. are vested forests and ecologically fragile lands and 284.21 sq. km. are proposed reserve forests. Over the decades, forest cover in Kerala has come down significantly. Prior to independence, more than 90 % of the geographical area along the Western Ghats, more than 75% geographical area along the midland and more than 60% geographical area along the coast had luxuriant forest vegetation. But, after independence, encroachments in the forest areas amplified. This continued till the early 1970s, reducing the extent of forest very drastically.

There was a perceptible shift in wildlife conservation in the Seventies, starting with the increased number of Protected Areas, as a result of the Wildlife (Protection) Act 1972 and the formulation of Wildlife Rules in 1978. Before 1956 if there was only Periyar Wildlife Sanctuary with an area of 777 sq.km, at present 3213.24 sq. km. of forest, which includes five national parks, two tiger reserves, two bird sanctuaries, one peafowl sanctuary and one community reserve, is under Protected Area Network. In October 2007, the Kadalundi-Vallikkunnu Reserve was declared the first community reserve in India for conserving the biodiversity and cultural heritage of the area with people's participation.[107] Kerala forests fall under two biogeographic provinces, the Western Ghats and the Western Coast. They are rich in biodiversity and vital for environmental protection and a repository of rare and endangered flora and fauna.

Yet, forests face many challenges in Kerala today, starting with the pressures of high population and population densities. The rapid growth of the economy of the State has put additional demands on forests. With greater climate change and natural disaster related risks, Kerala forests are expected to face even more challenges, as evidenced by the 2018 floods and landslides.

4.7.2 Impact of 2018 Floods

Although the 2018 floods impacted the midlands of the State more, it also affected the forest areas in a considerable way. The impact on forest ecosystems was marked by soil erosion, loss of humus and widespread destruction of the riverine vegetation. However, the number of landslides in the forests was much less compared to the other areas in the high ranges.

Areas under the Ranni Forest Division, Shenduruny and Aralam Wildlife Sanctuaries, areas bordering the buffer zone of Silent Valley, Mannarkkad, Malayattoor and Vazhachal Divisions were the most affected due to heavy rain. The Kurichiar Mala in Wayanad (a hill of high value biodiversity) was the most affected in the landslides that happened in forests. Reports of riparian forest damage occurred in the Chalakudy main river (290 m, Orukombankutty – Vazhachal – Athirappilli), Karappra river (116 ha, Nelliyampathy-Orukombankutty), Sholayar river 52.2ha (downstream of Sholayar Dam) and Parambikulam 13 ha (Kuriyarkutty – Orukombankutty).

The Protected Areas in the State were comparatively the least affected. However, landslides occurred in Kottiyur Wildlife Sanctuary and Karikombu in the Eravikulam National Park and some private areas in the border of the buffer areas of the Silent Valley National Park. The post- flood observations in Thattekkad Bird Sanctuary indicated a drastic change in the water bird habitats. The Periyar riverside of about 14-15 Km in length was almost completely destroyed. The water bird habitat was filled with silt and sand and

[107] http://www.forest.kerala.gov.in/index.php

the feeding canal from the water reservoir was also filled up. Aquatic vegetation was washed away and/or buried under sand. Feeding grounds were replaced with sand. The grasslands along the river bank were also eroded. However, there were no major adverse effects inside the Sanctuary. Basic facilities in these areas were also badly hit. Roads, culverts, bridges, forest department offices and staff accommodations were damaged.

Many plantations and ecotourism centres were also badly affected by the floods. There are 60 such centres under the control of the Forest Department. Among these, 23 centres under five Circles were the ones that suffered the most. Many tribal sectors were cut-off from the main land due to landslides, flood, mudslides and heavy rains. In different territorial circles, 131 settlements were adversely affected by the deluge. The Forest Department was able to reach out to location that other departments could not access. Overall, about 8850 people stranded in the flood were rescued by the forest officials. The following problems were encountered by the Forest Department while undertaking rescue and relief operations:

- Breakdown of transport and communication infrastructure in places;
- Lack of disaster response mechanisms like satellite-based communication facilities;
- Paucity of finance;
- Inadequacy in scaling-up of rehabilitation efforts, especially those related to civil works, need of technical skills in planning and execution within the department; and
- Inundated field offices and poor geographic locations of field offices in remote places that during such disasters become a bottle neck in affecting quick response.

State's forests, occupying about 29% of its geographic extent, did not adequately function as a percolator of incessant rains and the flash floods, due to the soil system. Also, the forest areas were devoid of stable multi-canopy vegetation which had given away and led to landslides. This, clubbed with fragmentation of forests due to habitation and developmental activities, especially building of roads, has further degraded the forest ecosystem. Due to inadequacies in disaster preparedness in the ecotourism destinations, the infrastructure suffered heavily, leading to closing of these sites for many months, thus affecting the livelihood of the local communities adversely.

Lack of integrated conservation and protection of the extremely vulnerable coastline of the State was evident. Soft protection measures like bio-shields in the ecologically sensitive areas based on the hazard line concept developed by the National Centre for Sustainable Coastal Management, Chennai which has taken into account the average of 100 years of flood data and provided an overview of the vulnerability of coastal line to natural calamities has not been undertaken so far. The protection and conservation of the coastal environment which rests with the Kerala Coastal Zone Management Authority (KCZMA), which has no field level functionaries for either management of the coast or enforcement of the coastal zone regulation (CRZ). This has led to violations in the CRZ regulation and heavy encroachments along the coast.

Kerala has 1726 wetlands, as per the Space Application Centre report, which include coastal wetlands, forest wetland and manmade reservoirs. Even though wetlands are an important tool for flood control, these were not managed adequately enough to be used for effective flood control. There are 44 rivers in Kerala out of which 19 are tidally influenced. Despite Acts enacted to conserve and protect the rivers and river banks (The Kerala Protection of River Banks and Regulation of Removal of Sand Act, 2001 and the CRZ Notification 2019 wherein the No Development Zone of the tidally influenced rivers has been specified as 50 meters) the rivers have not been able to discharge the function of flood control due to the lack of an integrated approach in their conservation and protection. Even though the major rivers originate from the forests, their protection outside forests is highly inadequate due to encroachments of river banks and excessively removal of sand making them unfit for water retention, resulting in both drought and flood.

As per the Kerala Forest Research Institute (KFRI), there are 5,924 quarries in the State covering an area of 7156.6 ha with nearly 1378 quarries within 1 km from the Reserve Forests and 79 quarries with total area of 85.83 ha within 500 meters from the Protected Forests.[108] Quarrying in vulnerable areas contributed in accelerating landslides at least in a few locations as the landslides were in slopes about 22 degree and most common between 22 degree and 28 degree. Destabilization of slopes by cutting and creating escarpments more than 3 meters for construction is mentioned as major cause for vulnerability. During the floods, 341 landslides were reported, out of which 143 were in the Idukki District; 209 landslides were reported from different forest divisions but the majority of the landslides were in the fringes of the forest, indicating that forest fragmentation that was disrupting slope continuity was a major factor contributing to the landslides. Most of the landslides occurred in human-occupied locations where excavation of hillocks for roads and other constructions took place.

4.7.3 Proposed approach

4.7.3.1 *Policy*

Management of resilient, critical ecosystems (mangroves, coastal areas in CRZ-1A, wetlands, sholas, grassland and other ESA) would be given adequate legal protection under Wildlife Protection Act 1972 and Kerala Forest Act. Under Aichi Biodiversity Targets, Strategic Goal – C, "by 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, would be conserved. This would be done through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures and integrated into the wider landscapes and seascapes".

Mangroves: Mangroves are vital coastal ecosystems that support the State's resilience. While the regulations fall under the Kerala Coastal Zone Management Authority (KCZMA), its management has not been clearly assigned. As per the mapping of ecologically sensitive area by National Centre for Sustainable Coastal Management, Chennai, mangroves cover 21.12 sq. km area in Kerala. Quick estimates reveal that about 440 ha have been accorded legal protection and formally handed over to the Forest Department for management. The remaining areas have not been clearly assigned or provided the necessary legal protection. These mangroves are either on lands with the Revenue and other Government Departments or on private lands. Presently, no management responsibility is assigned to these most sensitive ecosystems.

According to the Central Government Order No.8- 16/2002-FC dated 21st August 2003, which was accepted by the State Government, "*13,223.31 ha of land not under the control of forest department at present, shall be mutated in favour of the Forest Department and notified under Section 4 of the Kerala Forest Act 1961, as reserve forest for better protection and management*". This includes 1160 ha of mangrove forest available with the Revenue, other local authorities and private individuals in Kannur, Kasargod and Kozhikode districts. Government Order G.O (R.T) 166/06/forest dated 25.03.2006 directs acquisition of 50 ha of mangroves in 5 districts and extending legal protection under the Forest Conservation Act. Through Government Order vide G.O(R.T.) 165/07/forest dated 28.03.2007, initial financial provision was also allocated. This shall be extended and the required resources, both financial

[108] by Sajeev, T.V. and Alex C.J.: Mapping of Granite Quarries in Kerala. India: A Critical Mapping Initiative, Forest Health Division, Kerala Forest Research Institute, Peechi.

and human resources, shall be provided to the Forest Department to address this additional management responsibility. This shall be implemented in a timebound manner.

Sacred groves: The State has a number of sacred groves managed by different agencies and private individuals. There are normal groves as well. These are conserved mostly due to social belief and tradition. At least a few of these critical areas are threatened because of demand for land. Forest Department had initiated some programmes for protection by extending assistance to the concerned. However, there are a number of sacred groves requiring attention and conservation measures. Actions will be initiated for conservation of the sacred groves based on currently available information Further, information will be generated wherever it is currently not available.

Urban forestry: Growing natural forests in urban landscapes and creating green lungs for the cities. Apart from the beautification and becoming a public asset, such urban forestry would also facilitate better groundwater retention and mitigation in instances of future floods.

Coastal afforestation: Even though the State is blessed with an extensive coastal zone across its length, human habitations and civil structures have taken over much of this zone. Considering events like the recent tsunami, the Forest Department role would be to strengthen the coastal zone for creating/ managing bio-shields, coastal belt plantations, with native species and without affecting the naturalness of the coastal areas. This would be done with utmost care and based on a programme developed in consultation with experts. A Government Order in this regard will be issued. Extension forestry (agro-forestry) needs to be expanded in the revenue areas since most of the coastal zone areas are revenue lands or under private occupation.

Revenue lands with the Government / departments harbouring, or capable of harbouring coastal eco-systems like biologically active mud flats, coral and coral reefs, turtle nesting grounds, nesting grounds of birds, habitats of horse shoe crabs, and other special habitats in the coasts designated as CRZ – 1A which are environmentally more critical are to be given legal protection under the Wildlife (Protection) Act and Indian Forest Act and Kerala Forest Act.

Wetlands: Proactive conservation of wetlands is essential to maintain their ecological character and ensure the '*wise use of wetlands'* through implementation of appropriate approach within the context of sustainable development. This would also include monitoring the adverse changes in the ecosystem structures and ecosystem services 'in the zone of influence' (which forms a part of the catchment area of the wetlands or wetland complexes). As per the Wetland Conservation and Management Rules 2017, the coastal wetlands are to be managed under the CRZ notification and the wetlands inside forest are to be managed as per the Forest and Wildlife Act. Hence, the wetlands other than the Ramsar wetlands and the notified wetlands under the SWAK, numbering nearly 53 out of the 1726 wetlands already mapped by the SAC, shall be managed by the respective departments, including the Forest Department. The SWAK needs to prepare a list of wetlands in the State and get all of them notified without any further delay. Management of wetlands can be done with the active support of VSS / EDC members and the LSGD.

Rivers, riverbanks and riparian vegetation: A policy level decision shall be taken to ensure the protection of rivers, river banks and riparian vegetation outside forest through appropriate programs like plantations and geo-textiling of the river banks, stream banks, prevention of illegal sand mining and negating the adverse impacts on the river and riparian ecosystems. These are to be monitored by the Social Forestry Wing of the Forest Department. A Government Order to this effect shall be issued.

No further use of reserve forests land to meet the wood-based industries. Aichi Target 15 states that "by 2020, ecosystems resilience and the contribution of biodiversity to carbon stocks has been enhanced through conservation and restoration, including restoration of at least 15% of degraded ecosystems thereby contributing to climate change mitigation and adaptation and to combating desertification." In

the past, monoculture in the forests was promoted to provide raw material for wood-based industries. This practice would be progressively terminated, and the such areas would be converted into thick canopy forest over time. Apart from the meeting the existing contractual commitments, no new or renewal of contracts for the supply of industrial wood would be done. All the forest lands that have been used for monoculture need to be restored to their original natural vegetation status in course of time. A Government Order stating this policy of the Forest Department would be issued.

Monitoring the seasonality of first order rivers: The presence of first-order rivers in the State, especially in forests, shall be mapped and seasonality shall be recorded by using technology. A dedicated digital application for Forest field staff to identify the first-order streams, measure their flows and take pictures. A central monitoring system can analyse the data to help strengthen the water restoration capacity in areas where it is necessary. This will be a dedicated project to address droughts and forest fires.

No new openings in the forests area would be permitted: Forest fragmentation has been identified as one of the main factors contributing to the landslides. Given that, a policy banning any new openings is required. In particular, no new roads will be opened within the forests. This would be institutionalized through a Government Order.

No net reduction in forest land: Portions of Government-owned forest lands are at times diverted for non-forestry purposes, following the provisions of FCCI Act. Since the Act provides for afforestation of double the extent of degraded forests as one of the two options, the State shall go for the option of converting equal extent of non-forest land as Government forest land so that there is no net reduction of forest land. The Government Order already issued in this regard will be strictly followed.

Increasing Protected Areas: At present, the Protected Areas form about 8% of the total geographical extent of the State. The Government has taken the step of providing the highest levels of legal protection to the sources of the major rivers in the State by notifying their points of origin as Protected Areas. Such Protected Areas are indeed more resilient than the other areas.

Limiting of disruptive activities in the vicinity of the forests: In the past, no development or disruptive activities were allowed within 200 metres of the forest boundary. This has been reduced to 50 metres and presently development activities are being allowed along the boundaries of the forest areas. Such activities have direct and indirect impacts on the forests. In order to strengthen the resilience of the forests, it is required to revert to the earlier limit of 200m. A sub-committee constituted by State Environmental Impact Assessment Agency (SEIAA) has recommended for the same. This is particularly relevant to critical activities like quarrying, construction of roads, dams-related infrastructure, pilgrim facilities and other infrastructure. A Government Order by the Forest Department reinstating the 200-metre protection would be issued.

Centre for Eco-Restoration: Restoration of abandoned quarry sites into a plantation area after the extraction of minerals is a mandatory requirement of law under KMMC Rules, 2015. The same has to be undertaken by the project proponent with the technical support of Centre for Eco-Restoration (CER) by using the security deposit obtained under Rule 42 of the KMMC Rules, 2015. The security deposit under Rule 42 of KMMC Rules, 2015 shall be considerably increased from Rs.10,000 to a higher practical amount, considering the cost of restoration of the quarried land. The CER will be housed in the Kerala Forest Department, which shall create a pool of experts from the Social Forestry wing, Kerala State Biodiversity Board, CWRDM, KFRI and other related institutions, EIA experts etc. Centre will also facilitate the eco restorations of areas affected with landslides as well.

Coordination between Forest and Tribal Welfare Departments: Welfare of the tribal and management of forest are intricately intertwined. Managing them as two separate departments have created great stress for both. Close coordination is required between the Forest Department and the Scheduled Tribe

Development Department. Also, the tribal inside the forests and those in the periphery cannot be managed separately. Both these Departments need to be integrated at the State level and below. Any activity within the forest areas should be based on a written project document considering the impact of such activities on the forests (EIA) and should have written consent of the Forest Department.

4.7.3.2 *Institutional*

Establishing an inter-sector working group on slope protection: In order to share information and coordinate interventions to arrest potential landslides, an inter-sector working group would be established. This would include the Forest Department (forest areas), Department of Soil Survey and Conservation (watershed development), LSGD (human habitation), PWD (road infrastructure works) and experts from the research institutions. This working group would develop an integrated approach using the collective expertise within the Departments and also other research and educational institutes. The working group would also draw from the best practices from national / international experiences. Proof-of-concepts pilots would be designed and implemented in order to develop such an integrated approach. Further, monitoring will be incorporated as a regular inter-sectoral activity among the Forests, Water Resources, Power (KSEB), LSGD and other departments. This inter-sector working group would inculcate the habit of factoring the forest conservation requirements into the planning process of other departments who propose interventions in or in the vicinity of forest lands.

Landscape level approach: The recent frame work for management of the protected area network is based on landscape level approach which needs inter sectoral linkages, integrated planning and implementation at a landscape level, both within and outside the State where the landscapes converge. Hence, the policy level decisions are needed to establish/strengthen landscape level coordination committees comprising of relevant departments, both within the State and with the neighboring states, which shall ensure effective implementation of various programmes and also work for effective disaster response in the identified landscape units.

Ecologically Sensitive Zones in Protected Areas: Eco-sensitive Zones are declared in accordance with the Environment Protection Act. Eco-sensitive Zones around National Parks, Wildlife Sanctuaries and Tiger Reserves Act as a transition zone between areas of very high protection and little or no protection. There are 23 Protected Areas in the State. These are buffer areas to be declared along the periphery of Protected Areas and will act as a shock absorber for adverse impacts in the pristine ecosystem. Proposals have been sent to Government to declare Eco-Sensitive Zones around protected areas for the State of Kerala. Many Eco-sensitive Zones proposed around the Protected Areas would be strengthened further, in tune with the Supreme Court Order in this regard.

Management of Myristica swamp: This fresh water swamp forest predominantly composed of species of Myristica is found in 9 districts of Kerala. They are adapted to inundation by way of stilt roots and knee roots. They are rich in biodiversity and are virtually living museums of ancient life and primitive ecosystems and primeval forest. These swamps forests could provide better understanding of the influence of climate change on the evolution of plants. These swamps have high watershed value and because the bottom of the swamps is at or below water table**,** it serves as channel run-off into the ground water supply helping in stabilizing the water table. During periods of heavy rain, a swamp can act as a natural flood control device (Columbia Encyclopedia 1978). Hence, they need to be conserved and brought under the management of Kerala Forest Department. This would be done through a Government Order.

Control of invasive species: The invasives have a competitive advantage over the native species and have favourable adaptive features to withstand limiting ecological conditions. There is a huge risk of increased episodes of biological invasion in the post-disaster period. The newly exposed land substratum in landslide areas will be favourable for various invasive plants. The rivers are high speed corridor for the spread of invasive exotic plants downstream and form the major sustained source of propagules of these invasives. Drought like conditions have also been reported in Wayanad and Idukki Districts and the extreme biological stress condition could provide advantageous scenario for the spread of invasives in high lands. As per Aichi Target 9 "by 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment". A policy level decision is needed for engaging the Vana Samrakshana Samithies (VSSs) and Eco-Development Committees (EDCs) in eradication of invasive species as a priority, operating both inside and outside the forest. This will also ensure livelihood for all those involved in the aforesaid activity.

Incorporation of Climate Change and Disaster Management Plan in the Forest Working Plans/ Management Plans/ Tiger Conservation Plan: It is a fact that climate change, marked by reduced as well as an erratic rainfall and temperature rise has increased the vulnerability of the State. For the people residing within the forest as well as in the forest fringes, climate vulnerability has led to not only change in land use patterns, but also in their way of life, loss of traditional varieties of food crops, migrations, human wildlife conflict, loss of cultural values, lifestyle, habitation etc. Addressing climate change through climate adaptation and mitigation measures taking into account the indigenous knowledge of local communities is the first step in building resilience. Drafting Local Action Plan for Climate Change (LAPCC) by the EDC and VSS members and integrating it into their micro plans which are approved documents with 5-year validity and also preparation of Annual Micro Plan with climate orientation will go a long way in preparedness at grass root level and addressing to climate vulnerability and disaster response. This has to be undertaken by all EDCs and VSS in the forest as well as the coastal districts. Accordingly, methodologies, tools, guidelines, training materials and handbooks will be prepared followed by TOI and trainings. In addition, VSSs and EDCs will be provided handholding support to carry out these activities in a phased manner during the project period. There are 400 VSS and 190 Eco Development Committees. A few need to be formed and institutionalized in the ecologically sensitive coastal areas. Therefore, a total of about 600 VSS and EDCs need to incorporate LAPCC into their microplans and implement the activities so mentioned in their annual plans. This state –wide exercise shall be anchored in the Eco-development and Tribal Welfare wing of the Kerala Forest Department and shall be implemented by the Divisional Forest Officers within the project period of five years. The Forest Working Plans/Management Plans/Tiger Conservation Plans will include a chapter on Climate Change and Disaster Management.

4.7.3.3 *Investments*

Restoration of all damages to the forest infrastructure: To restore the damaged infrastructure to their intended use, for shifting the field formation to safer places where necessary and to strengthen the existing network of forest roads, investments are required. Investment are also required to make the Forest Department equipped with Automated Weather Stations, software and equipment for climate prediction and weather forecast and development and purchase of digital applications.

Establishing and maintaining resilient forests: Resources are required to implement strategies to restore natural vegetation (progressive move away from monoculture, removal of exotic / alien species, etc.), establish and maintain soil-moisture conservation / watershed initiatives (from top-to-bottom) and improve the maintenance of the physical infrastructure such as check dams, creation of natural gullies to

enable flows without causing soil erosion. These activities will be taken up based on a written project reviewed by experts in hydrology and geology.

Reducing forest fragmentation, minimizing human-wildlife conflict and enhancing connectivity in the forested landscapes: In order to enhance the resilience of the forests, the dependence of the tribals on forests should be reduced. Building their capability for alternative and sustainable livelihoods shall be adopted. Further, voluntary relocation of forest dependent communities from deep inside forest areas requires funds and technical assistance. This would enable these communities to relocate to safer terrains. As the experience from the recent floods suggests, the evacuation of forest dwellers was one of the most difficult tasks during the relief and post-flood operations and, further, many of the forest dwellers in relief camps were reluctant to go back to their original habitations and preferred to stay in safer zones. A proposal for acquisition of 13 estates has been presented to the Government. These estates are located inside forest areas. Acquisition of these estates and restoration to the natural vegetation will not only ensure continuity of forests, minimize disaster risks, reduce forest fragmentation and human-wildlife conflict but also ensure compliance of the sustainable development goals (SDG 13 and SDG 15).

Strengthening GIS capacity within the Forest Department and its inter-connectedness with other spatial information in other Departments: The utility of spatial information in building resilience cannot be overstated. The GIS facilities in Forest Department were established about a decade or more ago. They are outdated and do not have enough human resources. The technologies need to be upgraded and the staff need to be exposed to best practices in this area. A detailed and scientific vulnerability mapping of forest areas – both core and periphery – is done. It is also vitally important that the Forest Department is connected to the Government's Open Data Initiative and, in this regard, it is also important to collaborate and associate with Institutions working in similar areas.

Building resilience in areas of visitation (Ecotourism, tourism and religious tourism sites inside forest): Around 50 lakh tourists are visiting forest areas every year, including 5 lakh foreign visitors.[109] At present, there are no disaster response mechanisms in these sites. Investments are needed to build up resilience of infrastructure, and disaster response mechanisms in terms of resources, equipment, training and manpower. Places of mass tourism need to have disaster response cells, all weather vehicles, boats, etc. The approved Master Plan needs to be implemented in places of religious tourisms inside forests. Electric vehicles / NMVs need to be introduced in all ecotourism destinations to make them carbon neutral and energy efficient.

Forest Sanitation: Major rivers originate from forests. Their protection inside forests is highly essential to make them fit for water retention and play a mitigating or moderating role during droughts and floods. Within forest areas, streams are mostly polluted by largescale dumping of waste by outsiders and tourists. To contain dumping of waste and resulting water pollution at source and to augment the water retention capacity of rivers, the Government constituted a task force for removal of waste from forest areas in the State with Principal Secretary (Forest & Wildlife Department) as the Chairman [Vide Order GO(Rt) No.406/2018/Forest dated 13-09-2018]. The Forest Department had initiated action to clean the waste along roads, with emphasis on the 125 identified waste dumping points in forest, by engaging VSS and EDC members, as a part of Project Green Grass. Its progress is monitored in monthly reviews by the Chief Secretary.

Making infrastructure and visitation inside forest energy efficient – Disruption of power supplier during natural calamity has prompted to introspect into making all infrastructure inside forest energy-efficient by adopting to solar and hybrid energy. Even making all the settlements inside forest energy-efficient is a

[109] Status Report on Ecotourism, Kerala Forest Department.

step towards building resilience for future calamities. Visitation to the forest areas also has to take into account its carbon foot prints and minimize the same.

4.7.4 Specific Interventions

This section includes the list of interventions – policy, institutional and investments. The overarching theme would be "*all ecologically sensitive areas of the Western Ghats are to be clothed with natural vegetation and they are to be accorded the highest levels of legal protection, so that in future the chances of similar calamities are minimized*." The following is the table of interventions along with the proposed time lines and expected outcomes.

Table 38: Forestry Actions and Results Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Policy / Regulatory				
Policy level decision to ensure that no new openings in the Forests area would be permitted. Strict implementation of Forest Conservation Act.	X			Enhanced protection of forest cover.
Resource mapping and preparation of policies for increasing Protected Areas as per the international norms of forests.	X			Enhanced protection of forest cover in line with international standards.
Policies for reclamation and restoration of the abandoned and/or illegal mines and quarries near forest.	X			Restoration of lands with abandoned and illegal mines and quarries near forests
Institutional				
Establishing an inter-sector working group on slope protection			X	Better coordinated and integrated action on slope protection.
Preparation of framework documents for effective implementation of landscape level approach which will include identifying the landscapes and			X	Better coordinated and integrated landscape approach to Protected Areas.

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
defining specific inter sectoral co-ordination in terms of roles and resources.				
Preparation of management action plans for ecologically sensitive zones around Protected Areas.	X		X	Improved management of Protected Areas.
Mapping of the areas for control of invasive species by Forest Department agencies through VSS/ EDCs and preparing a management action plan.	X			Targeted eradication of invasive species and provision of livelihood to forest dependent communities, especially those affected by flood.
Investment				
Policies and Management Action Plans for effective management of resilient, critical ecosystems	X		X	Stronger legal protection to and improved management of critical ecosystems.
Programs for no further use of forests land to meet the wood-based industries.			X	Restoration of 5000 ha of forests over a period of five years, to its original natural vegetation.
Restoration of damages to forest infrastructure as well as strengthening of forest infrastructure.	X	X		Restoration of flood-damaged forest infrastructure to its intended functional use. Strengthening of existing forest road network.
Habitat improvement of 20,000 ha over 5-year period.	X	X	X	Strengthened natural vegetation contributing

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Integrated approaches to conversion of plantations to natural forests and maintenance.				to enhanced resilience of the forests.
Voluntary relocation of critically located human habitations (37 enclosures, 640.32 ha and 1861 families)			X	Reducing forest fragmentation and human-wildlife conflict.
Acquisition of eco sensitive areas				
Acquisition of estates - 13 - 1450.16 ha.			X	Reduced fragmentation and improved resilience.
Acquisition of mangroves.				
Expansion of forestry in coastal areas.				
Establishment of bio-shields and coastal shelter belts.			X	Strengthened capabilities of coastal areas against future calamities
Conservation of ecologically sensitive areas inclusive species conservation as listed in CRZ 2011 for Kerala – 22.82 Sq.Km. (mangroves, turtle nesting sites, active mudflats & protected area)				Strengthened coastal ecology against future calamities
Preparation and implementation of management action plans for conservation of major rivers and protection of river banks for originating from forests.			X	Improved conservation and protection of river, river banks and riparian ecosystem to act as an instrument for flood control.
Conservation of the riparian ecosystem and myristica swamp				Better protected riparian ecosystem and myristica swamp as mechanism of flood controls.

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Preparation and implementation of management action plans for wetlands inside forests involving local communities.			X	Improved wetland protection and enhanced community livelihoods.
Rebuilding of flood affected ecotourism areas.		X	X	Enhanced livelihoods and improved disaster resilience of ecotourism destinations.
Induction of all-terrain vehicles/ equipment/ boats and training of staff.	X	X		Strengthened disaster response capabilities of Forest Department.
Forest Sanitation	X	X	X	To ensure clean and litter free forests and in turn clean and litter free water bodies and water sources including rivers and streams
Updating and strengthening GIS and ICT capacity within the Forest Department.		X	X	Enhanced application of ICTs in Forest Department operations and management.
Establishment of Centre for Eco restoration.				Strengthened technical capacities of Forest Department in eco-restoration.
Mapping, monitoring and strengthening the seasonality of first order rivers within forests through technology.			X	Strengthened capacity of first order streams and rivers to address droughts and forest fires.

4.7.5 Technical Studies and Assessments

This section includes the list of studies that will be required in advance or in parallel with the selected interventions:

Pre-investment studies: The following pre-investment studies / proposals will be prepared:

- Study on the reasons of degradation of first order water streams within forests, and study on possibilities of its restoration.
- Study on the impact of mining in the vicinity of forests in triggering the landslides and degradation of forest areas.
- Study as to how the restoration of natural vegetation in denuded forests / degraded forests / abandoned estates can be done, and how can it be sustainably managed.
- Study the possibilities of a better protection of the river banks and catchment area of wetlands with natural vegetation and geo-textiling.

Project Proposals:

- Proposal for management of water bodies inside forests
- Proposal for coastal belt plantations
- Proposal for conserving special habitats in the coastal regulation zones
- Proposal for disaster resilience in places of visitation.

Feasibility / Scoping Studies: Policy briefs to be prepared prior to introducing each of the following policy reforms:

- Feasibility of alternate management strategies of the resilient, critical eco-systems (mangroves, sholas, grasslands and other eco-sensitive areas) by Forests Department.
- Study on the impact of policy as to not permit the use of forest land to meet the need of the wood-based industries. Study to mitigate the impact of the policy on the restriction of new openings in the forests area.
- Feasibility of increasing the protected areas.
- Study on finding alternate sites while limiting the development activities like mining in the 200-metre vicinity of the forests.
- Scope of aligning the Social Forestry wing of the Forest Department to manage and conserve wetlands outside forests as well as the coastal ecosystem.
- Feasibility and scope of the working of Centre for Eco-Restoration under the Social Forestry division of the Forest Department to take up the work of restoration and reclamation of abandoned and illegal quarries and mines by using CSR and other funds.
- Feasibility and Scope of Coordination Committees and inter-sectoral approach for landscape level management and ecologically sensitive areas.

The above briefs will analyse the implications of the policy change, if any, and accordingly help take an evidence-based policy decision and also modify the provisions to be included in the Government Order. The briefs will also focus on the dissemination / awareness creation, orientation, enforcement and monitoring that would be required in order to ensure effective implementation. Accordingly, adequate resources – manpower and financial – would be allocated.

Institutional briefs to be prepared prior to introducing each of the following institutional reforms:

- Establishing an inter-sector working group on slope protection.
- Restructuring the field units of Forest Department (Ranges and Divisions) to Revenue Administration.
- Management of coasts, wetlands, Rivers and riparian ecosystem and other ecologically sensitive areas.

The above briefs will analyse "how" the above reforms will be initiated, implemented and streamlined. Adequate resources – human resources and financial – would be allocated to ensure effective institutional change. Pre-investment studies / proposals will be prepared for the GIS Centre strengthening.

Table 39: Forestry List of Studies

Activities	0-6 months	0-18 months	18 months & beyond
Policy / Regulations			
Policy briefs (8 nos.)	X		
Institutional			
Institutional briefs (3 nos.)		X	
Investments Planning			
Proposals for the GIS centre	X		
Proposals for restoring damages to the forest infrastructure	X		
Proposal for protection of river banks and catchment area of wetlands vegetation and geo-textiling with natural	X		
Proposal for management of water bodies inside forests	X		
Proposal for coastal belt plantations	X		
Proposal for conserving special habitats in the coastal regulation zones	X		
Proposal for disaster resilience in places of visitation	X		
Proposals for investments are required for establishing and maintaining resilient forests		X	
Proposal for rehabilitation of tribal & acquisition of estates & corridors		X	

4.8 Agriculture

4.8.1 Introduction

Around 52% of Kerala's geographical area is under cultivation[110]. Kerala's diverse geographical landscape, comprising 5 major agro-ecological zones, is home to a wide variety of crops, including cereals, pulses, fruits, vegetables, tubers, spices, oilseeds, plantation crops and medicinal plants. The low-lands of Kerala are known for sprawling paddy fields featuring cultivation of over 600 varieties of paddy. The hill districts are suited for spices and plantation crops. Kerala is known as the spice capital of India; the State leads the country in the production of several commodities; the State accounts for 89% of small cardamom production and 98% of nutmeg production in the country. The State also accounts for 34% of national pepper production[111]. Kerala also produces about 70% of the natural rubber in the country[112], and is a major producer of other commodities such as cashew, ginger, tapioca and jackfruit. Export of agricultural products is the top contributor to Kerala's total exports. Total exports of agricultural products in 2017-18 was 0.236 million MT valued at Rs. 1,869 crore[113]. Agriculture along with livestock and fisheries contributes to 11% of the Gross State Value Addition (GVSA) at current prices (crops: 5.42%). 17.15% of the population depends on the sector.

4.8.2 Impact of 2018 floods and response

The floods caused widespread damage to the Kerala's agriculture sector. Districts such as Idukki that are characterized by hilly terrain of the Western Ghats saw large tracts of agricultural land and plantation crops wiped out due to torrential rainfall and massive flow of water. The mid-lands and low-lands (Kuttanad and Kole regions) on the other hand were characterized by massive flooding and inundation of fields, resulting in rotting of crops and wilting of trees, causing significant losses to farmers. Preliminary observations indicate changes in soil acidity levels in several regions. Over 1.08 million farmer households have been affected by the floods. The total cultivated area affected by floods is an estimated 236,650 ha which is 11% of the State's area under cultivation.

At least 51,194 hectares of agricultural land have been damaged due to silt deposition or soil erosion/soil being washed away due to landslides. This has affected an estimated 315,000 farmers. As per state government norms, Rs. 12,200 per hectare is provided to farmers for desilting/removal of debris, while Rs. 37,500 per hectare is provided to farmers who have lost substantial portion of top soil due to landslides. The actual cost of restoration is estimated to be substantially higher as per discussions with farmers and district level agriculture department officials. Some of the farm lands damaged by landslides may no longer be cultivable, while others may be reclaimed after significant investment over multiple years.

Total cropped area affected by floods is estimated at 236,650 hectares. The most affected crops are Pepper (98,000 ha), Cardamom (35,750 ha), Paddy (35,820 ha), Banana (21,620 ha), Tapioca (12,100 ha) and vegetables (10,850 ha). Total crop losses are estimated at Rs. 18,545 crore, with the maximum losses in Pepper, Cardamom and Banana crops. Idukki is the most affected district in terms of crop losses, with

[110] Agriculture Statistics, 2016-17, Department of Economics & Statistics
[111] Spice Board of India, 2017-18
[112] Rubber Board
[113] Agriculture and Processed Food Products Export Development Authority (APEDA), 2017-18

an estimated 132,767 hectares of crops suffering damages due to landslides / floods.

The floods also resulted in damages (estimated at Rs. 179.8 crore) to agricultural input stocks, farm equipment and machinery, and damages to community assets and public infrastructure. In addition to these estimates, large-scale damages to farm bunds and pumping units were observed, particularly in the Kuttanad wetlands.

The State Government responded with a sense of urgency and proactivity and have provided compensation for losses to 238276 farmers as on 28 February 2019. An amount of Rs. 94.54 crore has been disbursed against Rs.247.72 crore sanctioned till 28 February 2019.

A special programme for handholding and creating awareness among flood affected farmers, by name 'Punarjani' was conducted in all the 14 districts. With the help of Department officials, people's representatives, Scientists from Kerala Agricultural University, NGOs and members of Agro service centers and Karshika Karma Sena. Classes and seminars were conducted on the immediate farm operations to be carried out in the aftermath of flood to make land cultivable again. Sol testing campaigns were organized. Also, removal of silt deposited by flood in farmers' fields, application of soil ameliorants, plant protection measures including rodent control, repair of farm machinery etc. were demonstrated. It has helped to boost the morale and regain the confidence of the farmers of the farmer. Several policy initiatives were also taken to make relief readily available to farmers.

The Department of Soil Survey and Soil Conservation has completed and published a study in December 2018 titled "Soil Health Status in Kerala in Post Flood Scenario". The extend and type of damages have been documented in the study report.

Damage and Loss – As per the Kerala Floods 2018 Post-Disaster Needs Assessment (PDNA), the total damage and loss, and recovery needs for this sector estimated to be as follow –

Damage (Rs. crore)	Loss (Rs. crore)	Total Effect (Rs. crore)	Total Recovery Needs (Rs. crore)
2,723	3,558	6,281	4,194

**In PDNA, this data is under 'crops' subsector of larger Agriculture, Fisheries and Livestock chapter.*

Immediate Recovery Efforts – As of February 2019, a total of 3,05,964 applications were received for compensation for crops change, out of which 2,38,376 persons have been given compensation amounting to Rs. 67.7 crore utilising SDRF. The department of agriculture has distributed Rs. 110.45 crore to 2,24,610 persons from the budgetary resources of the State. An amount of Rs. 21.58 crore has been given as compensation to 13,775 farmers under the restructured State Crop Insurance Scheme. An amount of Rs. 197.78 lakhs has been allotted for dewatering, bond/block renovation and repair to water pumping service. Rs. 525 lakhs were disbursed from SDRF as assistance for removal of debris/desilting, loss of agriculture land due to landslide. The State Horticulture Mission has submitted proposal to the Central Government for additional assistance of Rs. 102 crore through the Mission for Integrated Development of Horticulture Scheme (MIDH), of which Rs. 93.93 crore has been received. Under reprioritisation schemes, assistance was provided for free distribution of paddy and vegetable seeds, rodent control campaigns etc. for an amount of Rs. 22.19 crore. Also, special flood mitigation package for Rs. 43.62 crore was sanctioned. Financial assistance for distribution of soil ameliorants, assistance for planting materials

of perennial spices like nutmeg and clove, assistance for mechanisations, both purchase of pump-sets for individual farmers and repair of petty and para and other machinery by farmer groups, free supply of paddy and vegetable seeds and seedlings etc are included under the package and are being implemented. About 5,651 metric tonnes of paddy seed were distributed to farmers free of cost along with one crore vegetable seedlings, 50 lakh vegetable seed packets, and 12 lakh pepper seedlings. A total of Rs. 92 crore has been given to vegetable farmers as compensation. In 270 places in Alappuzha and Kottayam districts, bund related works were carried out by Padashekara Samithis. Moratorium for agriculture loans in flood affected areas has been declared for one year from August 2018.

As suggested by the PDNA, recovery activities could include - developing sustainable, responsible, integrated, inclusive, eco-friendly, and resilient agriculture in line with the policies of Government of Kerala and Government of India. Implementation of an inclusive recovery strategy will promote the participation and well-being of women and other vulnerable groups in agriculture, fisheries, livestock, and allied activities. The aim of reconstruction efforts in the agriculture could be to increase economic activity and sector resilience to disaster events, in accordance with the principles of 'Build Back Better (BBB)'. Short term recovery could focus on provision of inputs and restocking, replacement or repair of assets and infrastructure, and finding alternative income sources for the population. Medium- and long-term activities could focus on building resilience of each subsector through environmentally sustainable integrated farming systems, community-based management of water resources, promotion of traditional indigenous livestock breeds (resilient to local conditions), improvements in value chain, setting up of early warning systems, and effective communication with enhanced GIS/technology backed capabilities. Essentially, Agriculture Development could aim for effective and timely implementation of all developmental programs of local bodies, State and Central Government using modern scientific techniques and information technology. The farmers shall be made aware of modern farming techniques and technologies to cope with the vagaries of nature which is essential for the survival of the farming community. The extension activities of the department could be restructured into AEMUs having similar soil, climate and crop patterns; and the present Agriculture Technology Management Agency (ATMA) restructured to address the extension needs of the AEMUs. This RKDP further develops upon the suggested sector recovery activities proposed in the PDNA through analysis of the root causes and through consultations with public and relevant stakeholders.

4.8.3 Major Legacy and Current Issues

Cropping pattern in Kerala is dominated by cash crops. Cash crops nearly constitutes 62.46 % of the total cropped area while food crops consisting of rice, tapioca and pulses constitute about 9.35 %. Coconut has the largest area under crop cover (30 %) followed by rubber (21.3 %) pepper (3.3 %) and coffee (3.28 %). Rice has the third largest area under crop cover (6.6 %)[114]. Four major crops, viz., paddy, coconut, rubber and arecanut, together accounts for over 60 % of the total cropped area in Kerala, mainly because of the increase in area under rubber, followed by coconut in the past decade.

Having said so, there has been a consistent decline in the total cropped area in the State from 30 lakh hectare in 2000 to 25.79 lakh hectares in 2017-18[115]. While the net sown area recorded a decline of 9.2% (i.e. 2206 ha in 2000 to 2040 ha in 2018)[116]. The State has been witnessing a year-on-year decline of gross cropped area by about 2%. As compared to 2016-17, there is a decline in area under barren and uncultivated land, cultivable waste, fallow other than current fallow lands and current fallow by 8%, 5%

[114] Reengineering Irrigation Systems in Kerala, Amrita Vishwa Vidyapeetham, December 2016
[115] Economic Review 2018, State planning Board, Kerala
[116] Ibid.

11% and 20%, respectively. This non-use of cultivable land is an indicator signalling the tendency of people to keep land fallow for various reasons. Some of the factors contributing to this increase are - decline in area sown more than once, diversion of economic activity from agricultural operations to non- agricultural operations due to high input prices and labour cost, shift in cropping pattern skewed towards cash crops, availability of water, etc.

4.8.3.1 *Crop-specific challenges*

Rice – Rice production took a major hit in the drought of 2016-17, which has influenced the reduction in the food cropping area. However, the various liberal measures both physical and financial support provided by the government to the farmers enabled production to increase by about 19.4% in 2017-18 (i.e. 436k tons in 2015-17 to 521k tons in 2017-18)117. Palakkad, Alappuzha, Thrissur and Kottayam accounted for 79.6% of the total area of rice in the State. Palakkad and Alappuzha saw an increase in productivity, while traditional rice production belts of Thrissur, Malappuram, Wayanad, Kozhikode, Pathanamthitta saw a decline. The district of Alappuzha recorded a decline in productivity which could also be attributed to rain water (2018 floods) retention in the irrigation channels due to the entire district being below the mean sea level.

Coconut – There has been an increase in the output of coconut in the recent past, is more on account of the increase in acreage of cultivation, rather than productivity of the crop. In 2017-18 there was a marginal decline in the production from 781k tons nuts in 2016-17 to 760K tons nuts[118]. The key reason for the decrease in the productivity is due to root wilt disease[119], poor management existence of senile and unproductive palms, high labour costs shortage of skilled labour, non- remunerative prices and lack of promotional programs to improve the markets. This led to both farm owners and GoK promoting replantation of root wilt palms by elite palms and elimination of senile palms, setting up of nurseries for production of quality seedlings and their subsequent distribution for increasing productivity. The Department of Agriculture (DoA) restructured coconut development programs through convergence approach at the Panchayat level in 2014-15 and backed it up with price advantage to revive coconut production in the State. Initiatives taken by DoA in promoting neera and other value addition to coconut and its products in 2017 and 2018 to boost the market thereof is now slowly reviving the coconut economy in the State. A slew of incentives and concessions has been announced in the budget of 2019-20 by GoK to address the aforesaid problems and improve productivity and marketing of Coconuts and its by-products.

Rubber has shown more than a three-fold increase in area of cultivation in the period starting 2011 and boosted production in the years 2015 to 2017. However, in terms of the sale prices, it has been heading south from a high in the earlier part of the decade. Current trends indicate that prices continue to falter albeit at a slow rate. The overall market trend continues to stay weak and subdued and has been accentuated by the 2018 floods and weak macro-economic climate. The declining price of rubber is a cause of concern as, survival of the sector and the related livelihoods of the people working in the rubber plantations will be affected adversely. Some efforts to improve the marketing of rubber has been announced in the 2019-20 budget.

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[117] Ibid.

[118] Economic Review 2018, State planning Board, Kerala

[119] Phytoplasma is one of the most devasting diseases of coconut palms. The major symptoms of the disease in leaves are wilting, drooping and flaccidity; ribbing, paling/yellowing and necrosis of leaves are typical symptoms of this foliar disease

Banana - Banana is cultivated 62,106 ha. and other plantains in 54,455 ha. in 2017-18 with a production of 4.89 lakh tonnes and 3.95 lakh tonnes respectively. These together account for 4.52 % of the total cropped area in the State. Banana production had increased slightly by 15.64 % in 2017-18 compared to the previous year. The major issues in banana cultivation are wide fluctuation in prices, incidence of pests and diseases like pseudo-stem weevil, bunchy top, etc. Rhizome rot and Fusarium wilt were widely [prevalent during the post flood period. The productivity is very low in Kerala, viz., only 8565 kg/ha (9111 kg/ha in 2017-18) compared to the national average of 34 MT/ha in 2016-17.[120]

Pepper - The cultivation of pepper is seeing downward trend in India specially in Kerala, Karnataka and Tamil Nadu, where its grown on the slopes of the Western Ghats. This downward trend in the last decade has adversely affected revenues and exports of the same. In 2016-17, the estimated pepper production recorded an increase to 55,500 tons from 48,500 tons[121]. However, Kerala which accounts for 75 % of the total production in the country recorded a drastic decline from 46 thousand tons in 2012-13 to 38 thousand tons in 2017-18.

One of the key reasons affecting the pepper production has been to the spread of a disease in the pepper gardens and decline in prices due to imports of pepper in the country[122]. DoA has initiated a comprehensive pepper development programme for revival of the crop, with extensive support towards reorientation of planting material production, expansion of grafting wherever possible, area wide disease management, liming, nutrient management and revival of Pepper samitis, which fairly brought production almost close to its old levels. On pepper prices - it is bullish despite a 0.03% drop in 2015.

Cashew – India is one of the largest producers of raw cashew. Kerala has lost its leading position now to Maharashtra and Andhra Pradesh which has cashew cultivation area of nearly 32.9% and 18.3% in the country. Kerala has seen a steady decline in the cultivated area now almost down to about 39.7k ha from high of 53k ha a decade ago, bringing down the production to about 25.6MT in 2016[123]. The productivity to 645 kgs /ha from a high of 799 kg/ha a decade ago. Part of the reasons could be attributed to climate change and the August 2018 floods worsened the outputs further. Hence, focused production incentives may be required to get the raw cashew production to old levels.

Coffee - Coffee production in Kerala registered a slight increase in 2017-18 by about four thousand tons compared 2016-17. Major variety grown in Kerala is Robusta with a share of 97.1 % in planted area and about 69.9% of coffee production. Productivity of the crop in terms of bearing area in Kerala is 782 kg/ha as compared to national level of 765 kg/ha. Kerala stands next to Karnataka which accounts for 70.4 % of total Indian coffee production. FAO estimates, yield and lower productivity is due to limited mechanization, pest infestation, existence of old/senile plants and labour shortage. Thus, on the productivity side much more needs to be done and towards this concerted effort are required both at the policy and farm level for achieving higher yields. In the annual budget for 2019-20 a special package of concessions for coffee growers in Wayanad have been announced by the Kerala's Finance Minister which included increase in the procurement price, special facilities for processing raw coffee beans, schemes for decreasing the carbon foot print in the production area and branding the coffee as "Malabar Coffee" to boost for international and domestic marketing.

[120] Horticulture – Statistics Year Book India 2018 of the Ministry of Statistics and Programme Implementation, GoI
[121] Economic Survey 2018, State Planning Board, Kerala
[122] UPASI annual Report 2017-18
[123] Economic Survey, State Planning Board, Govt of Kerala

Tea – Kerala accounts for 5.03 % of the area and 4.69 % of the total domestic production of tea in the country. In 2017-18, tea production increased by about 1.2% compared 2016-17 i.e. 3607 tons[124] despite area remaining the same on account of increase in productivity. The major issues plaguing the tea industry are stagnant productivity (i.e. 10% since 2000-01), acute labour shortage, high cost of machines, lack of indigenous machinery and other land and labour costs issues.

Cardamom – Cardamom production at all-India level increased and so did the prices. However, Kerala registered a marginal decline due to the drought in 2017 and with the August 2018 floods, the destruction to the crops have been manifold. Despite the 2018 floods, there has been an increase of 7% in production in comparison to 2016-17[125]. It is expected that there will be a substantial increase in production in 2019-20, if the monsoons are normal, helping Kerala retain its position as one of the top producers at the national level. Incentives and efforts need to be undertaken both by GoK and private sector to provide technical support, reestablishment of a robust collection and aggregation, for onward/ forward sales to export markets.

Collective farming through Kudumbashree - Collective farming is an important area of Kudumbashree, which aims at food security both at household and community level. The major crops cultivated are paddy, vegetables, banana, pineapple and tubers. The area brought under cultivation of paddy is about 11,337.9 ha, vegetables – 17,621.2 ha, banana 5,869.77 ha126 and 17,661 ha of other crops like, pineapple and tubers through 78,746 Joint Liability Groups (JLGs). DoA should engage JLGs of Kudumbashree to cultivate the fallow lands and other cultivatable lands which are now becoming fallow, to contribute to increase in Kerala's agricultural productivity. More hand holding support including facilitation with banks and technology support are essential for improving livelihood of the women groups involved in farming.

Given the above agricultural development scenario, indicating a movement away from food crops to a substantial expansion in area under commercial/plantation crops, appropriate state level interventions through application of satellite- artificial intelligence linked ICT systems to provide end-to-end solutions for farmers is as critical as interventions and investments being undertaken towards infrastructure development for the utilization of water resources, especially construction of surface irrigation systems.

4.8.3.2 *Overarching challenges*

Overburdened grassroots institutions: Appropriate utilization of human resources has been affecting the sector over a period of time, specially Krishi bhavans - the institution at the panchayat level. They are currently overburdened with more administrative activities due to execution of multiple agri-sector schemes, as against providing farm services to the cultivators. A Krishi bhavan is typically housed in the panchayat office and has a staff of three to four persons comprising an Agriculture Officer and two or three assistants. Krishi bhavans perform numerous functions including planning and implementation of state level schemes, central schemes and LSGI schemes, training of farmers and agripreneurs, campaign and exposure visits, conducting plant health clinics and several others. A Krishi bhavan Working Group meeting[127] listed 65 functions that are currently being undertaken by Krisi bhavans. This is a significantly higher workload as compared to the year when Krisi bhavans were first instituted (1987). The staff strength, however, has not been augmented over the years, which needs to be reviewed and addressed. Similarly, grassroots institutions in the Animal Husbandry sector also needs to be strengthened with additional technical staff. Additional institutional representation may be required at the village, block and

[124] Economic and Statistics Department, Govt of Kerala
[125] Economic Survey 2018, State Planning Board, Kerala
[126] Ibid.
[127] Organized by Department of Agriculture with support from the World Bank team in January, 2019

district level to strengthen service delivery and make the shift to proactive veterinary services at the doorstep of livestock farmers.

Plethora of institutions; Institutional framework is scheme-focused as against farmer-focused: There are numerous institutions operational in the Agriculture and Allied sectors. These include Department of Agriculture; Department of Animal Husbandry, Department of Dairy Development, Department of Fisheries, Rubber Board, Spice Board, Vegetable and Fruit Promotion Council, Directorate of Arecanut and Spices Development, Directorate of Cashewnut and Cocoa Development, Kerala Land Development Corporation Ltd, Kerala Fed, Kerala State Warehousing Corporation, Department of Irrigation and many more. The institutional machinery is geared towards implementation of schemes and distribution of subsidies, with a focus on outputs as against inputs and outcomes. As a result, many of these institutions work in isolation with limited or nil coordination with allied departments towards maximizing benefits to farmers.

Wetland Development Agencies lack teeth and suffer from coordination issues: The State government released a package for the development of Kuttanad under a dedicated development agency (Kuttanad and Alappuzha Prosperity Council - KAPCO)[128]. However, implementation has been slow, as development agencies lack teeth and have been marred by poor monitoring and oversight, as well as coordination issues with line departments. KAPCO is currently as good as defunct. The Chief Secretary of the State chairs the implementation committee which has never held meetings due to pre- occupation of the Chief Secretary and other board members. Project implementation by Kole Development Agency (KDA), which was set up to oversee development of Kole wetlands, is headed by DC, Thrissur. Again, KDA suffers from coordination issues with line departments, resulting in slow decision-making and delayed implementation, with declining allocation of funds as years pass by.

Limited use of technology has hampered development efforts: There is a need to introduce modern technology across the spectrum in the agriculture sector. The department of Agriculture uses little or no ICT based tools to manage the sector. This has led to reduced efficiencies and disproportionate allocation of time on peripheral tasks. For instance, Department of Agriculture Working Group meetings revealed that officials spend a large proportion of time responding to requests for information / reports from higher-ups and various agencies, as well as audit queries. This suggests a need for an MIS that can track physical and financial progress and generate real-time reports. The administration is also hobbled by lack of real-time data on cropping patterns, crop yields, livestock movements, livestock health and several other areas which hampers planning, investment and service delivery. ICT and GIS based monitoring systems are required to ensure schemes are targeted and implemented well and in a timely fashion.

Agricultural water and moisture management: Notwithstanding significant public and private investment in irrigation, many irrigation systems are underperforming and do not adequately serve the end users. Most of the larger (major and medium) irrigation systems have been designed for paddy, and so are not fully in sync with the changing demands of an agricultural sector that is increasingly dominated by commercial crops such as cashew, coconut and rubber. While water is a constraint in certain parts of Kerala, an equally pressing problem in other, lowland areas is too much water, making low value paddy cultivation the only option for farmers. Over time, the agricultural sector has become increasingly reliant on groundwater in many parts of the State, which has now surpassed surface / canal water as the primary source and is increasingly under stress. With limited water holding capacity, there are dangers of over-reliance on groundwater resources, as was shown shortly following the floods. Saltwater intrusion in coastal areas is also increasingly prevalent.

[128] This was based on a study conducted by MS Swaminathan Foundation

An analysis based on crop-wise irrigated area and source wise net irrigated area reveals that official statistics on crop-wise gross irrigated area, and source-wise net irrigated area, help in drawing any meaningful and realistic conclusions about the impact of irrigation in the State[129]. The core two reasons for the poor performance of irrigation systems in Kerala appears to be:

a) Most of the irrigation systems are designed for irrigating paddy lands. The decline in paddy cultivation is a manifestation of the ineffective performance of the irrigation systems constructed till date in the traditional cultivation belts. Although, rice had received focal emphasis in the design of irrigation projects in Kerala, it has not yielded the desire results in terms of production and multi-cropping of the cultivated areas; and
b) The shift in cropping pattern in the State from rice (paddy)-dominated food crops to coconut- and rubber-dominated commercial/cash crops over the past five to six decades (Viswanathan PK 2010, 2014).

There is a glaring mismatch between agriculture sector requirements vis-à-vis capital investments for development of large-scale canal irrigation systems and absence of corresponding area expansion under canal irrigation.

Apart from the management of irrigation and water availability, increased focus is required for moisture management which include promotion of practices, development of efficient moisture conservation technologies, relevant infrastructure and acquirement of relevant knowledge and skills.

Shifting Cropping Pattern: The shift in cropping pattern is having a significant impact on the performance of the irrigation sector in the State. In addition, to delayed implementation and poor performance of irrigation investments, other reasons attributing to the shifts are:

a) lack of profitability,
b) non-availability of labour and high wage rates;
c) non-availability and scarcity of water;
d) waterlogging in the paddy fields;
e) lack of interest among the younger generations;
f) declining operational size of paddy fields;
g) encroachment into irrigation canals and its sub-canals; and
h) the growing density of population and process of urbanization are highly responsible for conversion of farm land into residential and commercial establishments, with related infrastructure such as roads and other utilities.

It is critical that GoK revisits and notify master plans developed for each local body and strengthen the compliance audit machinery to halt further deterioration of the sector.

Modified soil environment: The large-scale flooding, silt deposition and topsoil erosion due to landslides has resulted in substantial changes to the soil's physical and chemical composition, with long term consequences for soil health and fertility. The aftermath of flood brought about severe damages such as surface crusting, surface cracking, loss of soil flora and fauna such as microbes, useful fungi, earthworms, etc in addition to the loss of nutrients due to leaching, loss of surface soil in many areas etc. The devastating impact of flooding on soils include deterioration in soil quality necessitating the need for its

[129] Reengineering Irrigation Systems in Kerala, Amrita Vishwa Vidyapeetham, December 2016

study. Soils are the key to food security, biodiversity, mitigating and adapting to climate change. Floods often wash away rich, weathered soil. The situation demands the launching of special package of interventions for recovery.

Poorly planned cropping in landslide prone hill regions: Cropping in hilly regions such as Idukki and Wayanad districts, where the top soil is prone to erosion, is intensive, unplanned and does not address risks posed by possible landslides. Use of intercropping techniques to combine shallow-root crops with deep-root crops is not widespread leaving plantation crops vulnerable to damages through topsoil erosion.

Low crop productivity: Despite good agro-climatic conditions, the average productivity of the majority of the crops is well below potential. Paddy cultivation in the floodplains is barely viable for marginal farmers, despite a range of subsidies offered by the government in terms of fuel and equipment such as pumps. The percentage of marginal farmers with landholding less than one hectare is highest in Kerala among Indian states. This indicates the need for additional sources of income for marginal farmers through allied activities.

Low awareness of crop insurance schemes: In addition to national schemes such as the Pradhan Mantri Fasal Bima Yojana (PMFBY) and the Weather Based Crop Insurance Scheme (WBCIS), Kerala has its own crop insurance scheme. However, uptake remains less than 10% across the State, affecting resilience of farmers.

Financing: Among Indian states, Kerala was the first state to have introduced a comprehensive Agriculture Workers' Pension Scheme which came into effect in 1980 benefiting a major segment of the State's workforce in the unorganized sector (other pension schemes depending on the occupational category came to be modified around it). In terms of wages, working conditions and provisions for retired life, these workers were the most disadvantaged and hence most deserving of a pension however small which entitled them to half the food grain requirement of an adult and enhanced their acceptability within the family and society.

4.8.4 Proposed Approach to resilient rebuilding

The multi-pronged approach is proposed for interventions in the Agriculture sector, within the eight broader principles of the overall engagement. The approach and the interventions that follow are based on detailed Working Group deliberations organized by the Department of Agriculture and is fully owned by the Department. The approach includes the following:

A. <u>Agroecological approach for sustainable and resilient development:</u>

An agroecological approach is recommended for Kerala's agriculture and allied sectors to ensure sustainable development of zones with unique agroecological conditions (e.g. Kuttanad, Kole, Hill systems) and increase household incomes, improve resilience and preserve biodiversity. Under a project coordinated by Kerala State Planning Board in 2015, agroecological delineation of Kerala was undertaken[130]. Based on climate, geomorphology, land use and soil variability, Kerala has been delineated into five major agroecological zones, and 23 Agroecological Units (AEUs), which were then regrouped into 20 Agroecological Management Units (AEMUs) after consideration of administrative boundaries.

[130] Agro Ecological Management Units of Kerala – Towards a new development approach in Agriculture, Kerala State Planning Board (P. Rajasekharan, K.M. Nair, V. K. Venugopal, P. Kochunarayanapillai), 2015

Agroecological planning can usher in faster development of agriculture in Kerala through efficient land use planning, mapping suitable crop varieties to AEMUs, optimal resource allocation, tailoring schemes / interventions and technologies to AEMUs, better risk analysis of climate hazards and identification of suitable mitigation measures, etc.[131] AEMU level planning emphasizes local planning and development based on agroecological boundaries as against top-down planning and implementation based on administrative boundaries. GoK should aim to align Kerala's policy and institutional framework in agriculture sector to agroecological approach for sustained and resilient growth of the sector.

Alongside the Agroecological planning, there are geographically contiguous areas falling under different agro-ecological zones, however they form the natural drainage system. Examples are the Idukki-Kottayam-Alappuzha area and the Wayanad-Kozhikode area. A comprehensive approach to develop the drainage is required on an urgent basis to both flood proof and drought proof these districts. Specific attention shall be paid to Crop Contingency planning in all the zones with adequate response and implementation capability.

B. Restoration of Damaged Soil:

Soil has borne the brunt of the flood ravage and requires immediate and significant attention. A time-bound action plan to restore/rectify the damages like top soil losses, hard crust formation, changes in water holding capacity, chemical changes, loss of soil microbes, flora and fauna etc. is urgently required. This will require a census-scale assessment of the damages and preparation of time-bound implementable action plan.

C. Re-engineering institutional framework for effective last mile delivery:

As mentioned earlier, a wide range of institutions are operational in the Agriculture sector. The institutional framework faces several challenges including coordination issues between different agencies, overburdened grassroots institutions, capacity gaps at different levels, multiple lines of reporting, focus on delivery of subsidies / schemes and outdated monitoring mechanisms. The project will support a comprehensive assessment of the institutions and re- engineer them for more effective delivery through restructuring, redefining of roles and responsibilities, strengthening staffing, capacity building and improving alignment with AEMU-centered strategy for sector's growth. GoK should also explore reviving and or consolidation of the existing institutions as required based on the detailed study of the irrigation impact on agriculture production – as recommended in the following point. The re-engineering may include deployment of early warning systems and effective communication with enhanced GIS/tech backed capabilities at the Krishi Bhavans. The agriculture department personnel have the capacity to be early respondents and it is important to strengthen their early warning capacity (GIS system, tools to monitor, detect, forecast risks and when necessary, issue alerts on impending hazards). Effective and immediate communication to the community in locally understood language has to be ensured. The institutional framework for effective last mile service delivery may take into consideration the close inter-

[131] The Kuttanad wetland ecosystem, for example, is a distinct agroecological zone, characterized by a network of canals and widespread backwater paddy cultivation. For improved resilience and disaster preparedness, this agroecological zone requires specific investments that include environment-friendly bunding (using bio-bunding, border planting, geotextiles, coconut planting etc.); investments in more effective pumping units; deepening of drainage channels; capacity building of farming households in allied activities such as animal husbandry and fisheries through cage culture.

relationships and prospects for integrated farming practices. It is advisable to see the Agri and allied sectors as one and model the re-engineering effort.

D. Agriculture Water and Moisture Management:

There is considerable scope to improve agricultural water and moisture management for climate smart agriculture, but specific needs have not been rigorously assessed. A number of issues need further study:

a) A detailed assessment of source-wise net irrigated area based on an extensive inventory of water resources structures in the State, needs to be carried out to work out, and recommend the interventions required to correct this anomaly;

b) Substantial, focused technically feasible and viable investments for rehabilitating the canals and its sub-canal systems, and watersheds of various river basins are required to encourage supplementary farm level investments by farmers, to increase productivity and employment.[132] The Kuttanad wetland ecosystem, for example, is a distinct agro-ecological zone, characterized by a network of canals and widespread backwater paddy cultivation. For improved resilience and disaster preparedness, this agro-ecological zone requires specific investments that include environment-friendly bunding (using bio-bunding, border planting, geotextiles, coconut planting etc.); investments in more effective pumping units; deepening of drainage channels; capacity building of farming households in allied activities such as animal husbandry and fisheries through cage culture.

c) Viable alternatives to paddy cultivation and/or the possibility of de-watering in areas where water is in excess

d) Specific needs in related to soil conservation and micro-irrigation in hilly areas, the performance of larger irrigation systems given today's conditions, and

e) Develop, popularize and mainstream moisture preservation techniques and technologies

f) Overcoming other constraints to agriculture such as high costs of labour, limited land, and scarce material in certain parts of the State.

Based on these assessments, technically feasible and viable investments for improving agricultural water management should be identified. Irrigation schemes that are only partly constructed due to delays and/or cost over-runs should be subjected to the same needs-based critical assessment. The recent initiative taken by Departments of Agriculture and Water Resources (Irrigation) to improve synergies through joint meetings should be encouraged and a formal coordination mechanism should be institutionalized.

E. Leveraging technology for enhanced monitoring and targeting:

Establishment of agro foods processing centres to attract private and public investments in establishment of nurseries for production and distribution of quality seeds and planting material, integrated pack houses, sorting and grading units, cold storage units, strengthen rural markets and wholesale markets allowing farmers to sell their produce, dissemination of market intelligence to farmers for planning cropping and sale of produce, extension quality awareness and farming guidance through ICT systems, and provide technical support to market led extension activities for fresh and processed Kerala needs to shift to data-driven agriculture development ("Agriculture 4.0") to strengthen service delivery, improve crop yields,

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and increase farmer incomes. The project will support development of ICT-based monitoring tools and Decision Support Systems that leverage modern technologies such as GIS, RFID etc. to complement institutional changes effected under the project. These are expected to speed up service delivery, reduce time spent in non-core activities (report generation, audit related activities etc.), improve coordination, improve targeting of schemes, open up opportunities for proactive service delivery. Importantly, these tools will significantly improve administration's response during and post disaster events.

F. Building knowledge base for effective planning and investments:

GoK should urgently invest in generation of knowledge, strategy and investment roadmaps that can strengthen planning and drive sustainable and resilient growth of the sector. With the available ICT expertise in the country, private sector software development firms may be engaged for the purpose, as has been done in the states of Gujarat and Madhya Pradesh provide end-to-end solutions to farmers directly.

Transformative Impact expected through ICT-powered Agroecological approach (~3 years)

- ✓ Increase in crop productivity (Seasonal crops by 50%, perennial crops by 25%)
- ✓ Change in institutional mindset from *Scheme-focused* to *Farmer-focused*
- ✓ Tripling of reach of services at the grassroots
- ✓ Improved risk bearing capacity through identification of local crops / solutions
- ✓ Improved adoption of technologies suited to local needs
- ✓ 90% ICT coverage of farmer households,
- ✓ Doubling of speed of service delivery
- ✓ 50% increase in productivity of officers, improved morale

G. Enabling business environment to improve agri-business in Kerala

To unlock the potential of agribusiness in Kerala, the State needs to create a conducive environment for market-oriented production. To improve delivery of extension services and outreach, the State needs to promote an ICT enabled agri-extension service, as expressed strongly through the working group discussions. However, unorganized producers, fragmented supply chains, lack of sufficient market orientation, lack of advisory and infrastructure support undermine the efforts for linking producers with profitable markets, including branding.

Further, there is a need to enhance penetration of institutional credit to producers in the State to enable adoption of modern technology and inputs. Facilitate local producers to tap attractive economic opportunities in agri-value chains to enhance their market share through establishment of improved market intelligence information systems and market drive supply-and extension services. A strategy paper should be developed to address some of the following key areas to strengthen agribusiness development opportunities in Kerala to transform the sector:

a) **Favourable environment for agribusiness:** Develop favourable policy environment to attract private sector companies and other business entities (such as external investors, multinationals, start-ups) provide adequate investments in services and resources to strengthening the agribusiness ecosystem in the State.

b) **Adequate Capacity development of farmers**: Capacity development of farmers (including women) and exposure to use of improved seed variety, application of technical information to improve productivity of the soil and crops, quality standards, value addition processes, and logistics systems of trade and use of market intelligence, and diversification into profitable markets including export, to expand economic potential of agriculture sector in the State.

c) **Access to institutional finance for value chain actors:** Increase exposure of both large and small farmers to formal financial institutions to enhance access to formal credits, and enterprises to address the product and quality needs of these segments to loop into the supply system of large value chains.

4.8.5 Specific Interventions

In line with the proposed approach, the following time-bound interventions/activities have been identified based on preliminary discussions with relevant line departments

Table 40: Agriculture Actions and Results Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Policy /Regulatory				
Strengthen policy framework for development of Kerala's Agriculture sector based on Agroecological Management Units (AEMUs) Develop a policy framework to consider the various upland to lowland geographical continuums in the State with focus on drainage development and moisture preservation, water table improvement etc. Strengthen policy framework to promote disaster resilient crop varieties in specific agro-ecological zones	X	X		The Agriculture Sector development shall be focused on Agro-ecology based planning and monitoring. Zone specific packages and practices will be developed. Research shall be reorganized to suit the needs of the revised system. The extension system will be re-engineered to meet the challenges of the Zone based approach. Department of Agriculture restructured into agro-ecological zones Integration of activities with Department of Irrigation; Consolidation of agencies and human resources redeployed to improve efficiency and efficacy of field operations and support to farming community. Technical cells established at district level to manage legal cases related to enforcement of Kerala Paddy and Wetland

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
				Act and other related Acts, leading to reduced burden on Krishi bhavans[133] Masterplans for integrated development & management of Kuttanad and Kole regions completed and under implementation.
Strengthen policy framework for promoting sustainable, ecology-friendly and integrated development of agriculture and allied sectors in Kole and Kuttanad wetlands	X			Restructuring of existing institutions and or establishment of Kuttanad Transformation Council and Kole Transformation Council for focused development in addition to redeployment of the existing skeletal staff to the new agencies completed. External expertise engaged to support and guide activities of the agencies. Policies developed and implemented for responsible livestock management practices, including biowaste management and animal carcass disposal
Strengthen policy framework to promote integrated farming systems specific in specific agroecological zones for risk mitigation, resilience and soil health enhancement	X			Schemes incentivizing / promoting integrated farming techniques including inter-cropping, multi-cropping, rice-cum-fish farming, off-season duck rearing, calf rearing etc. designed Improve planning of investments in consultation and coordination with other allied agencies
Strengthen policy framework to promote disaster resilient crop varieties in specific agroecological zones	X			Schemes incentivizing/promoting resilient crop varieties designed. Production tested and sustained
Institutional				

[133] This model has been demonstrated in Andhra Pradesh

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Re-engineer and re-organise the Department of Agriculture and Farmers' Welfare on Agro-Ecological Management Units. The major focus shall be: Develop "Agriculture 4.0" ICT-GIS-based Decision Support System (DSS) for evidence-based, data-driven development of the Agriculture sector Comprehensive Monitoring framework Revamp and strengthen extension activities using ICT system for data collection, management and dissemination. Programme for enhancing economic viability of Agricultural sector, leveraging the technological tools being developed and made available through the dynamic Start-up ecosystem in the State. Establishing a unified single platform for inter-agency data aggregation and sharing between various agencies and departments in the sector.		X		• Concurrent evaluation of the functioning and timely course correction • Effective and timely data collection and information dissemination • Digitized workflows to hasten monitoring and implementation period of schemes, and last mile delivery improved. • Real-time monitoring of physical and financial progress of schemes and AEMU masterplans lead to better outcomes. • Extensive report generation facilities developed to reduce personnel's workload in non-core activities (e.g. generating reports for multiple higher-ups, addressing audit queries) • Data-driven monitoring / decision-support features developed including soil health monitoring, dynamic crop calendar, water availability monitoring, area specific data for time-bound farm advisory, disease and pest management etc. • Agriculture Institutions at all levels provided connectivity and linked to DSS, improved economic return, Avoidance of duplication in data collection and related wastage of resources, Effective coordination of various agencies and Improved economic return.
• Modernize the Department of Agriculture and Farmers' Welfare with redefined roles and responsibilities		X		technical capacity of Staff and resources enhanced in Krishi bhavans for effective service delivery

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
of Agriculture Officers and required infrastructure and technology. Establish a Centre for Excellence for Precision farming and micro irrigation				Roles and responsibilities of Agriculture officers redefined to focus more on farmer-focused activities Krishi bhavans ICT-enabled and linked to directorate's ICT-based monitoring systems Provide focused attention on modern and efficient use farming techniques and water usage.
Investments Planning				
Develop strategic plan for Agro-marketing of key Kerala crops (including disaster resilient varieties) with strategy and roadmap for maximizing private sector funds for development	X			Value chain studies of key Kerala crops undertaken Roadmap for promotion of key Kerala crops developed Roadmap to increase net cropped area under disaster resilient crop varieties developed
Detailed assessment of source-wise net irrigated area and inventory of canals and sub-canals servicing cultivation in the respective areas		X		Capital Investment planning and implementation aligned with the requirements of agriculture requirements in the production areas with supplies regulated to the requirement of crops cultivated in each season
Develop investment / implementation roadmap for restoration of soil fertility and repair / reclamation of farmland damaged in floods	X			Roadmap for increased cultivable area and enhanced soil fertility developed Comprehensive recovery of soil health from the damages suffered during floods, Roadmap for increased cultivable area and enhanced soil fertility developed

4.8.6 Technical Studies and assessments

The list of studies to be carried out to support the above policy, institutional and investments activities is provided below.

Table 33: Agriculture List of Studies

List of studies	0-6 months	0-18 months	18 months & beyond
Policy			
Conduct review of policy environment and develop recommendations to promote disaster resilient crops, integrated farming systems and agroecological approach			X
Institutional			
Conduct Institutional assessment of Department of Agriculture, identify gaps and develop re-engineering/restructuring roadmap and effective operational mechanisms for alignment with agroecological approach and effective delivery of schemes and services.	X		
Enhance disaster response capabilities of the Agriculture department			X
Review current institutional pathways for development of Kuttanad and Kole region, and recommend structure of Kuttanad and Kole Transformation Councils and operational mechanisms to coordinate with line departments for effective implementation	X		
Other			
Develop strategic paper for agro- marketing of key Kerala crops including studies on value chains,		X	
Undertake value chain studies of key Kerala crops (including selected disaster resilient crop varieties)		X	
Develop strategy and roadmap to expand awareness of crop insurance and improve uptake		X	
Study of the impact of unprecedented flood on soil health and fertility	X		
Assessment of the influence of crops and cropping pattern being followed in hill slopes on the increasing land slide probability and Study of possible solutions based on global best practices	X		
Agro-ecological zone-based evaluation of factors affecting productivity of various crops and preparation of probable best practice solutions.			X

4.9 Animal Husbandry and Dairy Development

4.9.1 Introduction

The Animal Husbandry sector plays a pivotal role in the socio-economic development of Kerala and has great potential to contribute to the regional economy. Animal husbandry and allied sectors have shown promising improvement in recent times, with the milk production increasing from 21.19 lakh metric tons in 2006 to 25.72 lakh metric tons in 2018 and egg production from 119.39 crore in 2006 to 250.38 crore in 2014. Meat production has increased from 1.9 lakh metric tons in 2006 to 4.68 lakh metric tons in 2014.

The contribution of the animal husbandry sector to the Agriculture GDP of Kerala was 27.62% for 2014-15 (at 2011-12 constant prices), while in 2013-14 the share was 25.2%. As per the, 2017 Economic Review report the sector contributed 29% to the Agriculture GDP. By 2019-2020 it is expected that the animal husbandry sector will account for almost one-third of the agriculture sector. Although the production of milk, eggs and meat has increased in the last decade, Kerala is still not self-sufficient, especially considering the low in-house market availability of these items. The socio-economic changes observed in Kerala, necessitate urgent improvements in the sector to meet increasing demands. In addition, droughts and natural disasters increase the sector's overall vulnerability. The decline in the livestock population by 23% from 2007 to 2012 is an especially alarming factor. A positive aspect however, is the high productivity of milch cattle in Kerala due to effective crossbreeding policies.

The animal husbandry sector of Kerala is unique in the country for establishing a minimum of one veterinary institution in each panchayat, spread across the entire state. Additionally, its disease control programmes have curtailed the occurrences of economically devastating diseases like foot and mouth disease, creating a disease-controlled zone in the State which is suitable for export of livestock products like meat and egg.

4.9.2 Impact of 2018 Floods

During the 2018 floods the animal husbandry sector suffered massive damages including loss of cattle, buffalo, goat, pig, chicken, duck etc. life and loss to fodder plots, cattle sheds, farms and much more. The loss in this sector accounted for nearly Rs. 172 crore. This includes loss incurred due to death of livestock, destruction of animal sheds, damage to feed, fodder and hay, and infrastructure loss. An estimated 5163 adult cattle, 5193 calves, 541 buffalo, 1228 heifers, 6380 goats, 1053 pigs, 11.43 lakh chicken and 4.64 lakh ducks, 20000 quails, and 50 rabbits were reported dead or missing. Loss due to animals is estimated at Rs. 84 crore. The loss due to damage of animal sheds, feed, fodder plots, infrastructure and other resources of farmers accounts to about Rs. 60 crore. Infrastructure loss to 214 Dairy Co-operative Societies, milk production loss due to flooding and damage incurred to Veterinary Institutions together amounts to about 27 crores. Milk value loss is estimated at around Rs. 3.84 crore.

4.9.2.1 *Immediate Recovery Efforts*

The Animal Husbandry and Dairy Development Department was at the forefront of the flood relief operations. Some of these numerous immediate recovery efforts are summarized below:

- The plan funds of Animal Husbandry Department (AHD) earmarked for disaster management to the tune of Rs. 70 lakh were immediately released to the various flood-hit districts for arranging animal

rescue camps, on a need basis, to provide temporary shelter, feed, fodder and medical aid to the rescued animals. A total number of 1172 such camps were set up in the affected areas, catering to the need of 80538 animals.

- AHD distributed feed in animal health camps worth Rs. 2.68 crore from Kerala Feeds and Kerala Co-operative Milk Marketing Federation (Milma).
- Veterinary medicines and vaccines provided by State government, Veterinary Universities and drug manufactures were rushed to the calamity spots.
- With the intervention of the District Collectors and the Regional Cooperative Milk Producers Unions, the Dairy Development Department (DDD) could restore the milk collection of the flood affected areas with minimal interruption.
- The AHD mobilised milk and eggs for human consumption to the rescue camps. The National Dairy Development Board and AMUL supplied ready to drink milk sachets and milk powder.
- Nearly 40813.5 litres of milk were distributed to relief camps by DDD throughout the State. The expense of Rs. 14.28 lakh was borne by the Dairy Cooperatives.
- An amount of Rs. 33.75 lakh was provided to flood affected livestock farmers, as part of insurance claim settlement.
- An amount of Rs. 21.99 crore was distributed to livestock and poultry farmers in the State as compensation relief through AHD from State Disaster Relief Fund.
- In association with Dairy Co-operatives, DDD visited 31 relief camps and 582 houses and was able to provide food and essential commodities worth Rs. 2.42 lakh.
- The UN-FAO undertook CERF Project to train farmers and officials regarding post disaster management and supplied various inputs like gumboots, milk can, feed supplements, disinfectants, etc.
- Through the Donate a Cow Programme, an initiative of the DDD, around 300 milch animals were distributed to dairy farmers who lost animals due to flood.
- The DDD implemented Rs. 22 crore worth of special rehabilitation Programmes for flood-affected dairy farmers of the State during the year 2018-19. Around 3000 milch animals were distributed and 2130 farmers were assisted in shed renovation / shed construction and others in a need-based manner.

4.9.3 Major Legacy and Current Issues

There has been a paradigm shift from livelihood support to commercial ventures over the last decade. A robust domestic market for animal products is already in place. There is an organized cooperative network for milk marketing. Moreover, the State is known for having a veterinary institution operated by qualified veterinarians in all Panchayaths and Dairy Extension Service Units at the Block level. Dairy farming, poultry and goat rearing can also be practices in flood-affected areas as they include low investment, minimal operation and involvement of women workforce. The current issues faced by the sector are the following:

- Growing demand-supply gap in milk, meat and egg
- High cost of production-resulting in declining profits
- Declining trend in cattle population
- Limited land ownership among farmers

- Shortage of fodder and pasture land. At present the State is facing 60% shortage of fodder. Hence more dependency on compounded concentrate feed which in turn leads to high cost of production and reduced profitability.
- Labour intensive dairy farming, and difficulty in finding skilled labour. such as professional milkers
- Waste management issues
- Licensing formalities at LSGIs
- Need for synchronizing and streamlining various laws dealing with livestock and poultry sector
- Animal husbandry activities not considered as a primary agriculture activity. Therefore, interest rated are much higher than that of agricultural loans.
- Antibiotic residues in livestock and poultry products
- Vulnerability of livestock to various diseases due to uncontrolled animal movement across the border.

Overarching challenges

a) **Overburdened grass root level AH and Dairy Institutions:** Issues of appropriate utilization of human resources has been affecting the sector over a period of time, especially in veterinary dispensaries and hospitals under the AHD and Dairy Extension Service units as part of the DDD. Staff are currently overburdened with administrative activities and are thus unable to provide industrial output and extension services to livestock farmers. The staff strength has not been augmented over the years. More technical and ministerial staff are needed in the veterinary dispensaries and hospitals, research stations, vaccine production units, state dairy labs, regional labs, check post labs, dairy extension service units, dairy training centres, etc. The delegation of powers of the field level implementing officers also needs to be revised. Greater focus on staff deployment at panchayath, block, district and directorate level would ensure effective monitoring and end user service delivery.

b) **Streamlining of various departments and agencies:** Government departments like the AHD, the DDD, and public sector undertakings associated with these departments (such as the Kerala Livestock Development Board, Kerala State Poultry Development Corporation, Kerala Feeds Limited, Meat Products of India and Milma and the Kerala Dairy Farmers Welfare Fund Board) are involved in undertaking various programmes for livestock and poultry sector in the State. The R&D part is taken up by the Kerala Veterinary and Animal Sciences University (KVASU). To avoid duplication and fragmentation, there is a need to clarify distinct roles of these agencies in the sector according to their core competencies.

c) **Limited use of technology has hampered developmental efforts:** At present, there is minimal use of ICT tools in development, extension and programme implementation within AHD, DDD and allied PSUs. This has led to reduced efficiency and a disproportionate allocation of time to peripheral tasks. There is a need for an MIS that can track physical and financial progress and generate real time reports. ICT and GIS based monitoring are required to ensure that schemes are targeted and implemented in an efficient and time bound manner.

d) **Lack of proper cold chain from farm to fork level:** The lack of scientific cold chain maintenance from farm level to consumer level is a big constraint, that in turn affects the organoleptic, physicochemical and microbiological quality of milk, milk products, meat and meat products.

e) **Insufficient quality assurance facilities at State border check posts:** The quality of milk transported across the border from neighbouring states need to be evaluated, analysed on a real time basis, and corrective measures must be taken. Inferior quality of milk, presence of adulterants, neutralisers,

preservatives and antibiotics have been reported in recent times. This is a public health concern. The same applies to meat also and this needs to be addressed.

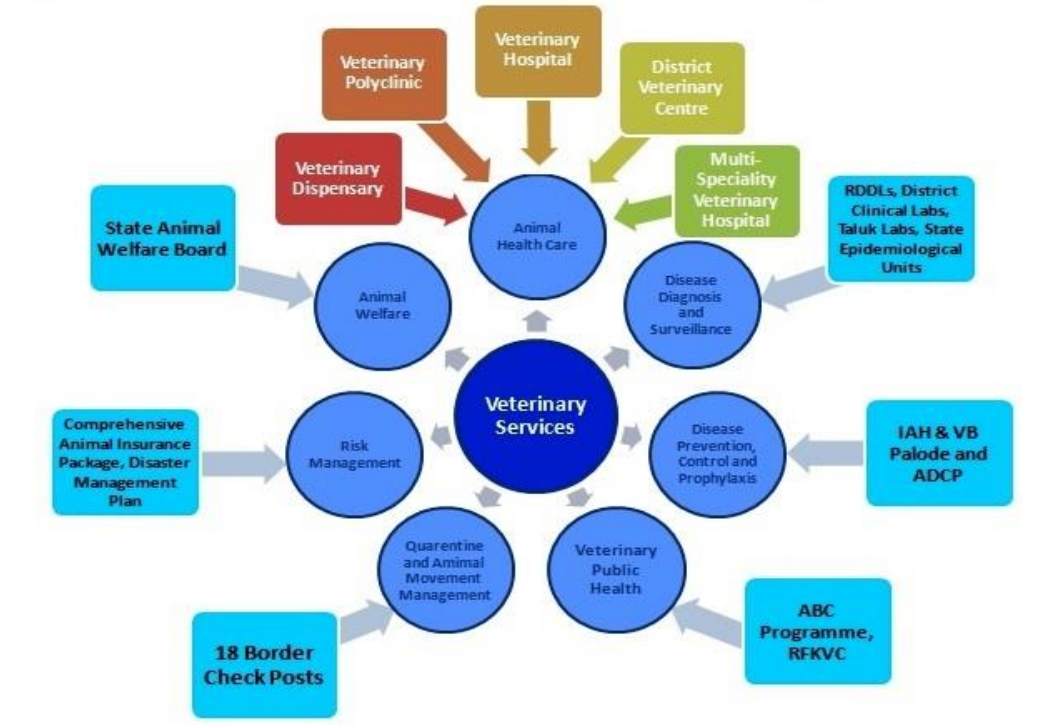
f) **Mechanisation:** Inadequate mechanisation of dairy farms in the State is adversely affecting the efficiency, business profitability and the quality of raw milk produced.

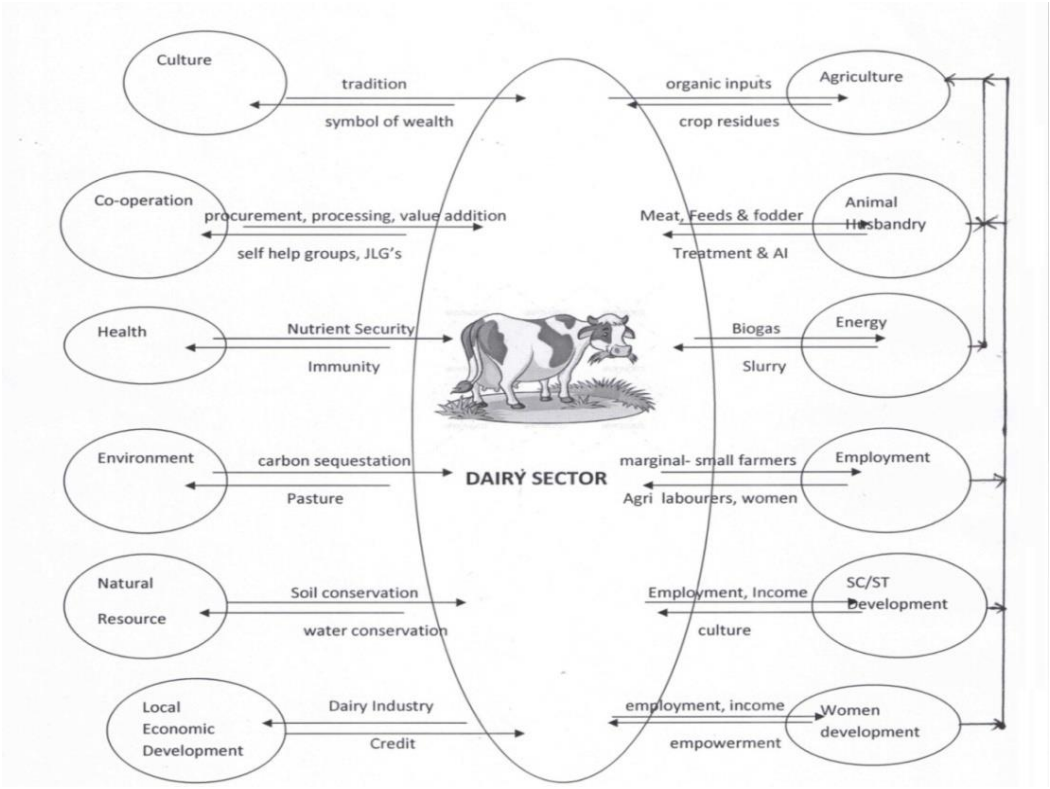
g) **Lack of statutory powers for officials:** There is a lack of statutory power entrusted with DDD officials for testing milk and milk products (Quality Control Officers for sampling, testing and initiating legal action against defaulters), or with AHD officials for testing the quality of meat, egg products and checking for antibiotic traces, etc. This a cause of concern in enactment of law against defaulters and for ensuring safe and quality food to consumers.

h) **Shifting from substantive farming to entrepreneurship:** Commercial dairy farms with more than ten milch animals will be encouraged state-wide. It is necessary to implement a phased shift from subsistence farming with 2-3 milch animals to commercial farming. Dairying needs to be treated as a livelihood support programme, as well as a commercial activity.

4.9.4 Proposed Approach to Resilient Rebuilding

Figure 38: Strategic Frameworks for Improving the Resilience of the Animal Husbandry & Dairy Sectors





4.9.4.1 *Implementation strategy and structure*

Re-engineering institutional framework for effective last mile delivery: The institutional framework faces several challenges, including functional and coordination issues between different departments and agencies, overburdened grassroots level institutions, capacity gaps at multiple levels, multiple lines of reporting, limited focus on the delivery of subsidies/schemes and outdated monitoring mechanisms, etc. More effective delivery through organizational restructuring, redefining of roles and responsibilities, strengthening staffing, infrastructure development and capacity building must be ensured. Utilisation of modern extension technologies for imparting updated information and soft skills to dairy, livestock, poultry farmers and stakeholders will be ensured. Integration with LSGIs will be taken up.

Reorganization of Animal Husbandry Department: The AHD has veterinary hospitals/dispensaries at the grassroots level that are manned by a Senior Veterinary Surgeon/Veterinary Surgeon, Livestock Inspector, among others. The Plan allocation of Rs. 20 lakhs has burgeoned to Rs. 270 crores excluding RKVY, Idukki, Kuttanad and other central schemes which comes to another Rs. 200 crores. Moreover, with the enactment of the Panchayath Raj Act, Panchayat level institutions of AHD implement schemes funded by LSGIs, which comes to another Rs. 500 crores. However, staff structure has remained the same. All these schemes are implemented by Panchayath level institutions. Thus, the farmers lose out on getting quality and timely veterinary service.

To improve the quality of clinical service delivery to the farmers, and to streamline and increase effectiveness and proper monitoring of schemes, department institutions need to be reorganized at the taluk level. This way veterinarians working in clinical institutions can concentrate on improving the quality and availability of service. Further, there is no veterinary institution at the block/taluk level for implementation of schemes and projects funded by block panchayath. Hence the demarcation of the AHD into five major wings is required:

1. Veterinary Services
2. Planning
3. Veterinary Public Health
4. Disease Control, Prevention and Research
5. Special Livestock Breeding Programme

A taluk level office headed by a Deputy Director and assisted by technical and administrative staff is proposed for the implementation of various State and Central Government schemes, monitoring of various technical and administrative activities, and performing surprise and detailed inspection of various animal husbandry institutions in the taluk. The taluk level office should have administrative control over the institutions of the taluk. Staff from within the department and minor additional post creation can facilitate this.

Reorganisation of the Dairy Department: The staff at local branches and institutions face significant challenges, including heavy focus on record keeping and multiple lines of report keeping, which hinder their ability to work directly with stakeholders. The focus areas of the Department are extension and advisory services, statutory power of dairy co-operatives, Kerala Dairy Farmers Welfare Fund Board (KDFWFB) activities, milk quality control activities, and forage production. The Department will be restructured based on a comprehensive internal assessment with attention to optimizing the skill sets and tasks of staff. The restructuring will include redefining roles/responsibilities, strengthening institutions, proper staffing, capacity building, etc. The availability of highly qualified officers at the Panchayath level will enhance the Department. The following institution level changes are suggested:

- Establishment of Institutions at Gram Panchayat level (Dairy Extension Service Units)

- Separate wings for development, quality control, extension and co-operation
- Establishing Quality Control Labs at all border check posts
- Establishing Training Centres in all districts with state-of-the-art facilities
- Strengthening and modernization of all district and state level offices
- Separate regional and district level Nodal offices for KDFWFB
- Strengthening of state, regional and district quality control labs

Development of Veterinary service

- Round the clock service in District Veterinary Centres and two shifts at Veterinary Polyclinics are essential for effective service delivery to farmers.
- Emergency Night Veterinary Service: This is presently available in 105 blocks out of 152 blocks in Kerala. Envisaged delivery of emergency Veterinary Service during night hours at farmers doorstep. Veterinary Service delivery will have to be made available in all 152 blocks.
- Mobile tele-veterinary unit: Advanced diagnostic facilities to provide treatment at farmers doorstep. Presently the facility is available in Kollam District only. It is proposed to extend the service to the remaining 13 districts.
- Multispecialty Veterinary Hospital: Two multispecialty veterinary hospitals to act as top referral centres must be established at the Northern and Central regions. One such veterinary hospital is presently working at Thiruvananthapuram.
- Establishment of a Research & Development wing at the State Institute for Animal Diseases (SIAD), Institute of Animal Health and Veterinary Biologicals (IAH & VB), Palode and KVASU for promoting translational research with field level implications.
- Fermenter technology for vaccine production with GMP standards to be established at IAH & VB, Palode for production of Duck Plague vaccine.
- Establishment of anti-rabies vaccine production facility with one health concept at IAH & VB Palode as part of Rabies control strategy in Kerala.
- Strengthening border check posts under AHD with adequate infrastructure facilities and technical human resources for effective monitoring of interstate animal movement.

Improvements in livestock and poultry development: Livestock and poultry rearing are significant sources of income of the farming community. To promote livestock production and thereby double farmers income, the following interventions are essential:

- **Scientific rearing of calves:** To extract the full production potential of milch animals, all calves born in Kerala are to be brought under the scientific calf-rearing programme that includes veterinary health care, nutrition, and risk management. With this programme, it is possible to replace 20% of the total breedable stock every year, thereby ensuring a stable population of milch animals in the State.
- **Crossbreeding:** Increase the productivity of the existing stock in the State, through breed improvement and production increase due to better management, ultimately leading to an increase in milk production in Kerala.
- **Sexed and sex-sorted semen for artificial insemination:** To increase the number of female cattle and buffalo in the State to a desirable level, the production of sexed semen for conservation and propagation of elite indigenous germplasm of cattle and buffalo could be considered. As part of this programme, a facility needs to be established for producing sex sorted semen doses of cattle and

buffalo breeds, including the Sunandini crossbred cattle of Kerala, at the Mattupatti semen station of Kerala Livestock Development Board (KLDB).

- **Comprehensive insurance coverage for livestock population:** Risk management and insurance are an integral part of veterinary health care. Feasibility scope has been undertaken for establishing a "master policy" for nearly five lakh milch cows in the State.
- **Activities for promoting entrepreneurship:** Livestock and poultry farming should be recognized as activities at par with Agriculture for State support. Single window support system could be established for obtaining pollution control certification and licensing formalities from LSGIs. Also fodder production needs to be enhanced through the promotion of fodder bailing and barren land cultivation and self-help groups can be supported in fodder cultivation.
- **Goat rearing:** Goat farms will be strengthened for production and supply of quality kids to farmers. Areas with ample fodder must be identified and provided with goat satellite units. Popular breeds like Malabari should be propagated. Artificial insemination for goat must be popularised as there is an acute shortage of bucks.
- **Pig rearing:** Pig rearing should be promoted as an area specific activity for Ernakulam, Kottayam and Idukki districts. Pollution-free pig farm models would be popularised and encouraged. To ensure enough parent stock availability in the State for supplying piglets to farmers, the import of pure breeds and frozen semen of breeds like Large White Yorkshire, Duroc and Landrace will be undertaken.
- **Rabbit farming:** Need area specific intervention for rabbit rearing especially in tourist destinations. Provide assistance to rabbit farmers. Animal Husbandry Department farm to be strengthened for ensuring supply of rabbits to farmers. Rabbit meat will be encouraged to become part of the diets of patients due to its high nutritional value and fewer health hazards.
- **Chick rearing:** To bridge the gap in domestic egg production, the production of chicks through Department farms will be enhanced to 50 lakhs during 2019-20. Private sector and SHGs like Kudumbasree are expected to intervene. Egger nurseries functioning under the AHD will be strengthened by enhancing the production capacity and providing licenses for starting private hatcheries. New hatcheries to be established in the Government and private sector. New marketing networks for eggs to be developed by involving agencies like VFPCKs, the Milma, dairy co-operatives, the Kudumbasree SHGs, and other marketing outlets. The KSPDC can act as the nodal agency. Cage system of rearing of birds would be promoted in urban areas as part of intensive poultry farming. Backyard poultry rearing will be promoted as an alternative source of income for the poor with minimal investments. The Kerala Chicken venture of Kudumbasree will be expanded to cover the entire State to cater to the broiler meat requirement of Kerala.
- **Duck rearing**: Though duck farming is a popular activity in Kuttanad and Kole wetland area, the sector is still unorganised. Compulsory licensing and registration of duck farmers and hatcheries will be instituted, especially in Kuttanad area and Chara and Chempalli breeds of ducks will be promoted. A single window system will be established for facilitating farmers entry into duck rearing activity. Duck farm and hatchery will be established in Northern districts of Kerala.
- **Quail farming**: Due to the recent demand as an alternative nutritive meat and egg, quail meat has gained much attention. Quail farms in the private sector will be promoted through subsidy schemes. Regional quail hatcheries will be established under the AHD.

Research and Development: Research for developing new broiler breed suitable for Kerala will be taken up by KVASU. Research for producing bio-fuel from poultry and other bio-waste will be promoted as part of environment-friendly future.

Innovative technological interventions: Proper record maintenance regarding identification, production and breeding activities of animals are needed for effective and timely intervention in planning, disease control, proper utilisation of available resources, etc. Radio Frequency Identification (RFID) can be used for identification of animals which will ensure uniqueness, traceability of animal and its products, transparency and prevent fraudulence. This also provides data on individual animals.

Establishing distinct dairy zones: The entire State will be divided into 4 distinct dairy zones based on factors like climate, geography, number of families involved in dairying, availability of milch animals, productivity of animals, fodder availability, availability of free space for fodder cultivation, availability of pasture lands, locally available feed stuff, availability of dairy cooperatives, marketing options, veterinary health facilities, etc.:

1. Highly Potential Dairy Zone
2. Prospective Dairy Zone
3. Mediocre Dairy Zone
4. Challenging Dairy Zone

The mode of dairy development in each zone shall be unique in respect to factors like the type of milch animals, shed constructions, type of fodder to be propagated, marketing options, etc. The strategy adopted shall encourage tapping available and locally available natural resources.

Herd Induction Programmes and Heifer Parks: Herd Induction Programmes can be a short-term strategy for gap filling and compensation for loss of milch animals due to the floods. As a part of developing future bench stock, heifer parks will be established in all the districts. Heifer parks with a minimum of 100 heifers each will be created in all blocks, selected dairy co-operatives and potential groups. The Heifer parks will be the future epicenter for distribution of milch animals to farmers and entrepreneurs.

Introducing calamity-resistant dairying/livestock/poultry farming technologies: Specialized farming technology (dairy farmers, other livestock farmers and poultry farmers) for natural calamity prone area will be developed and introduced. Techniques like elevated community cattle sheds in all the Panchayats of Kuttanad and Vaikkom, and elevated cattle sheds for mediocre and commercial farmers in flood-prone areas need to be propagated and established. Water resistant and drought resistant fodder varieties need to be developed and introduced to the farming community.

Extensive fodder development programme: The State has a 60% shortage in fodder availability. The DDD is the nodal agency for fodder development in the State. Specific and tailor-made programmes must be implemented for massive fodder cultivation in barren land, waste lands and unutilised lands. The dairy co-operatives can be considered as an epicentre for this activity. The programme can be better implemented through the active participation of dairy farmers, dairy co-operatives, LSGIs, etc. The marketability of the fodder shall be through dairy co-operatives and potential groups.

Ensuring fresh and safe milk, milk products, meat, egg and other livestock products and implementing Total Quality Management: The gap between requirement and availability in livestock products is now met through cross border transportation. The quality of milk, meat and egg crossing the border and reaching Kerala has to be evaluated on a real time basis. The Check post laboratories which deal with milk, meat and eggs will have to function 24 X 7 and be equipped, strengthened, modernized with adequate manpower. Additionally, the AHD and the DDD officials will have to be given statutory power for sampling and testing of milk, milk products, meat, water, cattle feed and other livestock products. Quality Control Labs at district level, mobile quality control labs and labs at dairy co-operatives will have to be reorganized and strengthened.

Premium, organic milk and A2 Milk for better price and export: The concept and technology of farm fresh milk, premium quality milk, organic milk and A2 milk need to be popularised and exploited. Premium price for premium products will add to the profitability of the dairying activity

Pollution control and energy conservation systems in dairy sector: Efforts will be made to establish scientific and low-cost Effluent Treatment Plants, biogas plants, rainwater harvesting and energy conservation suitable for small and commercial dairy farms, dairy co-operatives, value addition centres and Bulk Milk Chilling Units. Green Dairying Concept, eco-friendly dairying and livestock concept will be given a pivotal thrust during the coming years.

Enactment of Law for ensuring the safety and quality of cattle/poultry feed: Ensure the quality of raw ingredients of cattle feed and the quality of cattle feed/poultry feed sold in Kerala. At present, there is no strict law or rules to control the quality of cattle feed/poultry feed actually produced and marketed in the State, hence a law governing and managing the quality of raw ingredients and finished cattle/poultry feed will ensure profitable livestock farming.

Automation and mechanisation of farm level activities and dairy co-operatives: Dairy farm activities need to be mechanised and automated. The reduction in overhead expenses will add to the profitability of dairying activities. Automation/mechanisation will also help to improve the quality of milk produced at the farm level and milk handled, stored, processed at dairy co-operative society level.

Value addition of milk, meat and poultry products is a must to take advantage of fluctuating market conditions. This will enhance profitability and sustainability for producers.

4.9.4.2 *Monitoring framework*

The AHD, the DDD and various associated PSUs like the Milma, Kerala Feeds, Kerala Poultry Development Corporation, Meat Products of India, KDFWF, etc. are hindered by various shortcomings. A department-level monitoring system may be established for following up on the statutory and legal framework, as well as making the organisational structure for decision making and implementation more effective. An ICT-based monitoring system using GIS and RFID technologies to track livestock, proactive veterinary service and monitor delivery of animal husbandry as well as dairy development schemes could be established.

4.9.4.3 *Participatory implementation of the activities*

Selection of beneficiaries: The beneficiary selection of schemes and projects for the sector is made through Grama Sabha which ensures peoples participation. Most of the schemes implemented in this sector are routed through Dairy cooperatives and established groups. Youth and students are selected as beneficiaries through school poultry and dairy clubs.

Assurance of financial stability and social security to the dairy, livestock and poultry sector: Social security concerns exist for the dairy farmers and other livestock farmers. The high treatment cost incurred for cattle and cattle owners is an alarming factor. It is adversely affecting the profitability of the sector. The cattle and cattle owners, and poultry farmers will have to be brought under a comprehensive insurance coverage scheme implemented by AHD and DDD.

Increasing member participation in dairy co-operatives and diversification: It is estimated that in Kerala 8 lakh families are involved in dairying activities. However only 20% of these come under the co-operatives umbrella. Ensuring more member participation in dairy co-operatives will help to stabilise the dairying sector and ensure greater socio-economic security of dairy farmers.

Marketing strategies for livestock products: Intensive marketing interventions are required for livestock products such as milk, meat and egg. There is a need to look beyond the co-operative sector and bring in SHGs like the Kudumbasree. "Kerala Chicken" branding and marketing of poultry meat can be highlighted. Since there is more demand for farm fresh products, farmers could be encouraged to sell farm fresh milk and eggs from backyard rearing as premium products, which could demand a higher price. Clean meat production should also be promoted. Scientific slaughterhouses should be established under LSGIs with adequate technical manpower along with cold storage networks. Frozen meat products should be promoted. Kuttanadan duck meat and egg should be recognised with Geographic indication (GI) status so that branding and premium rate can be obtained by farmers.

4.9.5 Specific Interventions

a. Animal Husbandry

Table 41: Priorities and Criteria for Animal Husbandry

Activity	Criteria
Emergency veterinary night service	Round the clock veterinary service at farmers doorstep
Establishment of anti-rabies vaccine facility	Veterinary public health importance
Sex-sorted semen	Increase female cattle population of the State
Comprehensive insurance package for livestock with a master policy	Risk mitigation and management
Scientific female calf rearing	Increase production and productivity
Fermenter technology for vaccine production	Disease control
GIS and RFID	Traceability and transparency
R&D for broiler breed suitable for Kerala	For meeting the demand for poultry meat
R&D for swine fever vaccine production	For effective control of swine fever

b. Dairy Development

Table 42: Priorities and Criteria for Dairy Development

Activity	Objective
Establishment of Distinct Dairy Zones	To ensure more scientific planning of projects and schemes focusing livelihood support to dairy farmers for ensuring better business opportunities; improved nutrition security to the State; quality milk favouring export marketing; availability of organic inputs; and empowerment of women and the SC/ST population.

Establishment of Heifer Parks	To ensure better bench stock of milch animals and to reduce the extent of animal induction
Strengthening quality control laboratories at the State, regional and district levels and establishing permanent check post laboratories	To ensure safe and quality milk meeting legal standards
Establishing e-governance in the Department and developing unified software for dairy cooperatives	To ensure efficient resource mapping and planning, transparency and accountability of all operations
Strengthening of dairy cooperatives	To ensure greater participation in the cooperative sector, fair price and steady market to dairy farmers, enhanced people's participation
Massive fodder production schemes	To reduce the cost of production, improve farmers income and provide a better quality of milk and as a productive soil conservation activity
Schemes promoting processing and value addition activities of milk	To improve nutritional value, market penetration ensuring better price to farmers
Comprehensive insurance scheme	To ensure the welfare of both dairy farmers and animals in the sector
Promoting energy conservation activities, pollution control activities and non-renewable energy production	To aim eco-friendly dairy farming, dairy processing
Restructuring and reorganisation of Department, including infrastructure development	For effective management and implementation of schemes for the sector and better service delivery
Creation of infrastructure for resist natural calamities (flood and drought) in the sector	Resilient dairy sector to overcome challenges caused due to natural calamities

Table 43: Animal Husbandry, Dairy Development Actions and Result Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected outcome
Policy / Regulatory				
Restructuring the AHD and DDD at Directorate level, district level, block level, panchayat level with clear roles and responsibilities for more effective delivery of activities.			X	AHD and DDD restructured with improved functional efficiency Delineation of revised roles and responsibilities of human resources completed and functional

Activities	0-6 months	0-18 months	18 months & beyond	Expected outcome
Strengthening the policy framework to promote integrated livestock farming systems.	X			Schemes incentivizing/ promoting integrated farming techniques including cattle rearing, duck rearing, goat rearing, rabbit rearing, aquaculture integrated with other agriculture activities, etc. Improved planning of investments in consultation and coordination with other allied agencies.
Strengthening the policy framework to promote disaster resilient dairying and other livestock activities.		X		Reduction of natural disaster losses in diary and livestock sector.
Institutional				
Establishing an ICT-based monitoring system to enhance the effectiveness of the AHD, the DDD and various associated PSUs.		X		Improved follow up on statutory and legal framework, as well as more effective decision making and implementation in the Department.
Establishing an ICT system for data collection, management and dissemination within and between department. Geo-mapping of livestock assets like institutions, animals, sheds, farmers, etc.		X X		Effective and timely data collection and information dissemination. Asset registry of livestock assets.

Activities	0-6 months	0-18 months	18 months & beyond	Expected outcome
Establishing four distinct dairy zones in the State based on dairying related factors. 1. Highly Potential Dairy Zone 2. Prospective Dairy Zone 3. Mediocre Dairy Zone 4. Challenging Dairy Zone			X	More eco-friendly, resilient, productive and market-oriented diary development.
Establishing new veterinary and dairy development institutions and restructuring existing institutions at district / block / panchayat level as per currently existing gaps in service delivery.			X	More timely and effective service delivery to livestock farmers and other end users.
Developing ICT based monitoring systems using GIS and RFID technologies to track livestock, proactive veterinary service and monitor delivery of animal husbandry and dairy development schemes.		X		Efficient management and planning.
Investments				
Launching emergency night veterinary service	X			Enhanced emergency veterinary care for livestock during night hours.
Establishing mobile tele-veterinary unit with advanced diagnostic facilities in all districts		X		Advanced clinical services at the farmers doorstep.
Setting up multispecialty veterinary hospitals.			X	Enhanced veterinary referral care across the State.
Establishing fodder research station at State Fodder Farm, Valiyathura, Thiruvananthapuram.			X	Fodder with better yield and calamity resistant properties developed.

Activities	0-6 months	0-18 months	18 months & beyond	Expected outcome
Establishing Centre of Excellence in Food Safety Aspects (CEFSA) at Alathur, Palakkad.			X	Improved food safety and certification.
Establishing Dairy Entrepreneurship Development Centre at Kulathuppuzha, Kollam District.			X	Enhanced diversification and entrepreneurship among dairy farmers and producers.
Establishing anti-rabies vaccine production facility at IAH&VB, Palode.			X	Rabies-free Kerala by 2030.
Conducting R&D in developing an ideal broiler poultry breed suitable for Kerala conditions by KVASU		X		Enhanced availability of broiler poultry to meet the State demand.
Establishing Duck Pasteurella vaccine production facility using fermentation technology at IAH&VB.			X	Enhanced protection of floating population of ducks.
Establishing R&D facility to develop cell culture based classical swine fever vaccine to promote piggery.			X	Effective control of swine fever
Enabling e-Governance in the DDD and establishing unified software solution for all the dairy co-operatives of the State integrating all stakeholders			X	3673 registered dairy co-operatives will be provided with unified accounting and administration software with integration provisions for all stakeholders like Dairy Department, regional unions etc. E-office will be implemented in the Dairy Development Department offices. To ensure transparency and accountability of activities

4.9.6 Technical Studies and Assessments

Table 44: Animal Husbandry Studies and Assessments

List of studies	0-6 months	0-18 months	18 months & beyond
Policy / Regulatory			
Comprehensive study to access the women participation in Dairy Co-operatives and Dairying Sector	X		
Institutional			
Conduct institutional assessment of Animal Husbandry and Dairy Development, identify gaps and develop a restructuring road map and effective operational mechanism for effective delivery of schemes and services	X		
Review current institutional pathway for the development of Kuttanad and Kole region and recommend the structure of Kuttanad and Kole transformation councils and operational mechanism to coordinate with line departments for effective implementation	X		
Investment Planning			
Data Bank Creation - Comprehensive Survey to study the Milk Procurement Pattern through DCS and other means.	X		
Undertake value chain studies on key animal husbandry activities	X		

4.10 Fisheries

4.10.1 Introduction

Kerala is endowed with natural resources to support a fisheries sector that has significant potential to make a much larger contribution to economic growth and social development, while ensuring its sustainability and resilience to climactic-shocks. The Indian Ocean is one of the most biologically productive areas in the world. Inland are numerous productive waterways, and substantial area and suitable agro-climatic conditions for aquaculture. Globally, demand for protein-rich fisheries products continues to rise, providing opportunities for ocean-facing States such as Kerala. With the world population continuing to climb, and increasing incomes shifting fish consumption habits, demand for fish will continue to grow. With it, opportunities for ocean-facing and aquaculture-proficient States across India will increase.

Kerala's fisheries contribute to economic growth and social development, but their full potential is not being realized. Prior to the 2018 devastating floods, the fisheries sectors' contribution to State GDP was Rs. 7086.32 crore, or 1.36% but 11.49 % of primary products such as agriculture and allied activities and employed a reported 11 lakh people directly and indirectly. Yet, even before the floods and significant damage to the sector, parts of the sector were struggling: the marine capture fishery has been suffering decreases in production and per-unit value due to overfishing and poor quality. The aquaculture industry is growing, albeit slower than it could as it lacks crucial planning and governance arrangements. Post-harvest processing of fish is hampered by quality control issues and outdated technologies, and much processing capacity is focused on lower-grade products (i.e. fishmeal).

The right reforms could unlock far greater benefits. A clear vision, prioritizing resilience and sustainability, strategic investments and improved governance could put the fisheries sector on a climate-smart and solid development pathway. Urgent action to address overfishing and IUU fishing could preserve the productivity of the marine resource for future generations. Consistent implementation of the recently legislated Fisheries Policy could help coordinate development, ensuring that tradeoffs are well understood, and complementarities are realized among interlinked sector components. Improvements to biosecurity and food safety systems could help Kerala gain even greater access to lucrative markets, including international markets, and reduce risks that hold back private investment. Fisheries could also bring considerable benefits for human health, particularly food security and nutrition. Fish is a source of proteins, healthy fats, and essential micronutrients—all extremely valuable in the context of India's high level of malnutrition and childhood stunting from poor diets.

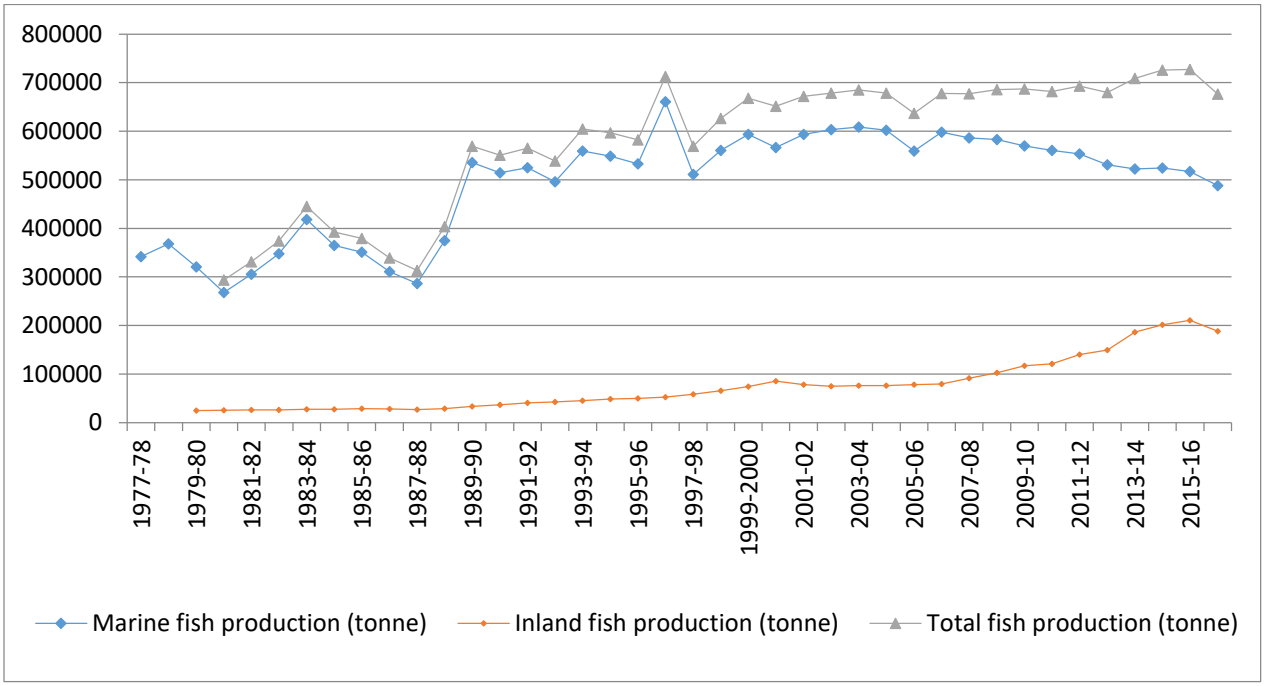
The time is right for the State to launch a strategic programme of support where increased fisheries production, both captured and cultured, and improved value-addition drive both domestic and export-oriented growth, while maintaining an ecosystem-based focus for resilience and sustainability. Such "blue growth" prioritizes the sustainable management of natural aquatic resources in the delivery of economic and social benefits. It minimizes environmental degradation, biodiversity loss, and the unsustainable use of resources, while maximizing the economic and social benefits that build strong communities. The approach also aims to help workers in fisheries, aquaculture, and along the seafood value chain to act not only as resources users but to play an active role in managing natural resources for the benefit of future generations (FAO 2015a). This also builds on a new Fisheries Policy revised post-floods (February 2019) in order to help rebuild the sector and the infrastructure and livelihoods lost from the floods. However, actualizing and implementing the new fisheries policy will require a comprehensive Master Plan with a clearly specified Matrix of Actions that prioritizes and sequences activities with correctly specified budgets; This document lays out a framework for such a Master Plan. There is no question that the 2018 floods severely affected the inland fisheries sector, destroying fisheries infrastructure and livelihoods with

significant financial cost and human lives lost and adversely affected. Our state is making important strides to 'build back better.' And while often overlooked, a revitalized, resilient and climate-smart post-flood fisheries sector could be one important sector driving sustainable growth for decades to come.

The fisheries sector has always been important in the socio-economic scenario of Kerala. With a 590 km long coastline, a continental shelf area of 39139 km^2, around 4 lakh hectares of inland water bodies like brackish water lakes, backwaters, estuaries, rivers, reservoirs, ponds, tanks etc. and an estimated 11.03 lakh people dependent on fisheries for their livelihood the sector plays an important role in the State's economy and in the nutritional security of the people. The number of active fishermen in the State is around 2.36 lakh. There are 222 fishing villages in the marine and 113 fishing villages in the inland sector. Besides the direct dependence of the above-mentioned population on fisheries, it also offers other employment avenues in fisheries related and ancillary industries.

Kerala stands fourth among Indian states in total fish production. The annual total fish production of Kerala during the last four decades (1977-78 to 2016-17) is presented in the figure below. It may be seen that the annual total fish production of the State has grown from around 3.50 tonnes in 1978-79 to 7.28 lakh tonnes in 2015-2016. During the last decade, however, total fish production of the State has stagnated between 6.77 and 7.28 lakh tonnes, the figure being 6.76 lakh tonnes in 2016-2017.

Figure 39: Fish production of Kerala during the period from 1977-78 to 2016-2017



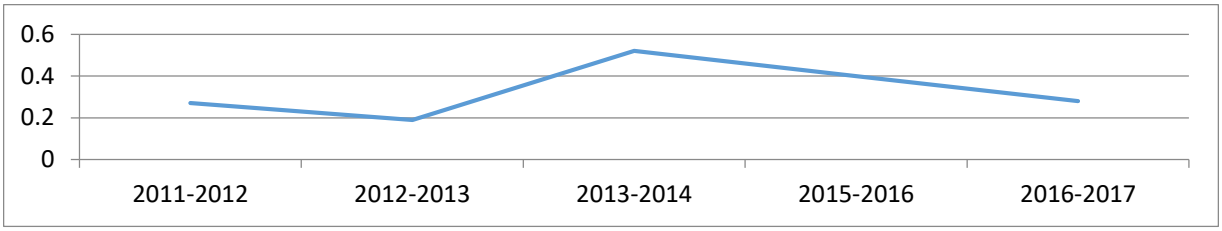
Fisheries sector is important from the point of view of its contribution to the SGDP. However, this contribution has steadily decreased from 2.24% in 1999-2000 to 1.04% in 2011-12. Thereafter it showed an increasing trend and reached 1.58% in 2016-17. Fish also contributes to the export basket of the country and exports from the State contributed 14% in terms of quantity and 13% in terms of value to total seafood exports from the country during 2016-17, i.e., 1,59,141 tonnes worth Rs. 5.008.54 crores.

Fisheries sector is also important from the point of view of nutritional security of the State. For the domestic consumer, especially those belonging to the lower echelons of the society, fish is the only affordable source of high-quality protein, essential vitamins and micronutrients. As a health food, certain species of fish are gaining importance on account of their medicinal properties.

Marine capture fisheries have always dominated the total fish production in Kerala. With an average annual production of 5.44 lakh tonnes (2007-08 to 2016-17) the State is in the forefront in marine fish production in India. Marine fish production of the State during the last three decades fluctuated between 2.86 lakh tonne (1987-88) and 6.60 tonnes (1996-97). Fish production in the marine sector over the last 10 years presents a more or less stagnant trend with an average production of 5.44 lakh tonnes. It may be noted that the marine fish landing of the State has almost attained or even exceeded the optimum level of production. There is little scope for further increase in fish production from inshore marine capture fisheries sector by increasing the fishing effort.

Kerala is yet to make a noteworthy contribution in the field of aquaculture. While the aquaculture sector contributed more than 50% of the total fish production in the country, the share of the sector in total fish production of Kerala is less than 10%. The sector is showing a declining trend during the last three years.

Figure 40: Farmed fish production in Kerala



With marine catches stagnating and aquaculture not really taking off, Kerala's pre-eminence in the fisheries sector is slowly diminishing. Kerala's fish processing industry is still dominated by shrimp and the capacity utilization is estimated to be about 20%. Shortage of raw material is one of the major reasons for this low capacity utilization.

In spite of all these, Kerala has one of the highest per capita consumption of fish in the country. The per capita consumption of fish in Kerala is around 24 kg which is much above the national average (3.3 kg) and is slightly above the global average (20 kg). Around 87% of the people of Kerala are fish eating population.

Despite the significant contribution of fisheries to nutrition, food security, sustainable livelihoods and poverty alleviation in the State, the issues constraining the sustainable development of fisheries remain poorly addressed. To add to this, the 2018 floods badly affected the fisheries sector. Inland capture fisheries and aquaculture sectors were particularly affected. The State is attempting to rehabilitate and rebuild this sector. Aquaculture has been recognized as one of the fastest growing food production sectors in the world but is vulnerable to climate change and this sector is the only alternative source to be relied on for increasing the fish production in the State. Aquaculture has a vital role in contributing to food security and poverty alleviation in India and many other developing countries. Specifically considering the prevailing climate change conditions in Kerala, the production efficiency needs to be increased in both capture and culture fisheries in a resilient manner, while keeping in check the possible vulnerabilities to the natural resources of the State. This, in turn, necessitates development of strategies for enhancing and increasing food production without damaging the environment and disturbing ecological balance. Despite

the significant contribution of fisheries to nutrition, food security, sustainable livelihoods and poverty alleviation in the State, the issues constraining the sustainable development of fisheries remain poorly addressed.

4.10.2 Impact of 2018 floods

The aggregated loss due to recent floods for aquaculture and inland capture fisheries is estimated to be Rs. 10,304 lakh and the aggregated damage is estimated to be Rs. 8450 lakh. In terms of breakup, the losses and damages were Rs. 8866 lakh and Rs. 6584 lakh respectively for aquaculture, and Rs. 1058 lakh and Rs. 348 lakh respectively for inland capture fisheries. The hatcheries, fish farms and field offices owned by Government also suffered losses and damages worth Rs. 380 lakh and Rs. 1518 lakh respectively. The worst affected districts in the State were Thrissur, Alappuzha, Kottayam, Ernakulum, Pathanamthitta and Idukki.

The losses and damages were mainly as a result of breaches of bund, overflow and damage to pumps and other farm equipment. The total expenditure for recovery in the fisheries and aquaculture is estimated to be Rs. 17,901 lakh. The damage assessment for inland fisheries and aquaculture infrastructure included boats, engines, fishing crafts and gear, damage to bunds, pumps, tanks, fences, cages and farm equipment. Losses to government-owned hatcheries, fish farm and field offices were also included in the assessment. As per the available data, a total of 1208 fishing crafts were reported to be damaged or lost. Majority of new small private aquaculture investments were severely hit by floodwater up to 6 to 12 feet. Most losses and damages were suffered by the fish culture, followed by shrimp, brackish water fish, one paddy one fish culture and cage culture.

Damage and loss: As per the PDNA, the total damage and loss, and recovery needs for this sector estimated to be as follows:

Damage (Rs. crore)	Loss (Rs. crore)	Total Effect (Rs. crore)	Total Recovery Needs (Rs. crore)
85	101	186	179

The Ockhi disaster of 2017 and the flood of 2018 shattered the fisheries sector of Kerala. To mitigate the losses and damages in the fisheries sector, a comprehensive Master Plan is needed. The rebuilding and sustainable development of the fisheries sector is vital for improving the State economy and nutritional security. The recovery vision for the sector is to develop a sustainable, responsible, inclusive, eco-friendly and resilient aquaculture and fisheries resource management measures consistent with the policies of the GOK and the GOI. To realize this vision, it is essential to develop a strategic plan for sustainable fisheries sector development with short-, medium- and long-term goals. The immediate to short-term measures for the recovery of fisheries will focus on the revival of aquaculture and inland fisheries system and cleaning of water bodies. In the medium term, it is essential to strengthen the Kerala Inland and Aquaculture Act, development of fisheries co-management in marine sector, systematic management of aqua farms, insurance compliance and de-siltation of water bodies and lakes. Medium- and long-term activities could also focus on building resilience through environmentally sustainable community-based management of water resources, setting up of early warning systems, and enhanced GIS/technology backed capabilities for tracking and management of the sector assets.

4.10.3 Major Legacy and Current Issues

Despite the significant contribution of fisheries to nutrition, food security, sustainable livelihoods and poverty alleviation in the State, the issues constraining the sustainable development of fisheries remain poorly addressed. Major issues constraining the potential of the fisheries are discussed below.

4.10.3.1 *Capture fisheries*

Unscientific fishing methods and Increased fishing pressure: Many methods of fishing in vogue are unscientific leading to resource depletion. Use of ever-increasing engine horse power, very large nets, nets with very small mesh size, use of powerful light, etc. for fishing leads to depletion of fish resources. The fishing pressure in the inshore area is much beyond what it can accommodate resulting in resource depletion.

Environmental degradation: The State of marine environment in Kerala is under stress due to climate change, pollution etc. Further, factors such as poor effluent treatment on land, plastics (especially, micro-plastic particles) in the sea and ghost fishing are equally affecting fish stocks. Water pollution, habitat modifications, sand mining, loss of breeding grounds, shrinkage of inland water bodies, mangrove deforestation are also important issues which leads to depletion of fish resources.

Inadequate management of marine fisheries: Management of marine fisheries in Kerala does not follow an integrated approach, blending traditional knowledge and science with business principles and effective engagement of both primary stakeholders, and also those engaged in ancillary activities to ensure that fisheries are ecologically and economically sustainable.

Neglect of deep sea fishing: Marine fishing in Kerala is more or less restricted to inshore areas. The average marine fish harvests from the seas around Kerala are close to the current potential yield estimates, indicating that there is not much scope for enhancing fish production from the area within 200-meter depth. On the other hand, the oceanic waters still contain an untapped potential of high value resources like tuna, tuna-like species, myctophids and oceanic squids. There is also considerable scope to harvest fishery resources of the high seas or in Areas beyond National Jurisdiction (ABNJ), as done by many other countries such as krill fishing, etc.

Inadequate Monitoring, Control and Surveillance (MCS) system: The existing mechanisms in place for a sound and effective MCS regime for marine fisheries sector need further strengthening. Presently, the Government has an online uniform registration and licensing system (ReALCraft) to register all fishing vessels operating in the marine sector (traditional, motorized, mechanized and non-mechanized). While monitoring of fish catch and effort and control of fishing through registration and licensing is in place, MCS activities needs be further strengthened through greater engagement of the Department of Fisheries (DoF) Coastal Marine Police and the Indian Coast Guard (ICG).

4.10.3.2 *Aquaculture*

Aquaculture is one of the fastest growing food production sectors in the world. The sector contributed nearly 47% of the total world fish production of 1710 lakh tonnes in 2013 (FAO, 2018). In India the share of aquaculture to total fish production is around 53%. But in Kerala, in spite of the availability of rich and diverse water resources aquaculture is yet to take off in a big way and the contribution of aquaculture to total fish production is only less than 10%. The State has immense potential for the development of aquaculture in fresh, brackish and marine waters. The principal issues which have a hand in the low-profile development of aquaculture are:

Inadequate diversification of species: Freshwater aquaculture in Kerala is at present more or less restricted to carp culture. However, in Kerala, people generally prefer sea fishes and demand for carps is limited. Carps generally fetch low price in the State. Under the circumstance a shift from the carp centric approach is very much required. In the brackish water environment, farming is at present restricted to the tiger prawn and to a very limited extent to the Indian white prawn. Commercial farming of milk fish, mullets and that of the white legged prawn (*Litopenaeus vannamei)* are not attempted to any appreciable level in the State.

Use of fry as stocking material in farming: In freshwater farming in the State, the stocking material used are generally the fry or the early finger lings of carps. It needs around 10-12 months for the fry to reach marketable size. In Kerala which is bestowed with plentiful water and rains for around six months, fresh water is available in most places for six to seven months a year. However, in most cases, ponds dry up or water will become brackish during the summer season. In short, fresh water will be available in many areas only for six or seven months in a year there by restricting the utility of ponds in these areas for raising freshwater fishes. It points to the necessity of a change in the present system of using fry as the stocking material. Advanced fingerlings or the yearlings which reach marketable size in 6- 7 months of stocking are obvious choice to circumvent the situation.

Non-utilization of brackish water ponds year-round: Majority of shrimp farms in Kerala remain idle for most part of the year. Ponds where two crops in a year are possible are also being used for raising only one crop, in the light of fear of occurrence of viral diseases. A cropping system which allows year- round utilisation of the ponds must be popularised, for increasing the aquaculture production. Farming of milk fish, pearl spot, sea bass, grey mullet, tilapia, crab etc. during the period in which shrimps are not grown will certainly prove to be beneficial to increase aquaculture production and in improving the profitability of farm units.

Low productivity of existing aquaculture farms: Among Indian states, Kerala has the lowest aquaculture productivity. By scientifically designing farms, adopting scientific management practices, species diversification, crop rotation and by intensification of farming activities the productivity of aquaculture units in the State can be improved perceptibly. Disease monitoring and management also needs special mention here. However, Kerala can increase its production per unit area with efficient resource use by adopting polyculture of key species, (i.e. carp/tilapia – mola for example). This would also increase the nutritional output per unit area of production.

Non-diversification of farming systems: Kerala, as the land of rivers and streams, has excellent scope for the development of cage farming. However, cage farming in Kerala is still in an infant stage. Non-availability good quality seed, absence of species specific feeds, low rate of technology percolation to farmers, low survival rate etc. are the principal reasons for the unsatisfactory performance of cage culture units in the State.

Lack of integration of nutrition-sensitive agri- fish farming/ fish- livestock farming: Integration of fish farming with agriculture and/or live stock is one of the important ways to increase production of fish as well as agri/ animal crop. It also helps to bring down the cost of production of both the crops. A multi-commodity farming system is more advantageous to the farmer than the mono cropping system. However, except the alternate culture of rice and fish in *kuttanad, pokkali and kole land area,* no worthwhile attempts are seen made for the integration of agriculture and/ or livestock with fish farming.

Lack of intensification of farming technology*:* Intensification in aquaculture operations proceeded from clear water system with proper feed management to zero water exchange because of many advantages including the bio-security. As part of the concept of delivering high productivity with sustainability many concepts like Bio- floc based farming technology (BFT) are being evolved. Bio- floc based farming

technology (BFT) applied to aquaculture is based on the concept of the retention of waste within the culture system and its conservation to bio-floc as a natural food.

Nonuse of specific pathogen free (SPF) and specific pathogen resistant (SPR) seeds: Use of SPF and SPR animals will bring down the chances of occurrence of diseases and increases farm profitability substantially. However, such seeds are not generally in use in the State of Kerala.

Skewed development of farming of molluscs: Aquaculture of molluscs like mussels, though well developed in some parts of the State, like Kasargod district, is yet to gain popularity in other parts of the State. Development of farming of molluscs in Kerala is more or less skewed. Farming of molluscs is one of the most inexpensive ways of producing quality animal protein in the world and backwaters of Kerala offer very good scope for development, if fisheries rights are exclusively reserved to department.

Neglect of Mari culture and seaweed farming: India has an Exclusive Economic Zone (EEZ) of 2.02 million km^2. Of this 36,000 km^2 is adjacent to Kerala coast. The territorial waters, where the State has exclusive right for fishing extend to 22 km from the coast. Besides the territorial waters, Kerala could utilise, by formulating appropriate policy and adopting suitable technologies, off shore/open sea areas in the EEZ contiguous to the coast for aqua farming. This is especially significant in view of the newly evolved technologies for open ocean aquaculture of tunas and other fin fishes like cobias, groupers and sea bass along with complementary sea weed farming.

Neglect of reservoir fish production: Kerala has 53 reservoirs most of which come under the category of small or medium reservoirs. These reservoirs have immense potential for fish production. The potential of these reservoirs for fish production is yet to be tapped which will be evident if one compares the productivity of reservoirs of Kerala (less than 20 kg par ha.) with those of other states (around 100 kg per ha.). It is due to ownership and operating rights over these water bodies.

Inadequate availability of quality fish and shrimp seeds: One of the most important reasons for the low-profile development of aquaculture in Kerala is the insufficient availability of quality seeds in the appropriate time. Seed produced in these units are grossly inadequate to meet the seed requirement of the State. A rough estimate indicates that only 35% of the seed requirement of the State is met by the seed production centres functioning inside the State and the balance is met by units functioning in Andhra Pradesh and to some extent by those functioning in Tamil Nadu. Seed brought from distant places are often weak due to stress caused by handling and transportation which will result in lower production level.

Lack of fish seed certification and accreditation facility: Good quality fish seed is a pre-requisite for the success of any aquaculture venture. To ensure quality of seed and sustainability in its production process, it is essential that the hatcheries use brood stock, breeding and husbandry practices as per scientific norms. Similarly, it needs to be ensured that seed farms use spawn obtained from reliable hatcheries that follow the norms of quality and sustainability. There is an immediate need for seed certification and accreditation of seed production centres on the lines of provisions existing in the farming sector.

Lack of species-specific feeds: The nutrient requirement of various species of fin fishes and shell fishes vary very much. However, in Kerala commercial feeds meant only for black tiger shrimp, scampi and, to a limited extent, carps are available in the market. In farming other species any one of the above-mentioned feeds or the conventional *ground nut oil cake and rice bran* mixture are used by aqua farmers. As a direct result maximum growth cannot be elicited in many cases, making farming of these fishes uneconomical.

Inadequate infrastructure and supporting facilities: Inadequate seed multiplication centres, seed banks, seed supply centres, seed rearing units, lack of brood stock banks, field laboratories, diagnostic centres, facilitation centres etc., facilities for processing and value addition all act as impediments to aquaculture development in the State. A large number of fish/ shrimp farming units in Kerala are located in remote

areas with little road access and electrical connectivity. Inadequate infrastructure facilities make intensification of farming systems difficult. In the absence of electrical connectivity, most farms do not use aerators to enhance dissolved oxygen content of the rearing water. Thus, the farms have to restrict to low stocking density there by resulting in low production.

Inadequate finance for aquaculture development: One of the principal reasons for the lukewarm development of aquaculture sector in Kerala is inadequate capital infusion into the sector. Barring aside a few, like units for farming of molluscs, aquaculture in general is capital intensive and is prone to high level of risks. In view of these, financial institutions in the State are reluctant to extend capital support for aquaculture ventures. As a result, entrepreneurs are finding it difficult to start new ventures.

Lack of support for creation of common facilities: *Kuttanad, kole, pokkali and kaippad* lands are perhaps the most important areas for the development of aquaculture in Kerala. These areas in general are low lying and lie adjacent to backwaters and rivers. In these areas strong common peripheral bunds are required to prevent water incursion and to protect the crop. Construction of strong peripheral bunds requires huge capital investment which is beyond the capacity of individuals.

Inadequate Insurance coverage for aqua farming: In view of the recurring viral diseases insurance companies in general are not willing to extend financial coverage to aqua farmers in Kerala, as in other parts of the country. This acts as a major obstacle in the development of aquaculture.

Lack of data base on aquaculture: A serious lacuna in the State, as in other parts of the country, is in respect of availability of aquaculture data. For any business planning or growth analysis data on past and present is a prerequisite. Unfortunately, authentic/organised data are not available on many aspects of aquaculture in Kerala.

4.10.3.3 *Post-harvest sector*

The general hygiene and sanitary aspects of fish landing centres, harbours and fish markets in the State need improvement to raise them to international standards. There is lack of programmes to sensitize the stakeholders for maintaining cleanliness and hygiene in these facilities. There is a need to ensure availability of safe and hygienic seafood. Provision of adequate infrastructure facilities is critical to marine fisheries value chain, and also critical for many MCS functions.

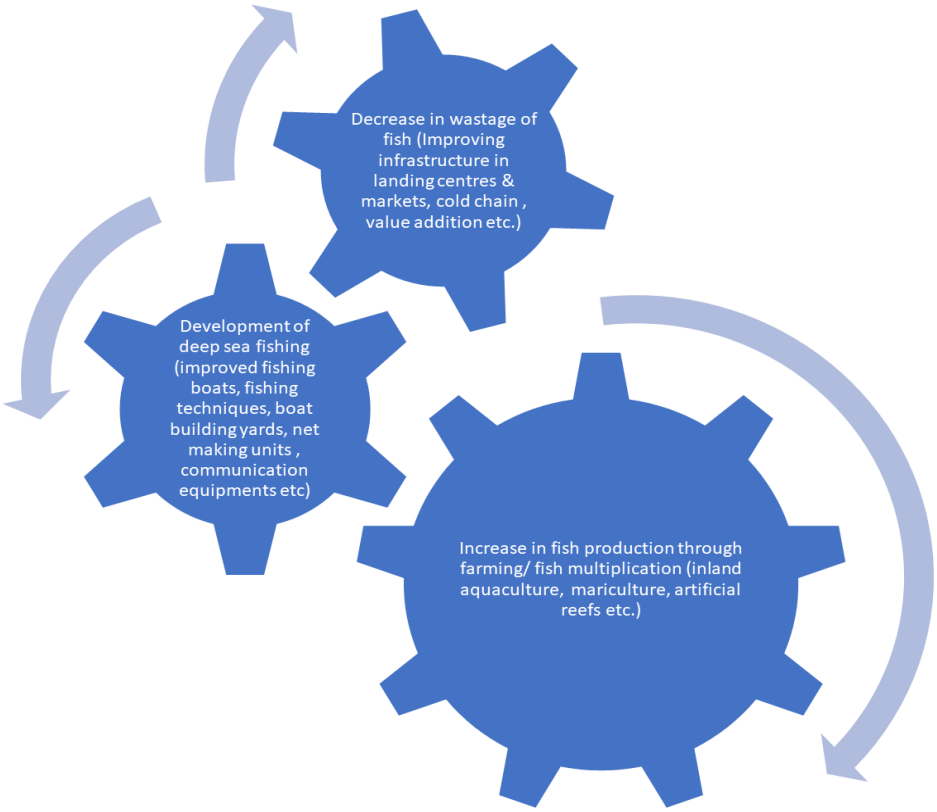
Harbours and fish landing centres should act as centres of agglomeration for both post processing and value addition. Based on a comprehensive reassessment of the requirements and ensuring minimal impacts on the coastal ecosystem, additional facilities, including harbour-based fish dressing centres and fish processing estates, are necessary. Presently, it is estimated that about 15% of the fish caught is lost in post-harvest phase, which is a colossal waste of natural wealth that otherwise could have been put to better use. The post-harvest losses through better on-board fish handling will lead to better quality and prices, particularly for high value fishes and their products. More importantly, loss of valuable fish wealth will be minimized so that more fish is available maintaining ecological balance. Mitigation measures to reduce by-catch need to be promoted through relevant implements, gears and other management measures.

4.10.4 Proposed approach to resilient rebuilding of the fisheries sector

The key development objective in the fisheries sector is to improve availability of fish by increasing fish production and by reducing fish wastage together with enhanced employment and income generation for socio- economic prosperity and nutritional security (see below figure). In this context, it is important to

improve fish production, productivity and profitability in the inland areas which offer high economic opportunities and benefits as well as assist in stabilizing declining marine capture sector. The approach also calls for the development of deep-sea fishing and sustainable Mari-culture activities. Finally, loss of valuable fish wealth needs to be minimized so that more fish is available for maintaining the ecological balance.

Figure 41: Approach to enhancing fish availability, affordability, and accessibility



Development of aquaculture on sustainable basis in the State would require interventions and support at different levels. These include policies, research and farmers' initiatives. Fish production can be increased by adopting a three-pronged approach which involves improving the productivity of existing farm units, extending farming operations to new areas, and adopting new and innovative farming technologies.

Increasing productivity and profitability in the inland water bodies which offer high economic opportunities and benefits as well as assist in stabilizing declining marine capture sector and develop sustainable Mari cultural activities as an alternative livelihood assumes great importance. The emphasis will be on the development of fisheries sector with the scope of enhancing fish production together with employment and income generation for socio- economic prosperity and nutritional security.

The Ecosystem Approach to Fisheries Management (EAFM) will be implemented with due consideration to the well-being of all living and non-living constituents of the marine ecosystem and the social attributes of stakeholders. In the same vein, participatory management or co-management in fisheries, which is recognized globally as one of the successful management systems for multi-stakeholder, multi-species and multi-fleet fisheries, will be promoted. Such a co-management system, which could include local,

regional, inter-state and national fisheries councils would also play a key role in resolving conflicts among different groups of fishermen. The norms for introducing these management measures will be worked out in consultation with the fisheries research institutions, local governments, fishers and their associations and other concerned stakeholders in the sector.

The Government will introduce new scheme(s) for enhancing the skills and capabilities of the traditional fishermen to undertake and popularize deep sea fishing. The scheme(s) will inter-alia consider modernization of existing indigenous deep-sea fishing fleet, introduction of new indigenous deep sea fishing vessels through fishermen cooperatives/self-help groups, on-board training and linkages to markets and export. While introducing these mechanisms/schemes, steps will be taken to ensure that such initiatives comply with the international regulations relating to fishing in the EEZ and beyond in the high seas.

Utilization of deep sea resources in the EEZ will be considered not only in terms of resources available in the EEZ, but also infrastructure, technical wherewithal for vessel construction, survey and certification, human capacity development and a comprehensive and implementable set of rules and regulations; with a strong Monitoring, Control and Surveillance (MCS) regime, availability of scientific and technical information on commercial fisheries resources, and the best fishing methods with which to target them.

While designing the recovery plan for Kerala, the mission is to establish a three-phased approach of short, medium- and long-term action plans. This approach will ensure continuous recovery and sustainable development. The next table provides a comprehensive list of actions to be undertaken for achieving these goals. Also, from a futuristic point of view we need studies to be undertaken for achieving green fisheries which is in line with the Kerala fisheries policy of sustainable fisheries.

A detailed set of actions for addressing the identified challenges and charting a sustainable course forward mare considered to build the fisheries sector back better and modernize it to meet the needs of people and the economy. These are arranged in five key themes: (1) creating an enabling environment for growth, (2) managing marine capture fisheries for long-term sustainability, (3) ensuring sustainable inland capture fisheries, (4) supporting the development of an environmentally sensitive aquaculture industry, and (5) optimizing the benefits of a productive fisheries sector – including the value chain – and for social goals.

1. Creating an enabling environment for growth

- The current governance structure is fragmented. Better-defined roles for existing institutions could improve management outcomes and investor confidence.
- Revitalization of the sector will require substantial financial investment for new production, structural adjustment, and value-added activities. Strategic financial support in the form of grants, loans, and guarantees is required, along with systems for efficient and transparent delivery. A State-level Fisheries Infrastructure Development Fund (S-FDF) could make strategic public investments in infrastructure required to modernize the sector, while crowding-in private-sector financing for investments along the value chain. Investments would be market-driven, yet eligibility criteria would help ensure that social goals are promoted.
- The sector needs investment in skills and training. This could be achieved through increased funding for existing State educational institutions, coupled with funding through the FDFs to support new partnerships with the private sector to ensure vocational readiness. This could also be pursued through technology-driven edu-tech solutions that promote disruptive and scalable skills development in countries that find it hard to mobilize global expertise due to conflict and safety concerns.

- With fish as an important local and global food, there is a need to strengthen food safety and sanitary and phytosanitary (SPS) systems, and ensure compliance, to build Kerala's access to high-value markets, and reduce the risks that currently discourages private- sector investment. Stronger Federal oversight, and increased capacity in inspections, diagnostic laboratories, border-quarantine facilities, and industry protocols, are necessary.

2. Ensuring productive and sustainable management of marine fisheries

- As in many other ocean-facing countries, improvements to productivity and sustainability of marine capture fisheries will require an urgent reduction of overfishing. An effort reduction programme and enforced licensing could cut fleet capacity and fishing effort and phase out certain types of vessels. Restrictions on timing and areas of fishing could further protect key habitats and ensure stock recovery. There are various technical approaches to designing such a programme, which would be detailed in Fisheries Management Plans (FMPs), informed by a new research framework. The reduction in overfishing could proceed in parallel with compensation for affected operators, or by alternative livelihood programs to ameliorate the costs of adjustment.
- To better nurture fisheries revitalization, improved monitoring, control, and surveillance is essential, so as to protect Kerala's fisheries both from unauthorized fishing activities. Better enforcement of existing regulations is as important as introducing new ones. Monitoring, control, and surveillance in fisheries are a multi-jurisdictional affair, and thus a unified cross-government plan of action that clarifies responsibilities is an important step, including with federal agencies.

3. Ensuring the productive and sustainable management of inland capture fisheries

- A review of the incentives created by existing management schemes for inland capture fisheries is needed. Many inland fisheries have low productivity and poor social and livelihood outcomes, partially due to contracting arrangements between managers and resource users. Policy options for management systems could be developed on a consultative basis as part of such a review.
- Improved ecosystem management would prevent further degradation of important freshwater resources. Improving yields and livelihoods will require better data collection and research to inform management of ecosystem trade-offs, and to identify and reduce sources of water pollution.

4. Supporting the development of an environmentally sensitive aquaculture industry

- Aquaculture faces risks that must be averted to encourage private sector investment and ensure that inadvertent costs do not outweigh benefits of growth. A system of spatial planning could reduce risks. Detailed mapping of where aquaculture development should be permitted would avoid environmentally costly impacts on mangroves and water supplies and ensure optimal use of existing infrastructure such as roads and export facilities.
- The quarantine and certification system also need strengthening to reduce biosecurity hazards. This would require upgrades to aquatic animal health laboratories, stronger certification measures, and better inspection facilities at ports of entry. Institutional changes, such as nominating and empowering a focal-point biosecurity institution at the Federal level, might also help. Greater engagement with international organizations that deal with aquaculture biosecurity and food safety risks is also recommended.

- Deeper extension service would foster development of the industry. Aquaculture extension in Kerala primarily takes place at the State and Territorial level, through largely unlinked institutions. Institutional coordination, upgraded curricula, and learning from other countries' successes could increase productivity. This should be supported through increased research, undertaken jointly by the public and private sectors.

5. Optimizing the benefits of a productive fisheries sector to advance social goals

- Investments and improvements in fisheries should benefit both large export-oriented firms and small-scale operators. There is also a need to ensure that polices disproportionately benefit poorer households and women. This could be achieved by encouraging FDF investments towards activities that employ or are led by women, which tend to be in post-harvest phase. Extension activities and financial support oriented towards small-scale homestead aquaculture could also help.

Table 45: Summary Framework of Specific Development Objectives (SDOs) and Results Areas for Greater Resilience and Sustainability of Fisheries Sector Revitalization

Action plan element	Specific Development Objectives (SDOs) and Results Areas
1. Enabling environment	**SDO 1:** Enact policies and programs that deliver structural funding, innovation, capacity building, and other changes to attract investment, support trade, and improve the management of fisheries resources.
	Results Areas:
	Reformed governance for greater oversight and coordination
	Provision of finance for structural investments
	Improve labour force skills and extension via education, skilling
	Improved SPS measures and enforcement to protect consumers and align with international standards to facilitate trade
	Innovative mechanisms to enable sustainable development of the sector (i.e. spatial planning, leasing of water bodies for sustainable aquaculture)
2. Sustainable Marine capture fisheries	**SDO 2:** Ensure that marine fishing activities are environmentally sustainable and managed in a way that will achieve equitable economic and social benefits.
	Result Areas:
	Effective management of sustainable marine fisheries
	A well-regulated and compliant fishing sector
	A healthy and productive marine ecosystem
	Evidence-based fisheries management enabled through good science and information

3. Sustainable Inland capture fisheries	**SDO 3:** Ensure that inland fishing activities are environmentally sustainable and managed in a way that will achieve equitable economic and social benefits
	Result Areas: Effective and equitable management of sustainable inland fisheries Effective freshwater ecosystem management
4. Climate-Smart Aquaculture	**SDO 4:** Ensure that aquaculture is managed in a way that will enable Kerala to satisfy local demand, grow exports, provide an alternative to wild capture, and contribute to jobs, food security and the empowerment of women
	Result Areas: Effective planning and management of aquaculture Effective aquatic animal health planning and management Expanded and improved aquaculture extension and training Expanded and improved aquaculture research and development aligned with industry needs and government objectives
5. Optimizing benefits	**SDO 5:** Optimize the economic and social benefits generated by a more resilient, productive and sustainable fisheries sector
	Results Areas: Improved nutrition and food security for all Greater attention to gender issues and progress towards gender equality Strengthened productivity of the sector to drive competitiveness Improved infrastructure and fisheries value chains (incl. equipment, technology, marketing) enabling primary and ancillary job creation and economic growth Improved safety at sea for fisherfolk

4.10.5 Specific Interventions

Table 46: Fisheries Actions and Results Framework

S.No	Activities	0-6 months	0-18 months	18 months & beyond	Expected outcomes
Policy/regulatory					
1	Deep sea fishing policy		X		Untapped deep sea fish resource can be sustainably tapped for increasing fish based products
2	Public water bodies including reservoirs utilization	X			Fishery management rights to be vested with fisheries department keeping the ownership of water body intact
3	Policy for seed certification and accreditation of seed production centres, feed mills standardization	X			Quality of fish/ shrimp seed ensured. Better survival on farming which increases the profitability of farming operations Incidence of disease outbreak minimized
4	Strengthen policy frame work to promote integrated farming systems		X		Integrated aqua- agri- animal rearing systems help produce different crops from the same area Increases productivity, reduces crop failure and increases profitability
Institutional					
5	Modernisation of Matsyabhavans with e-governance, man power allocation, etc.		X		Better delivery of services to fishermen and fish farmers Services of Department, Matsyafed, ADAK, FIRMA and KFWFB under a common roof at local government levels ensured

S.No	Activities	0-6 months	0-18 months	18 months & beyond	Expected outcomes
6	One stop aquaculture centres.	X			The centre will provide Information & Communication Technology (ICT)-enabled Aquaculture Support Service to the Fish Farmers Disseminate newer technologies and innovations Facilitate their wider adoption for the sector's growth
Technology					
7	Marine spatial planning		X		Demarcation of marine areas for multiple users of the ocean Help avoid conflict of interest in use of resources
8	Deep sea fishing		X		Deep Sea vessels with increased capacity for storage and processing helps in a) Capture of untapped fish resource b) processing at sea increases market value c) Value addition and income generation
9	Mariculture including seaweed farming			X	Diverification from capture fisheries to culture fisheries in the sea Alternate livelihood for fishermen More products from limited resource
10	Seed production of marine fin fishes, shell fish and indigenous species			X	Right Quality, Quantity at right time of seed production will increase aquaculture calender planning
11	Advanced control room for online tracking, communication mechanism and rescue		X		Builds confidence among fishermen in undertaking multiday fishing operations beyond conventional fishing seas. Traceability of produce and products possible. Mechanism for effective communication during disaster and warnings

S.No	Activities	0-6 months	0-18 months	18 months & beyond	Expected outcomes
Investment					
12	Aquaculture zonation - Species specific and region specific		X		Proper survey and zonation involves site specific, species specific, time specific inputs resulting in higher fish production in a sustainable manner
13	Inland aquaculture including cage farming		X		More than 15000 hectares of brackish water, reservoir, other water bodies can be utilised for growing fish in cages
14	Fish multiplication centres			X	Fish multiplication centres for marine and fresh water fishes have to be established for providing good quality advanced fingerling to the benefactors
15	Disease surveillance and control laboratories			X	Detection of disease free seed and juveniles. Provides facilities for early detection of fish diseases and their cure.
16	Artificial reefs	X			Conservation and development of sustainable heathy ecosytem for marine resources.
17	Construction of boat building yards			X	International standard boat building yards will act as centres for building, repair & maintenance and certification of boats.
18	Modernization of Harbours, Fish landing centres and fish markets.		X		Integrated development of Harbours, Fish landing centres and fish markets results in establishing Value chain. Reduction of fish wastage Increase in fish availability Ensures supply of good quality fish to consumers Increase in income to fishermen.

4.10.6 Technical Studies and Assessments

Table 47: Fisheries List of Studies

S.No	Studies	0-6 months	0-18 months	18 months & beyond
Policy / Regulatory				
1	Study for Marine spatial planning (MSP) to bring together multiple users of the ocean – including energy, industry, government, conservation and recreation to make informed and coordinated decisions about how to use marine resources sustainably. Maps may also be prepared to create a more comprehensive picture of the marine area– identifying where and how the ocean area is being used and what natural resources and habitat exist, similar to land-use planning.			X
2	Mari and Aqua Zonation: The data on water bodies available for fish farming need to be ascertained afresh and must be earmarked for fish farming purpose. A detailed survey aided by remote sensing techniques is required for the delineation of areas suitable for various systems of fish culture in a sustainable manner.			X
Investments Planning				
3	Ecosystem-based fisheries management (EBFM) is a holistic way of managing fisheries and marine resources by taking into account the entire ecosystem of the species being managed. The goal of ecosystem-based management is to maintain ecosystems in a healthy, productive, and resilient condition so they can provide the services humans want and need. The EBFM approach also can be applied in the management of protected and other trust marine species.		X	
4	Support Department of Fisheries and Matsyafed, the Kerala State Co-operative Federation for Fisheries Development Ltd., the Apex Federation of 654 Primary Fisherman Co-operative Societies spread over 10 districts of Kerala in three key Feasibility Studies: (a) feasibility study to assess adoption of innovative extruder based technology to locally process fish waste into feed and nourishing food, rather than rely on expensive imports into Kerala; (b) feasibility study to develop nutrition-sensitive hatchery and R&D Centre of Excellence for provision of fish fry or “seed” to poor fish farmers, ensuring State-wide self-sufficiency (currently lacking); and (c) feasibility study to develop Kerala-cantered ornamental fish trade, a $1.3B annual market for India currently untapped.		X	

4.11 Livelihoods

4.11.1 Introduction

Tourism and traditional industries, Micro, Small, Medium Enterprises (MSMEs), rural/Kudumbasree enterprises, agriculture and animal husbandry are key livelihood sectors employing a large proportion of Kerala's population. Considering the diversity of issues related to the livelihood options based on agriculture and allied sectors from that of the livelihood options in Tourism and Industries (microenterprises in particular), this paper attempts to address these two categories as two different sections. Discussions on livelihood development cannot be comprehensive without considering the specific issues of the most marginalized groups in the society, covering SC, ST and fisherfolk.

As per the Department of Labour, approximately 12.8 lakh of the 67.11 lakh workers pertaining to the sectors under its jurisdiction were affected by floods, leading to a loss of 269.08 lakh of person-days. Migrant workers from other states constitute 25% of the total workforce of the State. The wage loss of the migrant workers was estimated for 13 days, and the total wage loss worked out to be Rs. 2032.72 crore and 296.01 person-days. The plantation sector, one of the most important sectors from the employment and livelihood point of view, had 69% of its workforce affected by floods, resulting in loss of 245749 person-days. The State has its workforce employed in the organized and unorganized sectors as casual workers, regular workers and self-employed workers. The National Commission for Enterprises in the unorganized sector estimated that 87% of the workers in Kerala are informally employed without social security provided by their employers. The floods had a major impact on these workers and the recovery needs to be cognizant of their vulnerability.

Tourism accounts for 10% of the Kerala's gross domestic product (GDP)[134], with an estimated[135] share of 23.5% of the total employment in the State between 2009 and 2012. The tourism sector in Kerala directly employs 1.4 million people in the State and welcomed 15 million domestic and foreign tourists in 2017 alone. Kerala also has the highest number of Non-Resident Indian (NRI) visits in the country.

As the first Indian state to declare tourism as an industry and the first to trademark its tourism brand "Kerala – God's Own Country", Kerala has the highest[136] state expenditure on tourism in India. In 2017 alone, the state revenue (direct and indirect) from this sector was Rs. 33,390 crore[137]. The diverse tourism destinations in Kerala include[138] six broad categories: (1) heritage/cultural/religious sites & events (2) backwaters (3) beaches (4) hill stations (5) eco-tourism sites like wild life sanctuaries and (6) Ayurveda/wellness-related activities.

Kerala's highly skilled labour force and the relatively high levels of consumption are the key contributing factors for the industrial growth in the State. Per capita consumption expenditure in rural Kerala is twice that of rural India and in urban Kerala is 1.3 times that of urban India. 15,535 new MSME units were started in Kerala in 2016-17 with a total investment of Rs. 1387.12 crore and generating employment for 57,445 persons. Ernakulam district occupies the top position with 2,267 new units and 8,981 employees

[134] Government of Kerala (2017), Economic Review 2016
[135] Ibid.
[136] 1.27 % as against the national average of 0.49 %. Planning Commission (2014) State-wise/Sector-wise Annual Plan, 12-13
[137] Kerala Tourism (2017) Kerala Tourism Statistics - 2017 Highlights
[138] Ministry of Tourism (2003) 20 Year Perspective Plan for Kerala Tourism (2002-03 TO 2021-22)

in the MSME sector.[139] MSMEs play a crucial role in job creation especially amongst youth, women and marginalized communities.

Kerala's long-standing and renowned Kudumbashree programme has been integral in ensuring inclusive and empowering growth within the MSME sector. Initiated in 1998 as a part of the People's Plan Campaign to promote local self-governance, the program now boasts of over 30,000 Kudumbashree women enterprises running successfully in various production, service and trade sectors.

Handloom and Coir sector is a major traditional industry in Kerala. provides direct and indirect employment to 175,000 households. Participation of women, landless and marginalized communities in the handloom sub-sector is high. Kerala's handloom industry carries a vital role in the State's economy because of its employment generation potential, both upstream and downstream, and, second to the coir sector, in providing employment among the traditional industries of the State. The handloom and coir industry in the state is concentrated in Thiruvananthapuram, Kannur, Kozhikode, Palakkad, Ernakulam, Thrissur, Kollam and Kasargode Districts.[140]

4.11.2 Impact of 2018 Floods

According to the PDNA, the floods had a substantial adverse impact on the employment and livelihood sector of the State, which resulted in damages to physical infrastructure as well as monetary loss for the affected people by way of loss of wages, loss of production and income, and cost involved in managing the risk (termed as loss). It was estimated that livelihoods based on agricultural and allied sectors sustained a loss (other than the physical damages and loss already considered in the concerned sector) of 1097.15 person-days of employment, affecting about 72.42 lakh workers, including migrant labours, resulting in wage loss of Rs. 7300.99 crores. Similarly, livelihoods based on industry related sectors, covering MSME, traditional industries, tourism and rural/Kudumbasree enterprises, added up to another Rs. 2188.37 crores of wage loss, in addition to damage or destruction of physical infrastructure aggregating to Rs. 878.42 crores. Thus, the total impact affected the Employment and Livelihood sector of the State translates on monitory terms to Rs. 10,367.79 crores.

The PDNA pointed out a number of initiatives that could be considered to boost post-floods livelihoods, among them:

- Since the SCs depend on agriculture as their main livelihood, both loss of jobs and tools could be compensated by increasing the work-days under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS) for men and women.
- Enabling market expansion for farmers, enhancing their capacity to develop organic farming and deployment of new technology.
- Use Forest Right Act to implement land distribution programme providing land to landless STs/ SCs

Within tourism, the floods caused substantial damages to public, private and community-owned infrastructure in most districts, estimated at a total of Rs. 508.8 crore. This includes damages to hotels, jetties, navigation canals, parks, restaurants, sanctuaries and other tourist infrastructural assets. Alappuzha (Rs. 119.8 crore), Idukki (Rs. 96.9 crore) and Ernakulam (Rs. 88.4 crore) were the most affected

[139] http://spb.kerala.gov.in/ER2017/web_e/ch313.php?id=31&ch=313

[140] https://www.researchgate.net/publication/281748233_HANDLOOM_INDUSTRY_IN_KERALA_A_STUDY_OF_THE_PROBLEMS_AND_CHALLENGES

districts. The flow of tourism was totally disrupted for 15 days and the infrastructure loss of tourism sector alone accounts for 57.9% (Rs. 508.80 crores) of the total. The losses in terms of income foregone was significantly higher. As per estimates, income foregone due to cancellations and reduced tourist footfalls amounted to Rs. 1,701 crore, with 19% of the tourism work-force directly impacted.

The floods impacted eco-tourism sites, like the Periyar National Park in Thekkady, and cultural heritage sites like the ongoing Muziris Heritage Project including disrupted access and damage to infrastructure. The backwaters, which draw[141] the second largest share of tourists after cultural/heritage and religious sites, also suffered extensive damages to infrastructure like houseboats, boat jetties and navigation canals. In addition to the immediate stalling of tourist activities, the peak season of October to March also got impacted. Kerala sees a huge demand for meetings, incentives, conventions and exhibitions (MICE) activities during this period, but given that these events have a longer booking window, the hotels witnessed largescale cancellations.

The industrial sector was significantly impacted due to the floods. An estimated 4000 nano, micro and small units in subsectors such as plastic, building materials, garments, food, rubber, light engineering, paper, wood and spices were affected, impacting 20,964 workers. The nature of impact included damage to infrastructure, equipment, machinery, raw material stocks, semi-finished and finished goods, loss in revenues/business opportunities and working capital losses. Interactions with entrepreneurs and Kudumbashree-supported units revealed significant disruption to supply chains, indicating higher production / business costs in the short term.

In the handloom and coir subsectors, loss of houses, work sheds, equipment, raw materials, products, coupled with a dip in State tourist economy affected the lives of thousands of urban and rural households engaged in these activities. About 782 registered weavers and artisans engaged in handloom/coir activities lost their work sheds, raw materials, finished product stock, equipment, and tools.

Immediate Recovery Efforts – The Government formulated a new financial aid scheme, the Resurgent Kerala Loan Scheme (RKLS), with the aim of giving a helping hand to regain the lives and livelihood and to alleviate the problems caused by impact of the floods. Affected families may avail bank loan of up to Rs. one lakh per family, without collateral, for the purchase of domestic appliances and other purposes. Interest on the loan will be paid by the government. Total of 1,43,924 beneficiaries have applied for loans worth Rs. 1,149 crore through 23,758 Ayalkoottams under this loan scheme. Out of this, 1,27,237 beneficiaries in 17,891 Ayalkoottams have been provided loan. Kudumbashree initiated another innovative programme to augment the skill of flood-affected people to suit the job market available in the flood-hit areas. ARISE (Acquiring Resilience and Identity through Sustainable Employment) aims to provide skill training to 50,000 candidates in 10 selected areas. It includes housekeeping, plumbing, electronic repairs, electrical works, day-care, sales, data entry and laundry and ironing. A total of 32,132 people has been registered for this project. Kudumbashree has formed 246 construction groups comprising of women trained for various trades in the construction industry for taking up any construction related activities. The Kudumbashree members who were affected by the disaster have been offered more than 300 products from 15 companies at a discounted rate. Under the MNREGS, as of March 2019, wage employment has been provided to 14.72 lakh households with a total of 16.96 lakh individuals, out of which 4.83 lakh families were newly employed as per the data collected on 16th August 2018. As a result, a total of more than 7.5 crore (7,63,37,310) persondays were generated after 16th August 2018 till date, and 82,605 families were issued new job cards after the floods. An amount of Rs. 700.14 crore has been disbursed to the beneficiaries identified as unskilled wages by the Central Government through Direct Benefit Transfer. Projects worth Rs. 86 crore are currently underway for restoration and reconstruction

[141] Tourist Statistics, Department of Tourism, Government of Kerala

of flood damaged infrastructure. The Department of Industries and Commerce has formulated a new scheme 'Ujjeevani' aiming to provide bank loans to rejuvenate small, medium enterprises, commercial establishments and shops affected in the floods. The scheme envisages to provide margin money up to Rs. 2,00,000 for the loans taken. KSIDC has introduced a new loan scheme to help the flood victims, which intends to assist entrepreneurs with short-term loans up to Rs. 3 crore at 9% interest rate.

4.11.3 Major legacy and current issues

The key issues under consideration are highlighted below:

1. **Tourism**

Growth in foreign tourist arrivals (FTAs) in Kerala have slowed down over the recent years, from 11% between 2007 and 2012, to 5% in 2017[142]. Although 2018 witnessed a healthy growth in the first few months, however, the trend was broken because of the outbreak of Nipah virus in May and June, followed by the floods later in July and August. The GoK has stated its intention to double FTAs by the end of 2020[143] and has embarked on various campaigns in core foreign markets including UK, USA, Germany, France and the Middle East. Given this context, the following issues are under consideration for sustainable growth of the sector from the perspective of livelihoods:

a. Disaster preparedness: Rapid growth of Kerala's tourism sector over the past 20 years has led to rapid (and sometimes discriminate and illegal[144]) mushrooming of hotels, resorts and other buildings in key tourist spots with implications on ecologically-sensitive zones. There are instances of resorts located in areas classified as 'high hazard' or 'very high hazard' by the State Disaster Management Authority (SDMA). Post floods, GoK rolled out a 12-point action plan to prevent losses in the forthcoming peak tourist season. This plan includes restoration of road corridors and infrastructure and initiation of several marketing strategies to attract tourists, including digital campaigns, familiarization tours for travel agents/media-persons, and campaigning for events like the champions league boat race and Kochi-Muziris Biennale. It is imperative that GoK's recovery plan is informed by disaster and climate risks, both pre-existing and those emerging from the impact of the floods. The experience of the floods necessitates a review and update of GoK's Responsible Tourism (RT) policy to address disaster and climate risks, including, but not limited to responsible site selection and design of hotel buildings and other infrastructure, disaster management planning at cultural, heritage and religious sites, enhanced capacities of tourism sector employees for disaster response, business continuity planning etc. This is important to minimize disruption to tourism- supported livelihoods in the State after disaster events.

b. Community/Producer share in tourist spend: Along with the rapid growth in tourism revenues, the GoK has been endeavoring to increase the share of community and producers in tourist revenues. While notable efforts have been made in this area, field observations indicate the need for a scale-up of these efforts. The GoK's RT initiative, launched in 2007 in selected districts, aimed to increase the share of rural households in tourist spend through various measures, including facilitating buyer-seller linkages between hotel industry and local farmer communities, facilitating tie ups between hotels and local handicraft/souvenir production units, promotion of experiential tourism concepts centered around

[142] https://www.keralatourism.org/tourismstatistics/tourist_statistics_201720180314122614.pdf
[143] https://www.moneycontrol.com/news/india/kerala-eyes-over-20-lakh-foreign-tourist-arrivals-by-2020-end-3452471.html
[144] https://www.firstpost.com/india/kerala-floods-environmentalists-blame-destruction-of-eco-sensitive-zones-want- controversial-amendment-to-wetland-act-scrapped-4949381.html

local cuisine, art and culture, and so on. GoK's RT initiatives have shown encouraging results in Kumarakom. This needs to be scaled up across the State, along with improving the participation of rural communities in tourism, improving awareness among rural communities about potential opportunities, strengthening basic skills and knowledge, training the trainers, providing support for entrepreneurs, and others. An assessment[145] by JNU indicated gaps in these areas.

c. Waste management: The State is plagued by the unseemly sight of piled up garbage in prominent tourist spots including backwaters and seashores. During the floods, heaps of garbage were deposited back on the riverbanks. Disposal of these wastes was highly problematic. In general, waste management needs to be improved in order to prevent further degradation of the environment and reverse the negative impact on eco-tourism.

d. Quality control in tourism services: Quality of services has been identified as an area of concern by tourism officials. At a time when the growth in foreign tourist arrivals slow down[146], this has serious implications. An added factor is the emergence of Colombo as a competing tourist destination. GoK has initiated a set of measures to rate/categorize services (such as houseboats), check unseemly practices such as overcharging, and introduce waste collection mechanisms to ensure hygiene.

e. Infrastructure: Finally, infrastructural issues significantly affect the growth potential of the tourism sector. Uncontrolled construction, poor road infrastructure and frequent traffic jams, restrict movement and cause hardship tourists. The State also witnesses frequent agitations hamper free movement.

2. Microenterprises

GoK's impetus in microenterprise development is driven primarily through the Kudumbashree initiative. Kudumbashree is a community organization of more than 4.5 million plus women members organized in over 277,000 Self Help Groups (called Neighbourhood Groups (NHGs). Kudumbashree supports over 30,000 microenterprises[147] in diverse fields such as food processing, handicrafts, cosmetics and so on. While Kudumbashree has made substantial contributions to strengthening resilience of Kerala's marginalized women, going forward, the following issues merit consideration for enhanced economic resilience of Kudumbashree enterprises and members.

a. Need for financial management skills - While Kudumbashree provides a range of support services[148] for its entrepreneur members, studies[149] indicate that many Kudumbashree entrepreneurs face challenges in running their businesses due to difficulties in managing scarce capital, diversion of capital for non-economic/domestic purposes and inefficient financial management. Kudumbashree entrepreneurs also require skill building in other functional skills such as production, inventory management, marketing etc.

b. Need for mentorship - Majority of the Kudumbashree enterprises are run by poor women with little business or marketing acumen. Kudumbashree entrepreneurs require mentorship at strategic points

[145] http://www.krishisanskriti.org/vol_image/04Jul201504074359%20%20%20%20%20%20%20%20%20Philip%20Varghese%20%20%20%20%20%20%20%20%20%20%20%20%20%20612-616.pdf

[146] http://www.newindianexpress.com/states/kerala/2018/jun/08/a-plethora-of-problems-plague-keralas-tourism-sector-1825161.html

[147] https://rural.nic.in/sites/default/files/Kerala%20-%20PRC%202017%20Meeting.pdf

[148] http://thekudumbashreestory.info/index.php/programmes/economic-empowerment/enterprises/enterprise-promotion

[149] http://www.innovativejournal.in/index.php/jbme/article/download/1687/pdf_76/

in their entrepreneurial journey, including in areas such as making business plans, investments/business expansion, diversification, new product/service development, and so on.

c. Market development: Kudumbashree enterprises currently get a good marketing platform through the monthly fairs/markets. In order for entrepreneurs to move beyond local markets, they would require support across the entire value chain, including in branding, business development, quality control, market info, and so on.

3. Medium and Large Industries

Although manufacturing contributed only 7.5% to Kerala's GSDP, this sector employed approximately 14.0% of the State's total workforce in 2011-12. In comparison, the manufacturing sector's shares in GDP and employment were 15.8% and 13.0% respectively at the national level. This points to some degree of lop-sidedness in the structure of Kerala's manufacturing sector, especially the inability of firms to grow in size and/or specialisation.

Medium and large industries in Kerala face some major issues. Studies have shown that the roots of Kerala's industrial backwardness lie in the nature of industrial investments from the 1930s. These investments, mostly into chemicals-producing industrial units, were built on the short-term advantage of cheap hydroelectricity and locally available raw material. However, the growth of chemical industry in Kerala was constrained by the shortage of electricity from as early as the 1950s, as well as by problems of environmental pollution and the high cost of land. All these factors have led to a small and less-diversified industrial sector in Kerala. The nature of federal financial relations in India allowed only limited degrees of freedom for the State Governments with respect to intervention in industrial development.

Lack of availability of land for large manufacturing projects is a key constraint for industrial growth of Kerala. The quantity and quality of physical infrastructure in Kerala has also been as an impediment to industrial growth in the State. According to a recent assessment by the GoI's Department for Promotion of Industry and Internal Trade (DIPP), Kerala was ranked 20 (below other Southern States) out of 29 States in terms of Ease of Doing Business. There are frequent occurrences of general strikes or harthals organized by political parties.[150]. These strikes and harthals result in the loss of a substantial number of working days, causing adverse impacts on the growth of industry and tourism in Kerala.

4. Livelihood options for Marginalized Groups

There are a number of social security schemes and programmes envisioned in past years for improving the quality of life of the SC and ST population. However, their effectiveness is questionable. There is need to evaluate the suitability and implementation effectiveness of these schemes and incorporate corrective measures. The share of Kerala in the total export of marine products from India is falling, in terms of quantity and value. Inland fish production is an area which holds promise for future in Kerala, however, the same is yet to take off in a big way. This is further discussed in the Fisheries section.

[150] There are no official estimates of the number of general strikes. But according to an unofficial source, as many as 363 harthals were called either for the entire state or in specific regions during the seven-year period 2005 through 2012. See Henderson, Tony, Pressenza, http://www.pressenza.com/2012/09/india-363-hartals-in-7-years-in-kerala/ (accessed on November 22, 2016). Given the fact that a significant number of mandays are lost due to these harthals, it is high time that the Labour Bureau start documenting it.

Considering the fact that all these three sectors taken together adds up to less than 10 lakh families, it is possible to ensure a secure livelihood and social security cover for all these families. However, this would require a focused and committed action programme involving:

- Detailed demographic profile study of these families, filtering out the educated and employable, members requiring employment training and skilling and the families requiring partial or full social security /palliative care. This may be done through an IT enabled system ensuring fast data collection and processing as well as development of personal profiles for future traceability and follow up.
- Setting up a socially committed and motivated mission mode intervention for ensuring appropriate employment for all the educated and employable persons and providing training and skilling of based on aptitude for all those who aspire the same.
- Existing institutions should add modules on life-skill training with a focus on youth and vulnerable women, as well as for expansion of skills for currently employed/employable, giving specific focus on these marginalized segments of population. Existing material on industrial training should be upgraded to create skills to contribute to a green economy.
- Students to be ensured special skilling to face challenges of the new world, enabling them to become confident to merge with the main stream. Such trainings may be carried out in the public institutions (by ensuring adequate reservations) for doing away with inhibitions of the participants and mismanagement/exploitation in the implementation system. This may be made part of the co-curricular activities in all public schools.
- Integration of existing schemes and devise new schemes to bridge the gaps and putting in place an effective implementation system for ensuring a universal income scheme. Availing the social security cover may be made simple using modern technology tools and establishing online single window portals with accountability, traceability and transparency. This may also include establishing a single window Facilitation Centre in every Local Body for dissemination of information on the various schemes, follow up of all applications, ensuring effective delivery of the assistance and periodic monitoring of the results.

4.11.4 Proposed Approach to resilient rebuilding

To support and mitigate the losses and damage due to floods in employment and livelihood sector, a comprehensive action plan is needed. In the context of extensive loss of livelihoods in the State, the approach would primarily focus on restoring, promoting and developing the lost livelihoods and ensuring employment of the most vulnerable and marginalized communities and sections. The key livelihood/ employment categories considered in resilient rebuilding are:

- Farm livelihoods
- Off-farm livelihoods (livestock, poultry, fisheries etc)
- Non-farm livelihoods (Manufacturing, Trading and Service enterprises, including tourism, MSME, Kudumbashree etc)
- Informal/ unorganized sector workers, wage labour
- Skilled labour

Among the above categories, the farm and off-farm livelihoods are part of the agriculture and allied sectors and fisheries; and therefore, not separately addressed under the livelihood plans. While designing the recovery plan for Kerala, the mission is to establish a three-phased approach, wherein immediate

actions are carried out first, followed by medium term and long-term action plans. This approach will ensure continuous recovery and sustainable development over a five-year period. The recovery vision of Build Back Better needs to be rooted in environmental sustainability, cost effective technologies, green job creation, skill development, climate resilient livelihoods via decentralized planning and social cum gender inclusion for Nava Keralam.

The immediate short-term measures for the recovery would be aimed at mitigating the losses suffered by the most vulnerable segments such as MGNREGS job card holders, SC/ST, fisherfolk and disabled, informal workers, petty traders, women JLGs & micro-entrepreneurs etc. Assisting them via providing additional paid work days, grants, subsidies and loans (with interest subvention) such that they recoup the loss to their assets, capital and incomes is a key element in restoring their livelihoods. Continuing providing additional wage employment to address 2.05 lakh MGNREGS job card holders would be a key part of this initiative. These can be linked with infrastructure restoration, water and land resource management. Self-employed informal sector personnel, Joint liability groups and micro-entrepreneurs, vulnerable to post-flood scenarios would also be given special compensation packages, which could be a combination of grants and low-interest loans. Capital recovery/subsidy and loans for income losses would be undertaken to aid sections of workers such as artisanal households and other such sectors. Policy level interventions that facilitate the effective functioning of livelihood ventures, enterprises and placements would also be part of the short-term measures.

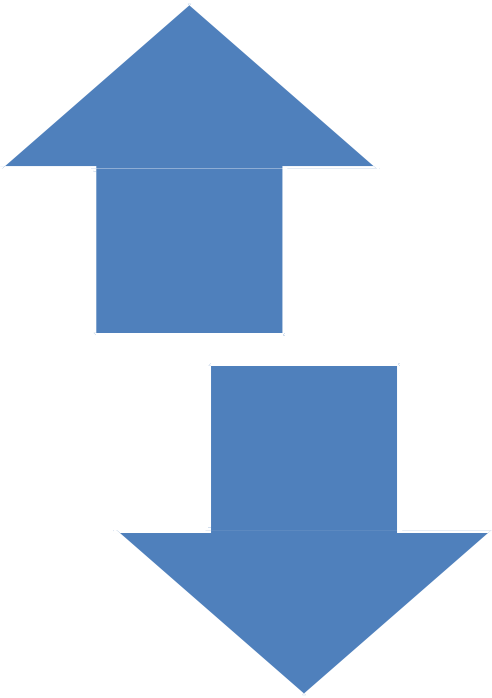
In the medium term, the focus would be on strengthening livelihoods, self-employment avenues and skilling initiatives. This would involve new programmes to support vulnerable groups and communities to upgrade their skills, start self-employment ventures (nano and microenterprises, especially in trading and services sector), and bridge the weaknesses in their functioning via institutional and handholding support. The medium-term interventions would be area and sector specific.

The long-term measures will involve disaster, climate and livelihood governance through active participation of stakeholders at the grassroots level. Livelihood action planning at the grassroots is envisaged by effectively integrating all the available resources and matching them to the most vulnerable, after taking into consideration their skills and capabilities. Such livelihood action plans would be able to converge the possibilities of MGNREGS, Kudumbashree and sectoral schemes. Besides, long term initiatives would also include creating institutional mechanisms for building value chains, forward & backward linkages and systems for livelihood projects, cooperatives, producer companies, traditional industries (such as handloom, khadi and coir). Product innovation, market development and skill development need to be carried out in the longer term to strengthen livelihoods sustainability. An estimated total of Rs. 2213.41 crore, Rs. 1311.25 crore and Rs. 371 crore will be required for the recovery needs in short term, medium term and long term respectively. Overall, the total recovery needs for the sector is estimated to be Rs. 3895.66 crore.

There is the potential to establish a Section 8 Company floated by Kudumbashree. This would be a market-facing arm – led by a professional which will be responsible for the marketing of women's enterprise products, leveraging technology, enabling access to commercial finance, etc. similar to the work that MoRD has already done and/or establishing a women's bank (owned and managed by Kudumbashree members).

Within tourism, a two-pronged approach is proposed, focused on (a) reconceptualizing the 'Responsible Tourism' policy framework for disaster preparedness (b) Enhancing community share in tourism spend for economic resilience. (see figure below).

Figure 42: Two-pronged approach for Tourism Sector



1. Reconceptualizing 'Responsible Tourism' policy framework for disaster preparedness

- Disaster management planning for key cultural, religious sites
- Business continuity planning
- Revision of accreditation criteria of tourist enterprises
- Risk informed site selection of hotels, resorts, other buildings
- Improved enforcement of environmental norms
- Crowd-sourced methods to track illegal constructions
- Capacity building of tourism sector employees

2. Enhancing community share in tourism revenue for economic resilience

- Productive alliances between tourist enterprises and community microenterprises / groups
- Creation of marketing spaces for local handicraft units in tourist enterprises
- Promotion of experiential tourism and thematic tourism concepts along lines of Kumarakom experience
- Skill and awareness building among rural communities

4.11.5 Specific Interventions

In line with the proposed approach, the following time-bound interventions/activities have been identified:

Table 48: Livelihoods Actions and Results Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Policy / Regulatory				
Policies for leased land cultivation that addresses aspects such as rehabilitation, issues of land ownership, leased land regulations, decent wages and insurance.	X			Policy framework developed for leased land farming that would help the farmers on leased land be resilient to future disasters; as also address various challenges that they currently encounter in enhancing their farm-based livelihoods.

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Development of Livelihood Action Plan (LAP) at Panchayath levels Institute a system for developing robust LAP at the level of local bodies. The LAP would have Kudumbashree CDS Action Plan, MNREGS and other sub-sector plans integrated into it and would also be based on the needs and capabilities of the vulnerable sections of the community.	X		X	The LAP leverages and converges all possible resources available at the local body across various programmes, schemes agencies and sectors. The LAP matches the plans to the neediest of the community.
Revisit GoK's 'Responsible tourism' policy framework to incorporate disaster and climate risks.	X			- Disaster management planning undertaken for cultural, heritage and religious sites - Business continuity plans developed for state-owned institutions - - Revised accreditation criteria for tourist enterprises that includes disaster resilience, including disincentives for further risk-creation by tourist enterprises - Risk-informed site- selection and design of hotel buildings and other infrastructure, especially in newly emerging landslide- prone areas - - Crowd- sourced website/app to track illegal constructions launched

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Revisit policy framework for microenterprises to include: - Making available more marketing spaces - Productive alliances with national/global retailers, exporters and other institutions - Better financing avenues - Leveraging government schemes for buy-back - Strengthened supply chain linkages with local tourism industry - Improved adoption of modern technology - Improved compliance to global standards	X			Comprehensive enabling environment for micro-enterprises
Institutional Implementation				
Address the loss of livelihoods of the most vulnerable communities such as SC/ST, fisher-folk and disabled by restoring their livelihood assets via grants after assessment and verification	X			Lost livelihood assets of the most vulnerable communities are fully restored by way of grants.
Enhance income security and address the loss of employment opportunities in the aftermath of floods by continuing to provide additional workdays and job cards to wage labourers under Employment Guarantee Schemes.	X			
Provision of an additional 50 work days under MGNREGS to be extended for FY 2019-20 as	X			Rural and urban poor receive an additional 50 days of paid wage

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
well. The guidelines under Ayyankali EGS to be modified to provide urban poor with additional paid work days of 50 days for the FY 2018-19.				labour under MGNREGS & Ayyankali EGS.
Address the loss of livelihoods suffered by workers and self-employed in the informal sectors through financial assistance. Identify and enumerate workers in this category. Targeted interventions with the focus on socio-economically and culturally marginalised and the differently abled. Special focus on tribal communities. Closely linked with the SC/ST department	X	X X X		Unorganized/ informal sector workers such as street vendors, push cart owners, hawkers, self-employed semi-skilled/skilled workers, etc. recover lost capital and are compensated for income lost.
Provide livelihoods opportunities to the poorest individuals by means of enabling them to start very low capital (nano) enterprises by means of a livelihood start-up programme. Design and implementation of a livelihood start-up programme for assisting individuals start nano-enterprises with subsidized investment at below Rs. 50,000. This programme is to be developed along the lines of Start-up Village	X X			Poorest individuals in the unorganized sector supported to start nano enterprises as petty traders, street vendors, vegetable vendors, hawkers, mechanics etc.

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Entrepreneurship Programme (SVEP) under NRLM				
Establish a 'Crisis Management Fund (CMF)' for micro-entrepreneurs and women JLGs engaged in leased land farming. CMF would be provided to the flood impacted women livelihood ventures based on the extent of losses incurred (as discerned through an ABC classification).	X			Women Leased Land Farming groups (JLGs) & micro-entrepreneurs belonging to Kudumbashree, Theeramythri, Women Development Corporation etc. that have suffered losses receive financial assistance that help them revive their livelihood activity as also recoup the income losses suffered during the floods.
Assess the feasibility, suitability and required features of a micro-insurance programme that would insure livelihood ventures from various hazards and calamities.	X			A study report that assesses the feasibility and features required for introducing a micro-insurance programme that covers the risks faced by livelihood ventures.
Capacity building of Tourism Department and the tourism and hospitality sector for disaster risk management planning, including early warning and evacuation as well as business continuity planning	X			Improved preparedness for disaster events. Improved ability to resume business / activities post disaster events.
Improve the success rate of livelihood initiatives & micro-enterprises by positioning effective mechanisms for their sustained handholding & incubation. Microenterprise Resource Centres (MRCs) are established at Southern, Central and Northern regions of the State wherein Micro-	X			-

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
enterprises may avail specialized services such as packing, branding, quality assurance, appropriate technology, procurement and marketing support. A Mentor Network for Micro-enterprise support is established at district level for providing continued hand-holding to micro-entrepreneurs during start-up as also operations. The mentor network would comprise of sector-specialists from farm (agriculture), off-farm (livestock, poultry, fisheries) and non-farm sectors; as also functional-specialists in procurement, production, sales & marketing, compliances etc		X X		
Leverage E-commerce platforms to promote entrepreneurship.	X			Young entrepreneurs are able to reach new markets and customers.
Develop Comprehensive ICT system/MIS with dashboard to track and monitor all producers/ artisans/ Kudumbashree entrepreneurs to improve targeting of support services and provide proactive support		X		Improved last mile delivery of government schemes Online mentorship system Improved targeting of financing, and other support services
Investment Items				
Enhancing economic resilience of traditional sector livelihoods	X			Traditional and artisanal enterprises are able to transition partly from focusing on low value-added traditional products

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Establish a design and product development centre to develop new designs & products based on contemporary designs and market demand. Strengthen the traditional sector livelihoods in handloom, coir, Khadi etc. by addressing their key challenges in increasing revenue and profit.		X	X	for the mass market to the luxury segment/ export markets. This would help them increase profitability and sustenance.
Strengthen livelihood projects by formation of effective value chains and forward & backward linkages. Support in developing export markets for NTFP like Honey Building linkages between the Coir workers and Dept of Environment/ LSGD/ Forestry for promoting geo-textile-based embankment protection Set up a company based on PPP model that would support livelihood projects, SMEs, traditional sector industries, producer companies and Cooperatives to undertake specialized functions such as Sales, Distribution, Marketing, exports, procurement, etc. effectively.	X	X X	X	Livelihood projects, Co-operatives, Producer Companies, Handloom, coir & other traditional enterprises would be able to generate greater business volumes, jobs and income by forming effective linkages, especially in weak functions such as marketing. The private partner would be provided a subsidy for ensuring a mutually agreed return on investment, if the initial business volumes do not ensure the same.
Skilling for enhancing employability	X			Provide new livelihood opportunities in areas such as: - restoration of natural capital

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Address employment of unskilled personnel by: a) Promoting skill upgradation of labour to take up jobs in newly emerging sectors such as those involving green technologies b) Formation of labour service cooperative which can provide services to households or institutions, along the lines of SEWA. b) Designing and operationalizing a new self-employment scheme for starting micro-enterprises with capital below Rs. 10 lakhs in the trading or service sectors		X		- Construction of embankments - Construction of eco-friendly buildings using low carbon foot print materials The self-employment scheme would help unemployed persons to start trading or service enterprises with a relatively low capital. It would fill the current gap of the State not having micro-enterprise schemes for males in the trading and service sectors.

4.11.6 Technical Studies and Assessments

The list of studies to be carried out to support the above policy, institutional and investments activities is provided below.

Table 49: Livelihoods List of Studies

List of studies	0-6 months	0-18 months	18 months & beyond
Policy			
Developing different risk transfer packages: Insurance scheme for providing an end product-based insurance coverage to all sectors of farmers, that could be formulated leveraging the modern technology tools and global best practice models.		X	
Study of informal sector-based livelihoods	X		
Scoping study for understanding existing and emerging livelihood opportunities under various departments and sectors	X		

HRVA of Tourism sector		X	
HRVA of nano- and micro-enterprises		X	
Assessment of key government schemes, effectiveness, gaps and impact		X	
Assessment of private sector main points that dampen investment, propose strategic investments and mechanisms for better private sector participation		X	
Institutional			
Organizational assessment of key apex institutions (E.g. Spices board / Dairy development institutions etc)		X	
Other			
Value chain resilience studies of key Kerala product categories			
Assessment of key government schemes, effectiveness, gaps and impact specifically covering the issues involved in the special educational facilities and skill development institutions being implemented for the SC, ST and Fishermen communities and evolving suggestions for intervention and improvement	X		
Carrying out a study and listing of the fishermen families who are likely to be affected by loss of fishing waters due to the ongoing expansion of inland waterways and devising and effective programme for their livelihood rehabilitation through development of inland fisheries based on ponds, quarry ponds and other waterbodies.[151]		X	
Designing the indicators for the formulation of a Universal Income Scheme, that would ensure a steady income job / social security cover for every household among the SC, ST and Fishermen communities.		X	

151 To be considered as part of Fisheries Sector; mentioning here for comprehensiveness of addressing the issues and planning of interventions.

4.12 Sector: Land

4.12.1 Introduction

Kerala is characterized by an asymmetrical topography. Its landform is dominated by undulating, subdued hills and steep scarp slopes, and its altitude ranges from below mean sea level to 2,694 meters above mean sea level. The State has three distinct elevation zones known as the lowland, midland, and highland regions. The State is extremely densely populated averaging 890 people/sq. km, and thus it is understandable that there is a high demand for land. Additionally, Kerala's high vegetation density and widespread tree canopy cover, as well as seasonal rains and heat waves pose challenges to land surveys and mapping.

4.12.2 Impact of 2018 floods

Status of Land Records in the floods impacted areas of Kerala: 379 of the 983 directly impacted villages of the foods have only historical mapping on land holdings dating back commonly to 100 years. Thus, the land holding maps (also known as revenue maps and later cadastral index maps) for these 39% of all floods-impacted villages are grossly out of date, kept and maintained in paper and cloth, and are commonly in unsatisfactory condition. Also, in these areas the records kept by the Department of Registration and the Record of Rights kept by the Revenue Department most commonly differ in content.

These out of date, incoherent and manual land records cause an impediment for the relocation and compensation of those who lost their assets and shelter. Incomplete and out of date land records also impede the ability to reconstruct and improve infrastructure due to unclear land tenure and insecure access to land.

4.12.3 Major Legacy and Current Issues

In Kerala, land records keeping is fragmented and while progress has been made in connecting the records, their data on land ownership differ. Registration of deeds are kept by the Department of Registration, and a Record of Rights by the Revenue Department, and the Field Book (i.e. a cadastral map) by the Survey and Land Records Department. Land rights related litigation dominates courts in Kerala stemming in part from the blind registration process that allows registration of deeds without verifying the property details or existence of previous deeds on the same land parcel. Also, a large percentage of land transactions between 1947 and 1967 have not been registered and vast State Land areas are being encroached to an unknown, but significant extent. In result, cadastral mapping is grossly outdated statewide requiring a resurvey in 46 % of Kerala's close to 1,700 villages and in 39% of villages directly impacted by the floods.

4.12.3.1 *Land Administration System in Kerala*

Kerala's land administration system is fragmented and contains incoherent information. The Department of Registration registers property transaction deeds in the Deeds Registry and collects 2% of the transaction value as a Registration Fee and 8% as a Transfer Tax. This makes it the third largest source of revenue in the State after the Sales Tax and Excise. Common issue of under declaration of transaction prices is mitigated by an area-based valuation system that defines 'Fair Values' for properties, which

constitute the minimum applicable values for the Stamp Duty and Registration Fees collection. The deeds registration process is blind to the title chain per transaction making it vulnerable to frauds. In practice, the Deed Registry does not have all the Deeds as the Stamp Duty and Mutation fees have in part incentivized informal property transactions.

The Department of Revenue through its village offices maintains the Record of Rights. It was established by the British for the collection of agricultural taxes but has evolved into the de facto Cadastre of the State, containing land parcel and land holder information. The Record of Rights is considered the most up-to-date land record in the State. However, it does not have legal value and it does not confirm the Title to land.

The Department of Survey and Land Records maintains a Field Book i.e. individual survey plans of each land parcel in Kerala. These plans are linked to the Record of Rights through Map Sheet and Parcel Numbering. After registering a transaction to the Register of Deeds in case of a subdivision, the new owner applies for a Mutation to subdivide the old parcel to two or more parcels and survey them to the Field Book and to the Cadastral Index Map. However, often the owners do not proceed with the Mutation request and the Field Book (and thus the Cadastral Index Map) does not get updated. Large numbers of Mutations are pending, which undermines the value of the Field Book. As a result, the Cadastral Index Map is less up to date than the Record of Rights, which the village officers of the Department of Revenue maintain directly based on first-hand information on land use and occupancy.

Around half of villages in Kerala have reasonable standard land registry maps available. The Cadastral Index Map which is compiled from the Field Book (which consists of individual legal parcel maps established in Mutation surveys) by the Department Land Records and Survey has been scanned for 828 villages. The individual maps and records have not been scanned, and they are stored in indexed archives, often without climate or dust control. Many maps are in a bad or poor condition to an extent that their digitization would need to precede with conservation. Historically, updating of Kerala's land records seized in 1947, and was revived in 1964 with a programme of Cadastral Resurveying. Currently, 901 villages have been resurveyed and the Record of Rights and the Cadastre Index Map are in a workable standard, but still maintained in paper format and in local (rather than National) coordinate systems. The State has a statewide Three-Order Geodetic Network connected to Survey of India's National Coordinate Network. However, many old cadastral surveys were done in a local coordinate system and have not been georeferenced to the National System. New surveys are being carried out by GPS to the WGS -84 global coordinate system. Estimated 763 villages need a full new survey for modernization, and about 100 villages have been completed to the new standard established for digital era surveying.

It is notable that the surveying accuracy requirements in Kerala are of a very high standard in global comparison, which in part may have contributed to pending resurveys. However, a possible justification is provided with the high demand on land in Kerala, and the fragmented and small land parcel structure. The State is extremely densely populated averaging 890 people/sq. km, and thus it is understandable that there is a high demand for land, and great level of attention to the land boundary details. Surveying in Kerala conditions is hard in general. Widespread canopy coverage over boundaries make satellite image-based surveys less efficient than commonly elsewhere, and the long rainy season is a major disturbance to field surveys.

Land rights related litigation dominates courts in Kerala, stemming in part from the above described challenges and in particular from the Deeds Registration system that allows registration without verifying the chain of title on the land parcel in question. Also, as described, a large percentage of land transactions between 1947 and 1967 have not been registered, and vast State Land areas are being encroached to an unknown but significant extent, causing property disputes. Property valuation infrastructure is also weak, particularly due to outdated valuation system and challenges with access to reliable land market

information (as transaction values are commonly under-declared) causing litigation, for example related to land acquisition compensation. However, there is also substantial amount of land related litigation that simply relates to occupancy and boundary disputes. While progress with updating and integrating land records will have a direct positive impact to land related litigation, complementary investments are required. Solid step forward is achieved with investing in mass valuation systems using the improving land records and registered transactions as the base data. Gradual steps towards a more market-based valuation infrastructure will reduce compensation-based litigation and improve fairness and equality between landholders in taxation and land acquisition, and subsequently improve the currently slow land acquisition speed. Another common problem is that local courts tend to lack expertise to settle land ownership, boundary or land compensation cases. Evidence suggests that technical land disputes should not be left to clog the court systems. They should be solved initially at an administrative level and be subject to court ruling only if parties disagree with the administrative solution. Global evidence also suggests that local courts are not always capacitated to handle land and property disputes. Many countries have made use of particular Lands Tribunals, or other specialized courts to handle land and property disputes, while the land administration system has yet to reach a full level of maturity.

4.12.3.2 *Land Records Modernization*

Kerala implements the Digital India Land Records Modernization Programme (DILRMP), which is part of the Digital India Policy that aims to making government services available to citizens electronically by improving Internet connectivity and making the country digitally empowered in the field of technology. The DILRMP guides States to invest in land records as the base for all development including infrastructure investments, planning, construction, revenue generation, and jobs and growth. The DILRMP modules include of (1) Computerization of Land Records, (2) Survey/ Re-Survey, (3) Computerization of Registration, (4) Modern Record rooms, and (5) Training/GIS/Legal FW/Programme Management. These investments stand comparison to international best practice, in particular when coupled with institutional reforms that make land authorities operationally sustainable. While Kerala has made solid progress in implementing DILRMP, resources have been inadequate for completing the job in particular related to the re-survey of records and creating a fully digital system. There is a lot of international experience and knowledge from countries with successful land registration programs that could help Kerala and other States in in completing and integrating land records and cadastral maps statewide with an increased efficiency and speed.

Progress with the Comprehensive and Digital Land Administration System in Kerala. The initial stage of DILRMP with computerization of Record of Rights and the computerization of Deed Registry indices have been completed for the most part, and records are interlinked to a single point of entry accessible by village offices. In more details, the Register (Index) Books have been digitized (back to 30 years) and 92% of register books have been linked online to the Record of Rights of the Department of Revenue. No access is provided to the Field Book or the compiled Cadastral Index Map. Positively, information requests and few other electronic service requests to the Deeds Registry can be processed online. However, this constitutes only an index level digitalization rather than digitalization of the entire system, and the information between the records is not harmonized due to multiple reasons explored above. The paper-based processes of property transactions, registration of deeds and updating of revenue records are continued, and the document archives have not been digitized at all, and they are often not securely maintained. The village offices work and maintain paper Revenue Records and the Field Book. The registered Deeds (that are physically required for each transaction) and other archived documents have not been digitized. True digitization of land administration system will only be achieved when the digital processes and records replace paper-based processes. In terms of process streamlining for enhancing

transactions, the use of licensed document writers for drafting Deeds of Sale have been made voluntary and corresponding document templates have been made available to public online.

4.12.4 Proposed approach

Secure tenure is the key for reducing vulnerability and risks. The more secure, formal and reconcilable the rights and systems are, the less vulnerable the land users are for eviction or loss of livelihoods in the case of a disaster. Comprehensive and secure land records offer critical protection of rights when population is displaced by a disaster. Therefore, investment to secure tenure is a direct investment to disaster recovery and resilience. In addition, secure tenure and comprehensive land administration systems increase investments to dwellings, which reduces risks and improves resilience through better siting and construction of buildings. Comprehensive land records and covering information on land leads to improved understanding of risks and evidence-based land use planning and land management. For example, it helps directs housing and occupancy to areas of low hazard exposure. The most vulnerable households are those that rely on access to land with temporary and insecure tenure. These include sharecroppers, farm laborers, and informal settlers. Apart from the dwellers, economic activities also require similar protection. Legal security of tenure allows claims on land and property to be validated easily and underpins the return and restoration of pre-disaster activities. Vulnerabilities increase with women, children, the elderly and those with disabilities. Minorities may be vulnerable due to past discrimination in securing tenure, i.e. in regularizing their land occupancy.

Land and geospatial information plays an important baseline and development platform role at the forefront in all Disaster Risk Management phases: Geospatial information is critical to disaster prediction (simulation and visualization), prevention, preparedness and mitigation, emergency response, evacuation planning, search and rescue, shelter operations, and the post-disaster restoration and monitoring. A comprehensive and resilient land and geospatial system also secures the quick recovery of economic activities by providing accessible and instant data on the impact, the value of losses, and the beneficiaries, as well as the levels of appropriate compensation and required recovery investments.

Land administration systems including legal land registers (properties, rights, owners, lessees, lessors), legal and fiscal cadastres (real properties, land parcels, buildings, parts of buildings, fixtures, users and land and property values), and register and cadastral maps, provide an important repository of pre-disaster land use, property assets and land occupancy, which provides the base for estimating damage, loss and economic impact, as well as eligibility for support, return and/or compensation. Land administration systems' relevance to resilience correlates with their ability to deliver their base duty of securing tenure. Systems' reach is improving in urban areas and with properties of value, but the world's poor still rarely have access to legal security of tenure increasing their vulnerability also in the occasion of disasters.

4.12.4.1 *Interventions*

Kerala State needs to unify and complete its land records and maps for improved resilience. Apart from sheer upscaling of investment in resurveys, success with land records requires institutional and operational integration and programme to complete and update land records systematically across Kerala. Major resilience impact is achieved by prioritizing resurvey and records updating to villages in most vulnerable areas to disasters. More concretely, 379 villages require full resurveying in the past floods impacted areas, and another 384 elsewhere state-wide for an advanced state of land records in 50% of villages in the State. In areas with new survey completed during past few decades the records are better

up-to-date, but require integration, interlinking, updating, digitalization and modernization. Integration can be progressed primarily along two main lines of progression a) technically and b) institutionally. Eventually, modern land records and maps would desirably be fully integrated technically through a unified Land Information Management System that brings together the Department of Registration's Deeds, and the Record of Rights and Field Book by the Department of Revenue through interlinked digital databases allowing service provision and data provision proving clients joint access point and services an online updating of all three records. Technical integration is commonly a first step towards also legal and institutional integration, which in Kerala would bring together the land records and land record operations of the Department of Registration and the Revenue Department to a single land registry and map of Kerala. Eventually this could lead into the creation of a new single authority on land registration, cadastre and cadastral surveys i.e. the Kerala Land Agency.

The State has made a good effort in implementing the land records modernization with constrained resources. Investments to land information systems under the Bhoomikeralam project that preceded the Kerala Land Records Modernization Mission interlinked the Department of Registration's and Revenue Department's record indices together. This revolutionized access to information between the two departments. The Kerala Land Records Modernization Mission is set to take the next step of digitalizing and interlinking the records, archives and processes themselves creating a true digital land administration system. However, achieving in concrete state-wide an integrated, digital, and up-to-date land records and cadastre system would require a programmatic investment of scale as well as rational process, technical and institutional reforms. Also, a regulatory reform will eventually be needed to replace manual land registration practices with digital processes eventually allowing fully digital access and services, even electronic conveyancing. The pending Kerala Land Administration and Management Act of 2017 would create a single land records system to Kerala and introduce an incremental transfer to a conclusive land titles system in the State. The Act is eventually needed, but technical integration, resurveys, digitalization and electronic web-based services should not wait for the ideal legal basis. Rather, progress with land records modernization will make the case for the eventual and full legal reform on land administration. It will be an investment well worth making. An investment in land records modernization and in the land sector bears potential for a high impact intervention. Increased security of tenure, digitized and accessible records and maps that provide a repository of information on property assets, their values and owners and allow land tenure sensitive informed decision making, master planning and construction implementation will have a dramatic positive impact to resilience in Kerala.

Progress with land related litigation will require also investments to judiciary and valuation infrastructure. Parallel investments to mass property valuation systems should follow the land records modernization investments. Resilience impact would be maximized by investing in areas to disaster prone areas where future disasters will potentially direct compensation cases, land acquisition and infrastructure investments. Revenue impact easily offsetting the investment will be achieved by focusing initially to high market demand urban centres and most valuable property segments, such as to commercial properties. Land records updating and completion is a prerequisite for a comprehensive valuation system capable of assessing all recorded properties annually. A lands tribunal approach could also be considered for removing backlogs of land cases in local courts. Lands tribunals tend to be periodical investments that are needed in the evolution of land administration systems when records, infrastructure and services are incomplete and litigation stems from this incompleteness. Land tribunals tend to become redundant when the land records modernization and completion progresses. Kerala could consider a 10 – 20 years investment to a Lands Tribunal approach where specialist judges and land administrators would efficiently adjudicate land disputes.

Challenges are sizeable, but doable with a concerted and programmatic effort. Consequently, the creation of the Kerala Land Records Modernization Mission for enhancing DILRMP implementation and completing comprehensive and modern land records to Kerala is a critical step towards improving security of tenure for multiple benefits. Importantly, the creation of the mission and making progress with DILRMP has a direct impact to resilience and reduction of vulnerability. The more secure, formal and reconcilable the rights and systems are, the less vulnerable the land users are for eviction or loss of livelihoods in the case of a disaster. Comprehensive and secure land records and tenure offer critical protection of rights when population is displaced by a disaster. Therefore, securing tenure directly contributes to rapid disaster recovery and resilience of vulnerable households. In addition, secure tenure and comprehensive land administration systems increase investments to dwellings, which reduces risks and improves resilience through better siting and construction of buildings. Comprehensive land records and covering information on land lead to improved understanding of risks and evidence-based land use planning and land management that guides siting of vulnerable land uses such as housing in areas of low hazard exposure.

Once complete the land records will have multiple social, growth and revenue impacts, and allow protection of rights in the moments of disasters and allow informed responses after the disasters. Valuation infrastructure improvements are among the most important direct opportunities improving infrastructure investment implementation and recusing litigation.

4.12.5 Specific Interventions

Table 50: Land Actions and Results Framework

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Policy /Regulatory				
Adoption of the Kerala Land Administration and Management Act.		X		Unified Land Register and Cadastre System in Kerala.
Institutional				
Operationalization of the Kerala Land Records Mission unifying the land records and registry map work of the Department of Revenue, Department of Land Records and Surveys, and the Department of Registration. Creation of a costed and timed programme for completing land records modernization in Kerala with components for (1)	X			Adoption of a programmatic approach for completing the land records and maps in Kerala.

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Computerization of Land Records, (2) Survey/ Re-Survey, (3) Computerization of Registration, (4) Modern Record rooms. In the mid-term the Digital Land Records and Cadastral Index Maps will become integrated to the broader Electronic Governance system of the Kerala State including Geospatial Data Infrastructure with Base Maps and Satellite Images, Land Use Maps, Land Use Plans and Zoning Data, as well as Census Records, Legal Entity Records, Address Records etc. This will create a situation where the general public has access to all relevant information prior to making investments. This will change the investment scenario of Kerala Functional/institutional merger of the land registry and cadastre records and services in Kerala. Functional review of the current land administration system for consideration of a fee based, or private public partnership based, Kerala land agency.		X X	X	
Investment Planning				
Land registration and cadastral mapping needs assessment, and business process review. ICT system design, process reengineering; Digitalization assessment and plan; Mass survey and registration campaign piloting. Implementation of: Deeds, Field Book, cadastral map and record of rights systematic digitalization An integrated land information and management system in Kerala.		X	X	Comprehensive land records and maps in Kerala, initially covering the most disaster risk parts of Kerala. Gender disaggregated data on land ownership and transactions Digital and accessible land

Activities	0-6 months	0-18 months	18 months & beyond	Expected Outcomes
Systematic campaign for land records modernization in the most disaster risk parts of Kerala. Mass valuation system development and piloting. Lands tribunal needs assessment.				administration system and services accessible online

4.12.6 Technical Studies and Assessments

Table 51: Land List of Studies

List of studies	0-6 months	0-18 months	18 months & beyond
Policy			
Valuation infrastructure, land acquisition, land litigation, property taxation studies.		X	
Institutional			
Functional review of the current land administration system for consideration of a fee based, or private public partnership based, Kerala land agency.		X	
Investments			
Technical Assistance: - Needs assessment, and business process review - Business process reengineering - ICT System and Digitalization - Land Records Completion and resurveys	X		
Investment programme on: - Digitalization - ICT system implementation - Land records completion and resurvey - Valuation infrastructure and systems - Land related litigation		X	
Others			
Preparation of an inventory of land parcels (listing out the locations, boundaries, extent, land type, present ownership, land use etc) owned by various Government Departments and Agencies.	X		

Chapter 5: RKDP Financing, Institutional and Implementation Arrangements

5.1 Financing Needs Summary

As noted previously, a JRDNA was conducted by GoK, with support from the ADB and the World Bank, covering 12 sectors and all 14 districts in the State which were affected by the floods and landslides to varying extents. The JRDNA was complemented by a more PDNA, led by Government and supported by the United Nations. The assessments estimated that total damages and losses to be around Rs. 26,720 crore (see the table below) and total recovery needs at around Rs. 31,000 crore. Infrastructure sectors like transportation, water, sanitation, power and irrigation were the most affected and have the largest recovery needs, followed by social sectors[152], productive sectors and crosscutting sectors.

Table 52: Overview of Disaster Effects and Recovery Needs

Sector	Damage	Loss	Total Effect (D+L)	Total Recovery Needs
	Rs. crore	Rs. crore	Rs. crore	Rs. crore
Housing, Land and settlements	5027	1383	6410	5443
Irrigation & Water Resources				1483
Water, Sanitation and Hygiene	890	471	1361	1331
Integrated Water Resources Management				24
Power				353
Transport				10046
Health and Nutrition	499	28	527	600
Agriculture, Fisheries and livestock	2975	4180	7155	4498
Livelihoods	881	9477	10358	3896
Education and Child Protection	175	4	179	214
Disaster Risk Reduction	17	583	599	110
Natural Environment & Biodiversity	26	0.04	26	148
Cultural Heritage	38	37	75	80

Source: Kerala Floods 2018 PDNA

Note: (i) The values have been rounded so the totals may not match.

A preliminary analysis of RKDP priorities yield a total outlay of Rs. 36,506.88 crores for a period from 2019 to 2027 (see the table below). These are initial estimates of investment needs in critical sectors noted in the table below. This list is by no means comprehensive. For example, there are sectors such as fisheries,

[152] Social sectors include Housing, Land and Settlements, health and nutrition, education and child protection, cultural heritage. Productive sectors include agriculture, fisheries and livestock.

environment and livelihoods which have not been included in these estimates and will be assessed subsequently. Within the assessed sectors also, the estimates are based on the following criteria:

- Critical priorities in the most flood- and landslide-affected areas;
- Projects and investment estimates shared by the respective departments;
- Projects and investments that are relatively shelf-ready or have been vetted previously; and
- Projects that have significant positive impacts on the poor, vulnerable, women and children

Table 53: Summary of Investments required for Rebuilding Kerala

Sector	Implementing agency	Investments required in Rs. crore			Total in Rs. crore
		Short term	Medium term	Long term	
Rural Roads	LSGD	247.94			247.94
Urban roads		86.90			86.90
Roads in Municipal Corporations	Municipal Corporations	7.53			7.53
State Highways & key feeder roads	Public Works Department	986.62	295.20	717.80	1,999.62
Water Resources Management	Water Resources Department	435.00	2,036.89	2,100.00	4,571.89
Rural Water Supply	Kerala Water Authority	470.00	9,488.00		9,958.00
Urban Water Supply	Kerala Water Authority	3,584.00	1,495.00	4,300.00	9,379.00
24x7 water supply in MCs	KWA+ Municipal Corporations	555.00	2,235.00		2,790.00
Urban Sanitation	KWA+ LSGIs	356.00	1,479.00		1,835.00
Urban & Rural Sanitation	KWA+ LSGIs	746.40	2,985.60		3,732.00
Agriculture	Dept. of Agriculture	1,035.00	665.00		1,700.00
Animal Husbandry	Dept of AH	199.00			199.00
Grand Total		**8,709.39**	**20,679.69**	**7,117.80**	**36,506.88**

Short Term = 2019-2021/22
Medium term = 2021-2023/24
Long term = 2024-2026/27

The success of RKDP is contingent on having a sound financing strategy to meet these requirements, especially considering the fiscal challenges that Kerala faces in the short term.

5.2 Kerala's Macroeconomic Fundamentals

Kerala has enjoyed respectable economic growth. Real Gross State Domestic Product (GSDP) has grown by approximately 5.8 percent on average between FYs 2011-12 and 2016-17 slightly (below the 7.0 percent average for Indian states), although it has risen to 7.4 percent in the two most recent years (FY16/17 and FY17/18). The structure of Kerala's economy has changed significantly over the past decade, with the share of agriculture in gross value-added falling from around 18 percent in FY 2004-05 to 11 percent in FY 2016-17, and the shares of industry and services increasing from 23 and 60 percent to 26 and 63 percent respectively over the same period. Inward remittances provide a significant source of financing for Kerala, which received almost 20 percent of all remittance inflows to India (Rs. 396,200 crore) in FY 16/17. Within services, tourism is a key subsector, accounting for 10 percent in the state's GDP.

Kerala can further tighten its fiscal discipline. After some improvement over FY02/03 to FY10/11, Kerala's fiscal performance deteriorated from FY11/12 onwards, with the fiscal deficit crossing the 3 percent mark that year and remaining above it in all subsequent years thereafter. This deterioration was primarily driven by gradual increases in committed expenditure (especially on salaries and subsidies) and, in FY16-17 (when the deficit reached 4.3 percent) particularly by the implementation of the 10th pay revision and the clearance of large contingent liabilities. Kerala stands out, among comparable states, in terms of both (low) own-revenues and (high) committed expenditures to GSDP. Although the state adopted a Fiscal Responsibility and Budget Management (FRBM) Act in 2003, (including an amendment, which came into force in April 2017 mandating the state to maintain a fiscal deficit of no more than 3 percent of GSDP during the period from FY17/18 to FY19/20), this was of little practical effect. In FY17/18 the fiscal deficit stood at 3.3 percent of GSDP, and revised budget estimates for FY18/19 have put it at [3.1] percent.

Total revenues have risen, but so have expenditures. On the revenue side, own-tax revenues, have been stable over the last five years, averaging 6.8 percent of GSDP (accruing primarily from the sales tax and VAT, excise duties, motor vehicle tax and land revenue, as well as SGST since 2017) while the state's share in central taxes increased significantly in FY15/16 to account for over a fourth of total tax revenues. By contrast, non-tax revenues increased over the last decade from 1.7 percent of GSDP to about 3 percent of GSDP thanks to increases in both state own non-tax revenues and grants in aid from the centre. Overall, funds received from the central government have risen from an average of 2.6 percent of GSDP over FY06/07 to FY15/16, to at least 4.0 percent from FY 2016-17 onwards, to make up approximately 31 percent of total state revenues. Similarly, however, total expenditures also increased steadily over the past decade. During this time, expenditures ranged from 12.6 percent of GSDP in FY09/10 to 16.4 percent in FY17/18. Current expenditures, which account for more than 90 percent of the total on average, have increased since FY10/11 from 11.3 percent of GSDP to 14.8 percent in FY17/18. The main reasons for their rise, especially in FY17/18, include the implementation of the 10th pay revision, and the distribution of social security pensions and long pending arrears. In turn, committed expenditures[153] accounted for the lion's share of current expenditures (approximately 63 percent on average over the past 10 years). Capital spending, whose share in total expenditures has traditionally been low, stood at 1.5 percent of GSDP in FY17/18, much below the national average of 3.0 percent of GDP.

[153] Whch includes salaries, wages, pensions, subsidies, interest payments and devolution to local self-governments

Figure 43: Fiscal Indicators (% of GSDP)

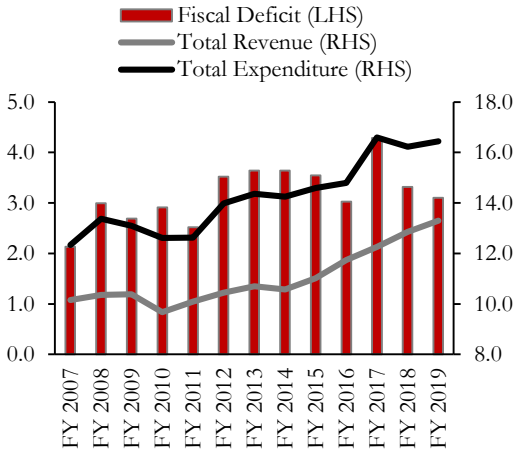


Figure 44: Deficit and Debt Dynamics

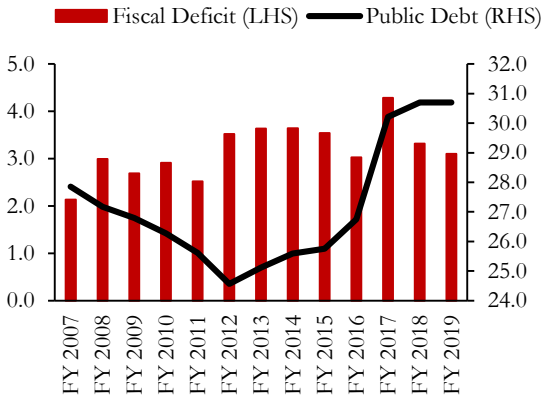
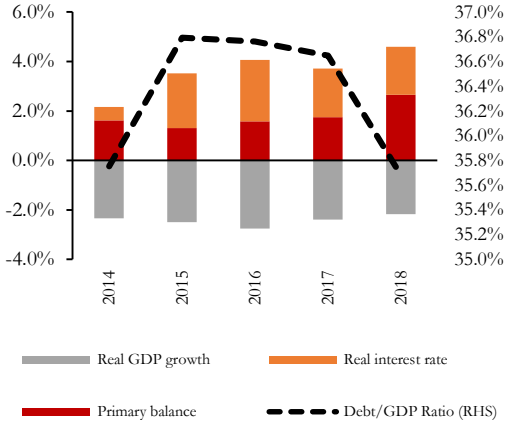


Figure 45: Contributions to Changes in Debt/GSDP



As a result, Kerala's public debt has been gradually increasing as a percent of GSDP. Public debt declined continuously between FY07/08 and FY11/12, but rose rapidly thereafter, due to (i) relatively low GSDP growth, (ii) relatively high deficits, and (iii) a rise in borrowing costs. While the public debt/GSDP ratio increased by two percentage points, from 24.6 percent in FY11/12 to 26.7 percent in FY15/16, it shot up to 30.2 percent in FY16/17. It stood at 30.7 percent at the end of FY17/18 which is marginally above the target of 30.4 percent of GSDP prescribed by the state's FRBM (2017-18 amendments), and significantly above the 25 percent level recommended by the 14th Finance Commission.

5.3 State Government Macroeconomic Outlook and Debt Sustainability

As per pre-flood projections, Kerala's fiscal position was expected to improve steadily over FY18/19-FY20/21. The improvement was expected to result from the combination of:

a) subdued expenditure growth: with virtually flat ratios of capital expenditure as a share of GSDP (from 1.5% in FY17/18 to 1.6% by FY20/21) and only slowly increasing recurrent expenditures as a share of GSDP (from 14.8% in FY17/18 to 16% by FY20/21), entirely because increases in non-committed revenue expenditures;

b) relatively significant gains on the revenue side, with revenue receipts projected to increase as a share of GSDP by almost two percentage points (from 12.9% in FY17/18 to 14.7% by FY20/21)

As a result, the, fiscal deficit was projected to decline gradually from 3.3 % in FY17/18 to just above 3 percent in the following year and 2.9% by FY20/21.

Under that baseline scenario, and assuming robust nominal growth, Kerala's debt trajectory was projected to decline steadily by FY21/22. Specifically, the debt to GSDP ratio was projected to decline from 30.7 percent in FY18/19 to 28.1 by percent by FY22/23. The decline was expected to be driven in equal measures by a favourable growth interest rate dynamic and by reductions in the primary deficit.

Under an alternative scenario that considers flood impacts, debt increases before declining again. If we model the impact of the flood as resulting -relative to the baseline- in higher primary deficit and lower nominal growth levels over FY18/19 to FY21/22 the debt to GSDP ratio increases initially from 30.7 percent in FY18/19 to 31.35 percent in FY20/21 before returning to a declining path and falling below current levels by FY22/23.

Thus, Kerala's macroeconomic policy framework is considered broadly adequate. With respectable economic growth and gradual fiscal consolidation, the debt/GSDP ratio is expected to fall over the medium term. The positive medium-term outlook, however, is subject to several downside risks, and its realization is contingent on sustained economic growth, improvements in revenue collection, and continued efforts at fiscal consolidation.

Figure 46: Kerala Fiscal Indicators under Baseline Scenario

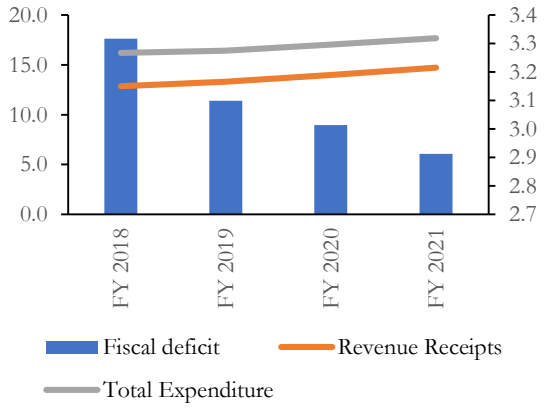
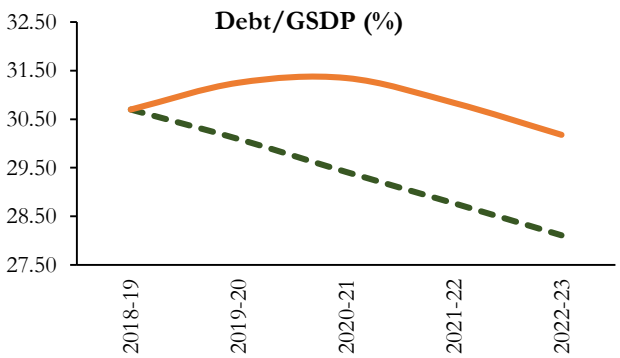


Figure 47: Debt Dynamics under the Baseline and Alternative Scenarios



5.4 Financing of RKDP

Funds necessary for implementing RKDP will be raised from multiple sources:

- State Budget — plan and non-plan allocations, including assistance from multilateral agencies (World Bank, AIIB and ADB), bilateral agencies (KfW, AFD, JICA, etc.)
- Central government natural disaster assistance for meeting expenditures which conform to modalities prescribed by GoI
- Flood cess - amounting to 1% of the GST on select goods and services for a period of 2 years
- Additional allocations under Centrally Sponsored Schemes
- Deployment of Flexi-Fund under Central Government Schemes
- Crowdfunding
- Mobilisation through CMDRF
- NABARD Funding through NIDA
- HUDCO and other loans
- Private and non-traditional sources of institutional and retail financing, including Masala bonds, Diaspora bonds and other private sector sources of financing

5.5 Challenges of Financing RKDP

There are financing challenges for RKDP that the State Government will have to continually keep resolving as it moves along the execution trajectory for the programme. Given the level of committed expenditures in the State, one major issue that is being discussed extensively within GoK, is the lack of fiscal space for the State to borrow.

No doubt, the task before Government to implement RKDP is quite formidable but not insurmountable. The State's Gross Domestic Product (GSDP) is estimated to be Rs.8.75 lakh crores (US$ 126 billion). Against these figures, the 3% limit for the State's borrowing works out to Rs. 25,000 crores (US$ 37.8 billion).

One of the most preferred routes for market borrowings for all States are Development Loans (SDLs) permissible under RBI guidelines and regulated by it. These are dated securities issued by states for meeting their market borrowings requirements and meet their budgetary obligations. The limit for borrowing under State Development Loans is determined by RBI. SDL securities are eligible securities for Statutory Liquidity Ratio (SLR) and Liquidity Adjustment Facility (LAF) of the RBI. Hence institutions like Banks have an appetite for investing in these instruments. The SDL securities issued by states are credible collateral for meeting the SLR requirements of banks as well as a collateral for availing liquidity under the RBI's LAF including the repo. SDL is a market-oriented instrument for states to mobilise funds from the open market. The yield for the SDL borrowings of any State corresponds to the fiscal rating that a State has. RBI facilitates the issue of State Development Loans securities in the market. SDL securities are more preferred by State Governments to loans mobilized or bonds issued by state government entities. The RBI as the facilitator to the issue of SDLs, has the power to make repayments to SDLs out of the central government allocation to states. Thus, there is no credit risk attached to SDLs.

Every year, GOI specifies the limits of a State for its overall borrowings at 3% of the State Domestic Product. Included in this are a range of instruments including the SDLs, RIDF allocations through NABARD, loans from LIC/GIC, NCDC borrowings etc. But more significantly from the perspective of RKDP, the limit includes the amounts availed under Externally Aided Projects (EAP) also.

The right of GOI to grant permissions arises from Article 293(3) of the Constitution, which makes it mandatory for State Governments to have the permission of the Central Government to raise fresh loans and the right of GOI to set conditions for this is derived from Article 293(4) of the Constitution.

Prior to August 2017, GOI would set these limits in respect of the total loans that were to be availed by the State Government in each year. But, from that date onwards, GOI introduced the practice of allowing only residuary amount left after setting off the amounts that a State Government had accumulated in its Public Accounts. Unfortunately, this has had the effect of GOI extending its hold on the management of the Public Account of the States, even as Article 293 referred to the control on loans alone. The Public Account created by the Constitution, thus, has for all States lost its potency as an effective buffering mechanism to help States in their fiscal management. Not only are the loans availed by a State Government forced to stay within the '3% of GSDP limit' but, with this push on the Public Account, the Gross Fiscal Deficit (GFD) (less the Capital Receipts of Government) too are also pushed under this limit.

All this creates an imminent risk for RKDP. Unless, the EAPs for rebuilding the State under RKDP are kept outside the 3% limit, the State's efforts to rebuild and reposition the State post the floods and increase its post-flood resilience, will be stymied.

The arguments for why EAP funding to Kerala is critical at this juncture of its economic history, following the August 2018 floods, is obvious. The requirement of resources needed for rebuilding the State and its economy in the aftermath of the floods is colossal. There would be no area more eligible than post-disaster rebuilding, in which international assistance at concessional or reasonably priced rates can be most effective. While a State like Kerala manages its own budgets quite effectively, the fact remains that it does not have sufficient funds for focused interventions in areas like transportation, water resources, agriculture, sanitation, urban waste handling. It is such kind of interventions with specific infusions of funds and human resources that can enable the State to make a quantum jump required to propel a flood affected State of Kerala to a higher orbit of sustainable economic development.

In short, effective utilisation of international financial support in delivering public goods in developing countries and that too in a State like Kerala in the wake of this natural calamity cannot be over emphasised. Many public goods and services do not lend itself to private investment. Their return economic rate is not well defined and private investors are often not willing to venture into such uncertain terrain. External Assistance can be an effective substitute for private capital here, providing funds for investment in public goods at rates that are more favourable to the borrowing entity than what is available in the domestic and international financial markets. Hence, if, through proper design of external assistance programmes, it can be ensured that spending in unproductive activities are eliminated, then such assistance is a big source of strength and support for a region finding its way back after facing a natural calamity. One danger of frittering away external assistance is to entrust execution to governmental agencies which do not have the necessary technical or administrative skills and use it inappropriately. That, is the main reason that capacity building of human resources along with upgradation of standards, as outlined in the previous chapters, are identified as core priorities under RKDP.

As against a budgeted increase of 23.86% in the State's Own Tax Revenue for 2019-20, early growth trends in own tax revenue for the month of February - April 2019 indicate likelihood of significant shortfall in the State's own tax revenue for the year 2019-20. To a considerable extent, this would reflect the persistent deleterious effect of the August floods on the economy of the State. This will directly manifest itself in lower consumption spending which will further impede the recovery and growth of the economy. This will, over 2019-20, translate into a more pronounced increase in revenue deficits, unless swift countervailing measures for expenditures are introduced through RKDP. Given these considerations, it is

even more important that the rebuilding efforts of the State tap into all possible sources of External Funding through EAPs.

Putting constraints on availing EAPs would exacerbate the effects of the floods and decelerate the process of recovery set in motion by Government. If EAPs, as part of RKDP is to be set off against the total borrowing limit and consequently restricts SDL, then this would result in weakening the State at a time when it needs such assistance most. The argument relates to a distinction between the use of SDLs and the use of advances from EAP. SDLs are free cash which can be used to meeting budgetary deficits. EAP advances on the other hand, are tied to specific programs and projects. Setting off EAP advances against the total gross borrowing limit to allocate the SDL quota to the State Government, directly results in constraining the free and untied cash flow of Government. This would have very heavy consequences on the budgetary management of the State.

If, for financing of RKDP, it becomes necessary to make inroads into the regular budgetary financial allocations for ongoing development and administrative expenditure of the State, then the development outcome may be quite contrary to what is envisaged as the goal under RKDP. The erosion of the normal expenditure programmes of the State would lead to the weakening of State's ongoing development – an outcome that is antithetical to the very philosophy under RKDP. This will further make the goal of holistic development of the State - where the principles enunciated under RKDP, as explained in this document, will be absorbed into planning and policies in Government and will through RKDP, permeate into and strengthen the very fabric of public institutions – more difficult.

The State Government has already appealed to GOI for keeping EAPs under RKDP outside the purview of the State's borrowing limits. The State will have to tenaciously continue its efforts to drive home its case.

5.6 Analysis of RKDP Financing from a Public Finance Perspective

Since the crux of the decision around RKDP will be the availability of fiscal space for GoK, it becomes necessary to examine this in detail. In building a model to do so, one has to rely on several basic assumptions for reasons that are evident. A model, as is often said, is an abstraction of reality or a representation of a real object or situation. Given the numerous econometric parameters required for a more rigorous approach, a very simplified approach has been used for assessing the fiscal space for the State to accommodate RKDP. These assumptions are shown in the Table below.

Table 54: Fiscal Assumptions to Accommodate RKDP

Model Assumptions	Rs. (crore)	*USD (billion)*
RKDP Outlay	36500	5
RKDP Outlay (less Budget outlay of Rs.1000 crore in State Budget 2019-20)	35500	4.86
Revenue-Capital Mix in RKDP	40%	
Capex Fiscal Multiplier	2.45	
Revenue Expenditure Fiscal Multiplier	0.99	

These assumptions are explained below:

1. The overall budget requirement for RKDP will be of the tune of Rs. 36,500 crore (approx. 5 Billion USD) as approximately identified in this document. Out of this Rs. 1000 crore has been budgeted in the Annual Budget of GoK for 2019-2020.

2. The Revenue-Capital Mix under RKDP will obviously undergo a great deal of refinement and assume more finality over the projects design phase of RKDP. For this analysis, it assumed that 40% of all RKDP expenditure will be revenue in nature while the rest will be capex.
3. One of the constraints for developing a more accurate model, is that there no authentic forecasts of the State's public finance over the next five years. The only official record is the Medium-Term Fiscal Plan, presented along with the State Budget. This document presents at a three-year period from 2019-20 to 2021-22. These official estimates were disaggregated, and each item modelled using a simple two-year Moving Average forecast building on the growth estimates in the official figures themselves. While, this simplistic approach cannot boast of any academic rigour, it does yield a fair understanding of the shape of the public finances in the next six years over the life of RKDP.
4. For estimating the impact of Government expenditure under RKDP, a simple approach of using impact multipliers (both for revenue expenditure and capex) is adopted (Source: "Fiscal Multipliers for India" Sukanya Bose and N. R Bhanumurthy, National Institute of Public Finance and Policy, New Delhi, May 2014).
5. One of the crucial assumptions for developing such a model is that the growth of the State Budget will be in line with historical trends. The rest of the fiscal space will be available for accommodating the expenditure requirements under RKDP. This means that the State's Annual Plan will continue to grow at historical rates, and will cede the extra space for growth it would need to accommodate RKDP.
6. The Revenue Expenditure under RKDP will be assumed to be higher during the early years and then tapers off towards the end of the implementation period.
7. The Capital Expenditure on the other hand, is assumed to peak towards the middle of the implementation period and then tapers off towards the end of the implementation period.
8. Another assumption is that the repayment liabilities because of RKDP, will devolve on the State Government after the expenditure horizon of RKDP. For purposes of this analysis, the post RKDP impact on State Debt is not considered here.

Four scenarios have been analysed. The four scenarios assume that RKDP will be implemented almost fully over three, four, five and six years respectively. It is also assumed that there will be spillovers of 30%, 25%, 20% and 10% in the project implementation. This means that under Scenario I, with a spillover of 30%, it would mean that only 80% of the project would be completed during the assumed expenditure horizon of three years. Likewise, for Scenario II, III and IV the extent of completion within the assumed expenditure horizon of 4, 5, and 6 years would be 75%, 80% and 90% of the total RKDP, respectively. This is shown in the Table below.

Table 55: Scenario Analysis

SCENARIO	I	II	III	IV
RKDP Expenditure Horizon (Years)	3	4	5	6
% RKDP spent during the horizon period (Rest being spillover or projects that are non-starters)	70.00%	75.00%	80.00%	90.00%

Under each scenario, the incremental increase because of RKDP, in two important fiscal parameters viz. Revenue Deficit to Gross State Domestic Product (RD/GSDP) and Fiscal Deficit (FD/GSDP) are computed over each year of the horizon period.

The Tables showing the relevant data for each scenario are presented below:

Table 56: Scenario I (RKDP Implemented Over 3 Years)

	2019-20	2020-21	2021-22
RKDP Year Wise Expenditure	15.00%	45.00%	40.00%
RKDP Rev. Exp. (Yr. Wise Spread of Rev. Expenditure)	50.00%	30.00%	20.00%
RKDP Cap. Exp. (Yr. Wise Spread of Capex)	40.00%	40.00%	20.00%
Baseline RD/GSDP	1.00%	0.61%	0.78%
Baseline GFD/GSDP	3.00%	3.00%	3.00%
Incremental increase in RD/GSDP Ratio due to Rev. Expenditure in RKDP	0.08%	0.15%	0.09%
Incremental increase in FD/GSDP Ratio due to Capex in RKDP	0.10%	0.29%	0.13%
Revised FD/GSDP with RKDP	3.18%	3.44%	3.22%

Table 57: Scenario II (RKDP Implemented Over 4 Years)

	2019-20	2020-21	2021-22	2022-23
RKDP Year Wise Expenditure	15.00%	25.00%	40.00%	20.00%
RKDP Rev. Exp. (Yr. Wise Spread of Rev. Expenditure)	30.00%	30.00%	30.00%	10.00%
RKDP Cap. Exp. (Yr. Wise Spread of Capex)	25.00%	30.00%	30.00%	15.00%
Baseline RD/GSDP	1.00%	0.61%	0.78%	0.67%
Baseline GFD/GSDP	3.00%	3.00%	3.00%	3.03%
Incremental increase in RD/GSDP Ratio due to Rev. Expenditure in RKDP	0.05%	0.09%	0.14%	0.02%
Incremental increase in FD/GSDP Ratio due to Capex in RKDP	0.06%	0.12%	0.19%	0.05%
Revised FD/GSDP with RKDP	3.12%	3.21%	3.33%	3.10%

Table 58: Scenario III (RKDP Implemented Over 5 Years)

	2019-20	2020-21	2021-22	2022-23	2023-24
RKDP Year Wise Expenditure	10.00%	20.00%	30.00%	20.00%	10.00%
RKDP Rev. Exp. (Yr. Wise Spread of Rev. Expenditure)	20.00%	30.00%	30.00%	15.00%	5.00%
RKDP Cap. Exp. (Yr. Wise Spread of Capex)	15.00%	20.00%	25.00%	25.00%	10.00%
Baseline RD/GSDP	1.00%	0.61%	0.78%	0.67%	0.71%
Baseline GFD/GSDP	3.00%	3.00%	3.00%	3.03%	3.05%
Incremental increase in RD/GSDP Ratio due to Rev. Expenditure in RKDP	0.02%	0.07%	0.11%	0.04%	0.01%

Incremental increase in FD/GSDP Ratio due to Capex in RKDP	0.03%	0.07%	0.14%	0.09%	0.02%
Revised FD/GSDP with RKDP	3.06%	3.15%	3.25%	3.16%	3.08%

Table 59: Scenario IV (RKDP Implemented Over 6 Years)

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
RKDP Year Wise Expenditure	10.00%	20.00%	20.00%	20.00%	10.00%	20.00%
RKDP Rev. Exp. (Yr. Wise Spread of Rev. Expenditure)	30.00%	25.00%	15.00%	15.00%	10.00%	5.00%
RKDP Cap. Exp. (Yr. Wise Spread of Capex)	15.00%	20.00%	25.00%	20.00%	10.00%	10.00%
Baseline RD/GSDP	1.00%	0.61%	0.78%	0.67%	0.71%	0.67%
Baseline GFD/GSDP	3.00%	3.00%	3.00%	3.03%	3.05%	3.08%
Incremental increase in RD/GSDP Ratio due to Rev. Expenditure in RKDP	0.04%	0.07%	0.04%	0.04%	0.01%	0.01%
Incremental increase in FD/GSDP Ratio due to Capex in RKDP	0.03%	0.08%	0.10%	0.08%	0.02%	0.04%
Revised FD/GSDP with RKDP	3.08%	3.15%	3.15%	3.15%	3.09%	3.14%

The Table below shows the maximum FD/GSDP ratio reached because of RKDP. As is obvious, the shorter the implementation horizon, the higher is the fiscal deficit going to be.

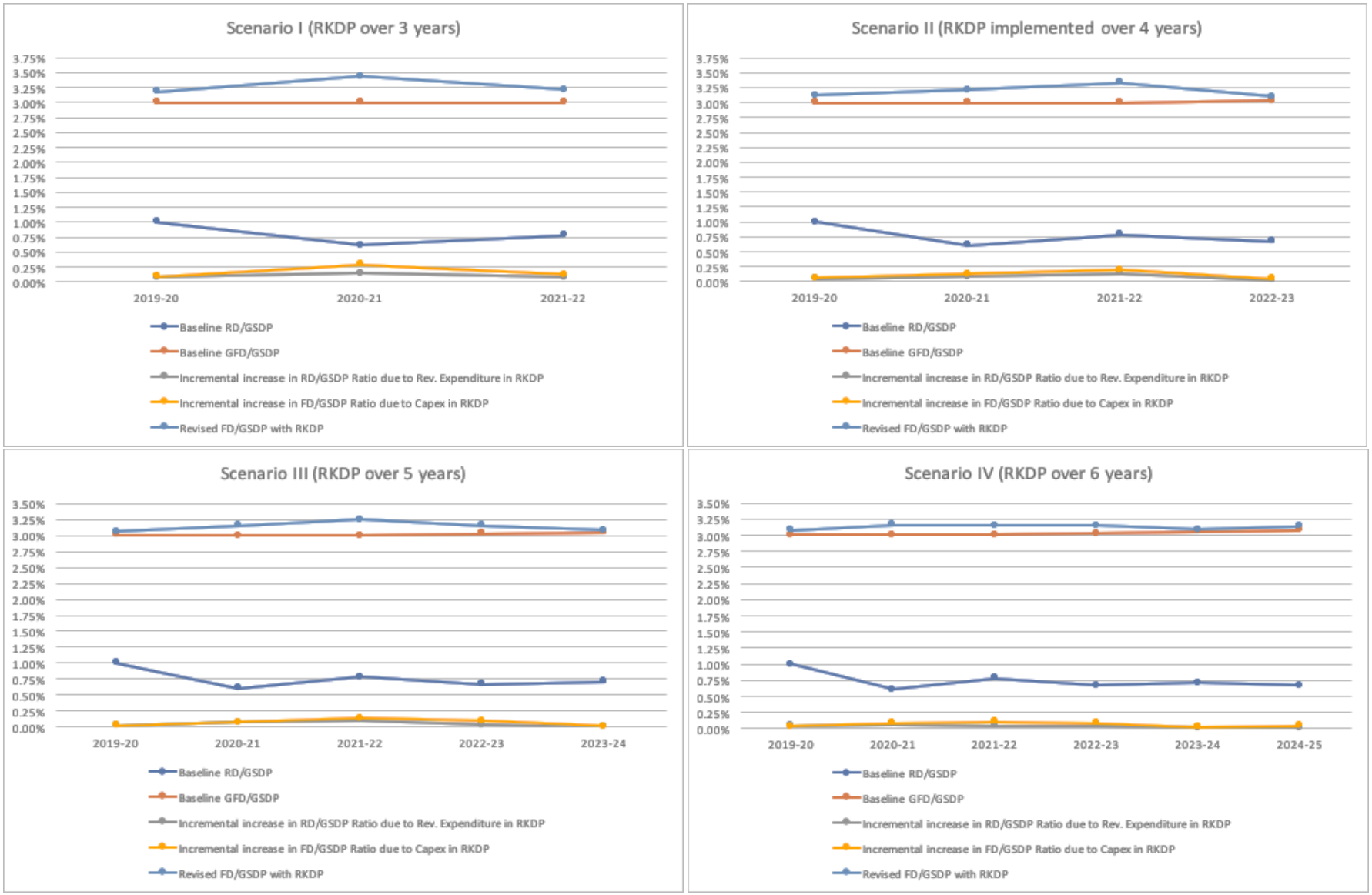
Table 60: Maximum FD/GSDP Ratio due to RKDP

Scenario	I	II	III	IV
Expenditure horizon (years)	3	4	5	6
Max FD/GSDP	3.44%	3.33%	3.25%	3.15%
Year in which Max FD/GSDP occurs	2020-21	2021-22	2021-22	2020-21

But what follows from the above analysis is, that under a carefully chosen financing strategy from among the implementation scenarios analysed, the Gross Fiscal Deficit of the State consequent to RKDP, can be kept within reasonable bounds.

The following graphs indicate the fiscal position of the State under the four scenarios discussed for implementation of RKDP.

Figure 48: The Fiscal Position of the State under the Four RKDP Implementation Scenarios



5.7 Partnership with Development Partners

The State of Kerala has a long history of working with a diverse set of Development Partners. These partnerships have been of tremendous value for the development of many sectors in the State (Roads including Rural roads, Water Supply, Skills etc.) A brief outline of the current and active Development Partners of the State and some of the new partners that could be of immense help to the success of RKDP are outlined below.

World Bank (WB)
Formed in 1945 and headquartered in Washington D.C., the World Bank Group works in every major area of development. It is one of the world's largest sources of development financial and knowledge/technical assistance for developing countries, and is committed to reducing poverty, increasing shared prosperity, and promoting sustainable development. The World Bank has been working in Kerala for well over a decade, and its projects span Hydrology, Coastal Management, Dam Rehabilitation, Cyclone Risk Mitigation, Water Supply, Sanitation, Power, Urban Services, Transportation, Agriculture, Livelihoods, Governance, Education, Health and Nutrition, and Forestry. With over 30 projects in the country, the World Bank has a history of deep engagement with the State.

Asian Development Bank (ADB)
Founded in 1966 and headquartered in Manila, the ADB is dedicated to reducing poverty in Asia and the Pacific through inclusive economic growth, environmentally sustainable growth, and regional integration. It aims to do so by providing loans, technical assistance, grants, and equity investments to promote social and economic development (some sectors of development include infrastructure, health care services, financial and public administration systems, preparing for the impact of climate change, natural resource management, etc.) Some of ADB's prior investments in Kerala include a Skill Acquisition Program for Schools to increase employability of youth, and Sustainable Urban Development.

KfW (originally Kreditanstalt für Wiederaufbau)
This German government-owned development bank established in 1948 finances and supports programs and projects that mainly involve public sector players in developing countries and emerging economies – from conception and execution to monitoring success. KfW's goal is to help partner countries fight poverty, maintain peace, protect both the environment and the climate and shape globalization in an appropriate way. KfW's work in Kerala includes support to the Water Metro in Kochi, Urban Transportation, and Smart Cities

Asian Infrastructure Investment Bank (AIIB)
Headquartered in Beijing, AIIB is a multilateral development bank that started operating in 2016 with the aim of supporting infrastructure development in the Asia-Pacific region. By investing in sustainable infrastructure and other productive sectors in Asia and beyond, AIIB aims to better connect people, services and markets that over time will impact the lives of billions and build a better future. AIIB currently does not have a presence in Kerala.

Housing and Urban Development Corporation Limited (HUDCO)
Founded in 1970, this government owned corporation in India has experience in providing loans for housing and urban infrastructure projects in India. Borrowers are primarily State Governments and their agencies. HUDCO has provided loans in Kerala supporting Cochin International Airport, Calicut International Airport infrastructure, Kerala State Road Transport Corporation, and the purchase of buses by KSRTC.

Rural Infrastructure Development Fund from NABARD (RIDF)
The Government of India created the RIDF in the National Bank for Agriculture and Rural Development (NABARD) in 1996, to provide loans to State and Panchayat bodies for eligible activities in the three categories of Agriculture and related sector, Social sector and Rural connectivity. RIDF's work in Kerala includes Watershed Development, Irrigation, Agriculture and Rural Development, Rural Roads, Rural Drinking Water, Soil and Water Conservation and Construction of Schools.

NABARD Infrastructure Development Assistance (NIDA)
The Government of India created NIDA within the NABARD in 2010, as a line of credit support for funding rural infrastructure projects. NIDA is designed to fund State owned institutions/ corporations on both on-budget as well as off-budget for creation of rural infrastructure outside the ambit of RIDF borrowing. The assistance under NIDA is available on flexible interest terms with longer repayment period up to 15 years. Kerala Infrastructure Investment Fund (KIIFB) has availed of funds from NIDA already for financing some of its infrastructure projects.

Japan International Cooperation Agency (JICA)
This governmental agency coordinates the official development assistance for the government of Japan. Established in 2013, JICA aims to contribute to the promotion of international cooperation as well as the sound development of Japanese and global economy by supporting the socioeconomic development, recovery or economic stability of developing regions. JICA's work in Kerala includes Water Supply, Non-Revenue Water Reduction, and Forestry.

Agence Française de Développement (AFD)
AFD funds, supports and accelerates the transitions to a fairer and more sustainable world. Focusing on climate, biodiversity, peace, education, urban development, health and governance, AFD teams carry out more than 4,000 projects in France's overseas departments and territories and other 115 countries. In this way, AFD seeks to contribute to the commitment the French Government to support the sustainable development goals.

5.8 Need for a Dynamic and Flexible Financing Strategy

The financing needs for RKDP outlined at this stage and reflected in this document is Rs. **36,506.88 crore (USD.5.25 billion)**. At this stage, these are only thumb-rule estimates. When the Detailed Project Reports (DPRs) are prepared, these are naturally bound to change. Furthermore, at the time of actual procurement of goods and services for the many packages that will finally make up RKDP, the costs are bound to be even further revised, albeit to a smaller extent. Overall currently, it would be safe to estimate that the total requirements under RKDP would range between Rs. 35,000 to Rs. 50,000 crore (USD 5-7 billion).

Given the constraints of how much of this substantial requirement, can be accommodated under the State's Annual Budget either through EAPs and other loans OR financed under the free available resources under the Annual Plan, depends on several factors. The stand of GOI would be a crucial determinant of the State's overall plan to finance RKDP. Therefore, strategically, it would be good for RKI to devise a plan of financing with a mix of budgetary and off-budgetary balancing. Needless to say, the preference would be for budgetary financing of RKDP, given the fact that the institutional and administrative arrangements for off-budgetary routing of funds for development are more onerous.

Given these constraints, RKDP implementation should adopt a strategy that is reasonably flexible and dynamic. It should be one which will evolve over the next two years over which the sources of funds and the requirement of funds are matched progressively.

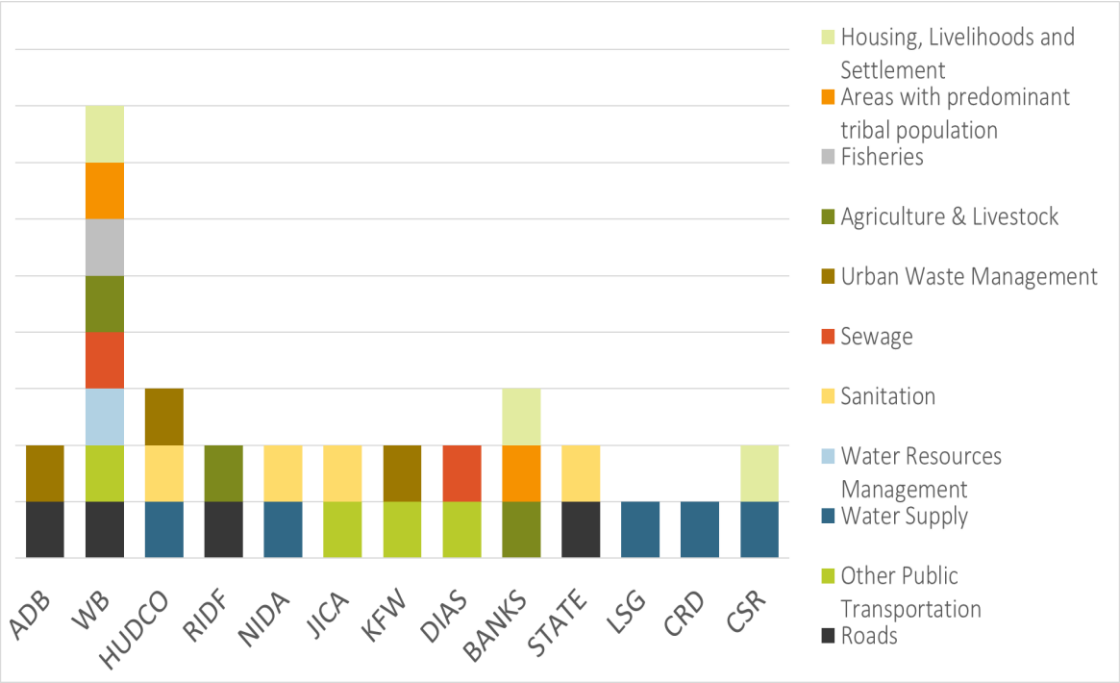
What follows below is a conceptual sequence for the implementation of the dynamic strategy envisaged for RKDP is as follows:

1. Once the RKDP programme document is completed and approved by the High-Level Empowered Committee (HLEC) chaired by the Chief Secretary, it is then placed before the Council of Ministers for approval. Simultaneously it is also circulated to the members of the Advisory Council. Once approved, the proposal is circulated to all potential Development Partners. A broad list of Development Partners whose support will be enlisted is shown above.
2. Development Partner Conclave: This conclave will be a meeting of all potential development partners who have extended a helping hand of partnership and support and new development partners who will be approached for their support for RKDP. The World Bank has been at the forefront in the State during the last few months offering substantial support in terms of very high-quality resource persons backed by involved and committed leadership for drawing up the RKDP program document and for various sector level consultations. The UN Agencies have come together to assist in preparing the PDNA Report as well as coordinate the whole stakeholder consultations on the preliminary draft of the RKDP document. As described above, the State has very strong partnerships with several DPs. Under these partnerships, many projects are in progress and the rest of them have been successfully completed. ADB, kFW, JICA, among others, are some of the prominent DPS. GoK would look forward to the World Bank to bring together all DPs and provide leadership to the Development Partner Conclave.
3. Prior to the Development Partner Conclave, the State Government hopes to initiate discussions with DPs about RKDP. These initial discussions will be led by the Secretaries of the Departments covered under RKDP with the support of Principal Secretary and CEO of RKI. During the Development Partner Conclave, the State Government would seek to get firm support from the DPs as to the areas and sectors in which they would be interested in collaborating under RKDP and the approximate quantum of funding that they will extend.
4. The State Government believes that it would be serious opportunity lost to let the 3% borrowing limit drive the mobilisation of support from DPs. As shown above, GoK will have no doubt to present a credible argument to GoI as to why this fiscal constraint should not be allowed to weigh down the RKDP efforts. Therefore, support from all DPs, should be secured to the maximum extent possible upfront, without being tied down by this constraint. In other words, the emphasis should be on building partnerships and obtaining commitments from DPs for as many as the components under RKDP.
5. Once the mapping of the entire RKDP against likely source of funds from DPs is completed, it will be evident as to what is the extent that must be financed either through the State Budget from its own free resources and what needs to be financed through off-budgetary mechanisms.
6. A funding table with an indicative structure given below, will have to be progressively filled up and updated. These will attain a state of finality only with time when project specific requirements in the various sectors are fully specified and the commitment from Development Partners are firmed up.

Table 61: Funding Structure

Fund source and tentative amounts	Short term	Medium term	Long term
FUNDS ALLOCATED THROUGH THE STATE BUDGET FOR RKDP			
State budget			
RIDF			
World Bank			
ADB			
KfW			
JICA			
AFD			
FUNDS MOBILISED THROUGH OFF-BUDGETARY CHANNELS FOR RKDP			
External Commercial Borrowings			
Masala Bonds			
US Dollar Bonds			
Diaspora bonds			
Domestic Bonds			
NABARD/HUDCO			
Other banks/financial institutions			
Total			

Figure 49: Mapping Development Partner and Sector Financial Sources (illustrating the approach based on the commitments received from the DPs)



NOTE: Diaspora Bonds (DIAS); Term Loans from Banks (BANKS); State Budget Allocations (STATE); LSG Share (LSG); Crowd Funding (CRD); and Corporate Social Responsibility (CSR)

5.9 Determining the Quantum of Off-budgetary Financing

Once the total quantum of finance required for implementing RKDP is identified, the scale of RKDP funding that can be accommodated through the State Budget and the off-budgetary mobilisation of funding required for meeting the residual portion required for RKDP can be assessed.

Budgetary spending of GoK would depend clearly on the fiscal targets that the State intends to impose on itself and the period over which it proposes to implement RKDP. In other words, given a fiscal target, expressed as the Fiscal Deficit to GSDP ratio, the selection of the expenditure horizon, as was discussed above will be a major determinant of the budgetary and off-budgetary financing that should be set as a goal under RKDP.

Two fiscal targets viz. one in which FD/GSDP is set as 3% itself and another in which it is relaxed to 3.25% are taken for analysis. As discussed above, the setting of the fiscal target would firstly, depend on the relaxation that GoI will be willing to extend to the State for RKDP to help restore Kerala's economy back to health and secondly, it would depend on the medium-term fiscal targets that it wants to pursue.

Fiscal Target of GoK: Fiscal Deficit to GSDP = 3%

	I	II	III	IV
Expenditure horizon	3	4	5	6
Off-budgetary funds required (Rs. crore) over the expenditure horizon	8353.68	6828.00	4767.97	3830.08
% of off-budgetary financing needed for RKDP	24.57%	20.08%	14.02%	11.26%

Fiscal Target of GoK: Fiscal Deficit to GSDP = 3.25%

	I	II	III	IV
Expenditure horizon	3	4	5	6
Off-budgetary funds required (Rs. crore) over the expenditure horizon	1860.71	944.04	12.17	0.00
% of off-budgetary financing needed for RKDP	5.47%	2.78%	0.04%	0.00%

5.10 Execution of Off-budgetary RKDP Projects

1. There is a range of Public Sector Enterprises (PSE) in the State, which operate in many of the sectors identified under RKDP. They have been created at some point in the State's development history, when successive Governments in Kerala saw merit in entrusting specific functions to them. These agencies differ from one another in their functioning as well as in their organizational effectiveness and competence. However, these agencies could be one very powerful channel of deploying off-budgetary funds, if they are adequately prepared and guided towards this purpose.
2. Off-budgetary borrowing through a State Agency will succeed only if they are backed by Government Guarantees. The key to the success of fund mobilisation would be these guarantees, as it is expected that a lion's share of the requirements under RKDP would be projects which will not generate self-sustaining revenue flows. Limits on the quantum of guarantees issued by the Government of Kerala is regulated by The Kerala Ceiling on Government Guarantees Act, 2003. GoK would have to, where necessary amend the ceiling limits specified under this legislation to accommodate the borrowing needs under RKDP, from extra-budgetary sources.
3. An illustrative list of public sector agencies with the sectors in which they operate is shown below.

Agency	Sector
Kerala Agro Industries Corporation Ltd	Agriculture
Kerala Land Development Corporation Limited	Agriculture
The State Disaster Management Authority (KSDMA)	Environment
Kerala State Coastal Area Development Corporation Ltd., (KSCADC)	Fisheries

Kerala Forest Development Corporation Ltd. (KFDC)	Forest
Kerala Road Fund Board	Infrastructure (Roads)
Kerala State Construction Corporation Limited	Infrastructure (Buildings)
Roads and Bridges Development Corporation of Kerala	Infrastructure (Roads)
Roads and Infrastructure Corporation of Kerala (RICK)	Infrastructure (Roads)
Suchitwa Mission	Sanitation
Kerala Irrigation Infrastructure Development Corporation Limited	Water Resources
Kerala Water Authority (KWA)	Water Supply
Kerala Rural Water Supply and Sanitation Agency (Jalanidhi)	Water Supply

4. However, many of the above agencies would need further support and capacity enhancement to take up the role of execution of RKDP projects if they must execute works of high quality. Such support should be an appropriate mix of the following:

   a) Establishing individual Program Management Units within each Public Sector agency

   Establish a PMU with adequate high-quality experts in the Sector within the selected PSE in a given sector. The expenditure for this should be charged to the RKDP budget and met from Technical Assistance Grants availed from DPs or through the State Budget.

   b) Building up internal capacity of the selected Public Sector Agencies

   Identify core strength needed within the selected PSE and recruit the necessary personnel expeditiously. The salary and other operational expenses of these units can be met from additional grants to these PSEs from the State Budget made specially for RKDP.

5.11 Raising of Off-budgetary Funds for RKDP

1. The important sources for off-budgetary financing are the following:

a) Borrowing from National Institutions like NABARD (NID), HUDCO

b) Term Loans from Banks

c) Domestic Bonds for Infrastructure

d) International Borrowings in the form of:

(i) Dollar Bonds: These are External Commercial Borrowings (ECBs) availed through Foreign Investment is allowed under the **automatic route** without prior approval of the Government or the Reserve Bank of India, in all activities/ sectors as specified in the Regulation 16 of FEMA 20 (R) or the **approval route** prescribed by GOI and RBI in this regard.

(ii) Masala Bonds: Masala Bonds are also a class of ECBs and are rupee-denominated borrowings issued by Indian entities in overseas markets. The term Masala means

spices and the term was used to give an Indianness as well as a distinctiveness for this financial instrument on international platforms. The objective of Masala Bonds is to fund infrastructure projects in India, fuel internal growth via borrowings and internationalise the Indian currency. KIIFB, one of the body corporates set up by GoK under an Act of the Legislature, has already successfully tapped the international financial markets for funds.

(iii) Diaspora Bonds: These Bonds are an affordable channel for governments to raise funds. Diaspora communities tend to remain loyal to their countries of origin. Debt securities, tailor made for accepting investments from this community, in the aftermath of natural calamities have the potential of earning a "Patriotic discount" where citizens of the issuer country feel encouraged to forego some share of the interest in public interest of rebuilding or restoring their country. Israel has been able leverage on this sentiment and sell bonds to Jewish investors abroad and succeeded as result of patriotism. This class of financial instrument can provide much needed long-term deposits that can be a stable source of currency that can be used for development projects.

e) Domestic Bonds for Infrastructure

2. Mobilisation of off-budgetary financing can be done through the following options:

Option 1:

The **first** option is to utilise the services of existing State Government Public Sector Agencies which have prior experience in raising funds from domestic and international financial markets. A few of such prominent agencies in Kerala under the administrative control of Government are listed below:

Kerala Financial Corporation (KFC): This corporation is incorporated under the State Financial Corporations Act of 1951. It has a long history and was established as the Travancore Cochin Financial Corporation in 1953. Consequent to the reorganization of states on linguistic basis in November 1956, Kerala State was formed and the Travancore Cochin Financial Corporation was renamed as Kerala Financial Corporation. It is a trend setter and path breaker in the field of long-term finance, playing a major role in the development and industrialisation of Kerala. The Corporation is one of the best State Financial Corporations in the country with a competent tech savvy team of professional at the core of services. KFC has now diversified and consolidated its operations and has gone into areas like Bill Discounting for Infrastructure Construction. The agency has a good track record for mobilising investments from financial institutions as well as floating bonds in the domestic markets.

Kerala State Industrial Development Corporation (KSIDC): KSIDC is the premier agency of the Government of Kerala, mandated to for industrial and investment promotion in Kerala. Formed in 1961, KSIDC's primary objective was to promote, facilitate and finance large and medium scale industries and catalyse the development of physical and social infrastructure required for industrial growth in the state. KSIDC acts as a frontline agency of the State in spreading the message of industrial development. Besides, it is also a flagbearer for Government in its programmes to mobilise investments. KSIDC team includes a core group of skilled professionals from various fields like Engineering, Management, Finance and Law. KSIDC has over five decades of proven track record of attracting a commendable volume of investment to

the State. The agency has a good track record for mobilising investments from financial institutions in India.

Kerala Industrial Infrastructure Development Corporation (KINFRA): This agency aims at bringing together all the suitable resources available in the state and developing infrastructure to bolster the Industrial growth of the state. KINFRA is dedicated to catalysing Industrial growth in Kerala by providing the best industry-specific-infrastructure. KINFRA has identified over 20 core competency areas and it has 24 well-defined Industrial parks, including those which are currently being operationalized. The Agency has significant experience in mobilising funds from financial institutions especially Banks.

Kerala Infrastructure Investment Fund Board (KIIFB): The Board, established as a body corporate, came into existence on 11.11.1999 under the Kerala Infrastructure Investment Fund Act 1999 (Act 4 of 2000) to manage the Kerala Infrastructure Investment Fund. The main intention of the Fund was to provide investment for critical and large infrastructure projects in the State of Kerala. Comprehensive modification of the Act and Scheme has been made through an amendment Ordinance in August 2016. With the new structure, KIIFB aims to mobilise funds for the infrastructure development of Kerala, adopting a wide range of financial strategies and tools for this. This also includes addressing major land acquisition needs of the State for infrastructure. KIIFB is the first State Level Agency in India to successfully complete an ECB through the issue of a Masala Bond.

Option 2:

The second option will be to decentralise the fund mobilisation function and entrust the agencies identified in the previous section for execution themselves. Under this option, each of the project execution agencies under RKDP will be given the responsibility of mobilising a portion of the funds as Term Loans or Institutional Finance required for RKDP.

Option 3: The third option is a mix of the first two options. The agencies identified under Option 1 will be given the responsibility of the bulk of the off-budgetary funds required for RKDP, while Public Sector Agencies which are selected for execution as outlined above, will also participate in the resource mobilisation efforts by additional borrowing on their balance sheet with Government Guarantees.

5.12 Mode of Deployment of Funds from the State Budget for RKDP

For incurring Capital Expenditure, a sub-head of account 5475-00-115-94 Post-flood Projects under the Rebuild Kerala Initiative (RKI) – Plan has been opened for providing state funds for capital expenditure under RKI. Following sub-sub-heads have been opened under the above sub-head. More functional heads would be created on a requirement basis

- Roads of Local Self Government
- Livelihood support
- PWD Roads and bridges
- Public Buildings – Major repairs and reconstruction

For 2019-20, an amount of Rs.250 crores has been provided in each of the above sub heads, with a total allocation of Rs.1000 crores for capital spending under RKI.

For meeting Revenue Expenditure, a sub-head of account 3475-00-115-99 Post-flood Projects under the Rebuild Kerala Initiative (RKI) – Plan has been opened for providing state funds for revenue expenditure under RKI. The allocations will be made by Finance Department on a 'needs' basis.

The Secretary, Planning and Economic Affairs department is the Controlling Officer of these Heads and the Chief Executive Officer may be made the Drawing and Disbursing Officer (DDO) for each of the Capital and Revenue sub Heads mentioned above.

5.12.1 Need based and responsive allocation strategy:

As mentioned above, one of the themes for discussions that is likely to persist through the implementation is how both RKDP and the implementation of the State's Annual Plan are likely to compete for resources, and how this must be harmoniously managed. To some extent this can be ensured by ensuring synergy between the Annual Plan outlays and the requirements identified under RKDP.

However, to ensure, the optimum use of the budget and the State's funds are not locked up because of RKDP, it is desirable that the State institutes an efficient system for making additional budgetary allocation to correspond to the needs of the implementation process itself. This contrasts with the current system of making all the required budgetary provisions for any project beforehand.

5.13 Mode of Deployment of Funds Outside the State Budget for RKDP

Where, funds from financial institutions like banks can be availed for RKI through Public Institutions like KRFB, KIIFB, RBDCK, KSIDC etc., arrangements to disburse funds directly through such agencies should be made as far as possible. Where such arrangements are not possible, these funds may be placed at the disposal of the CEO for disbursement of project expenses in a bank account opened for that purpose. The limits specified above for imprest funds shall apply to this mode also. The CEO shall arrange for separate projects/package-wise accounting of all funds allocated.

5.13.1 Implementation Arrangements

- RKI is fundamentally different from a traditional rebuilding approach which focuses on restoration of assets and maintains the status quo both in terms of the processes as well as the larger ecosystem in which the programs are implemented. RKI seeks to make paradigm shifts in the way in which policies are formulated and implemented. Emphasis will be on institutional consolidation, coordination and capacity building. Post RKI, the Government machinery should stand differentiated from what exists currently in its overall competencies to deal with challenges of natural calamities as well as in its planning, design and execution of its regular development projects and schemes. Above all, wherever relevant, the process of policy formulation in sectors related to RKI, the planning, design and execution cycle should be built on disaster and climate resilience well interwoven into it. While this transformation may not be immediate, laying a sound foundation for RKI will be a key step to ushering in this change. Chapter 3 comprehensively brings out the salient features that set apart RKI from traditional implementation of projects and schemes within government.
- The Government will have overall responsibility for project management and coordination. The RKI-IC with the RKI-Secretariat will set up a Project Management Unit under it. The RKI-IC, the RKI-Secretariat will provide overall project insight and policy direction under which, given the multi-modal nature of the RKDP agenda and the numerous sub-components of the Program.

- Specifically, the RKI- Secretariat and the Project Management Unit will be responsible for: (a) providing policy advice and operational guidance; (b) reviewing financial and physical progress; (c) resolving any implementation problems and addressing grievances, and (d) providing any other necessary direction for effective implementation, including avoiding any duplication between line agency interventions instead maximizing mutual gain. It will also process documents for sanctions and approval of the High-Level Empowered Committee, the Advisory Council and the Council of Ministers.
- The Project will use existing implementation arrangements of the GoK and all implementation on ground will be coordinated through the existing Government mechanism.

Given the multi-disciplinary and often complex nature of the packages that must be bundled into RKI, it is essential that the stakeholder perspective is brought into these institutional arrangements at all levels. The scale of the disaster, planning required, implementation complexities, financial management and service delivery calls for a dedicated institutional framework.

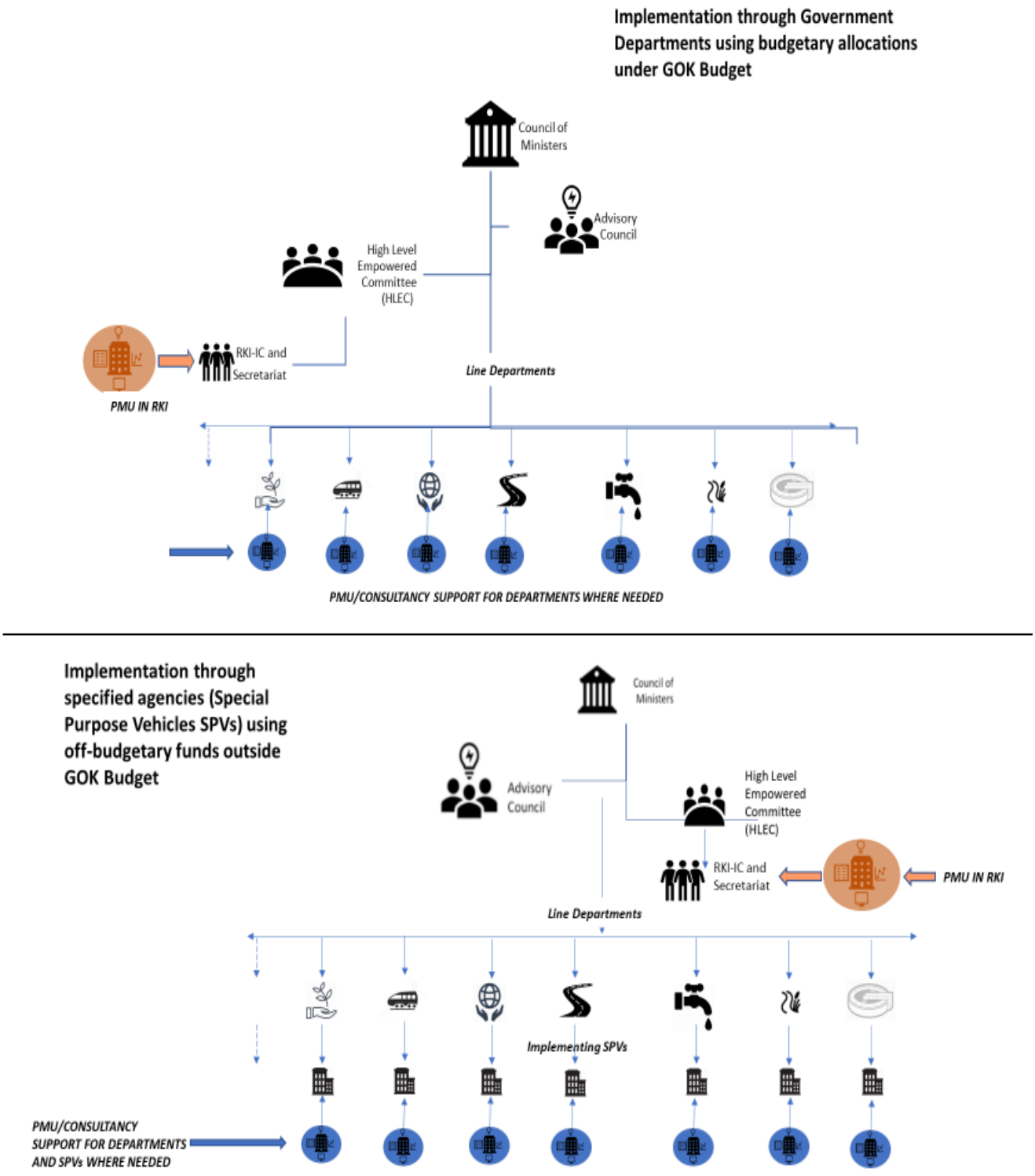
The outline of institutional framework proposed for RKI is shown below.

1) Council of Ministers
2) Advisory Council
3) High Level Empowered Committee (HLEC)
4) RKI Implementation Committee (RKI-IC)
5) RKI Secretariat
6) Institutional Support

As referred to above, there will be essentially two types of projects under RKDP. The first will be those that are financed by funds through the State Budget and the second would those that are financed through extra-budgetary or off-budgetary mechanisms.

The Implementation and Coordination Arrangements are pictorially shown below for the two arrangements.

Figure 50: The Implementation and Coordination Arrangements (State and Off-budgetary Arrangements)



Council of Ministers: The Council of Ministers will be responsible for deciding any policy matter including recommendation for legislation as may be required for effective decision making and co-ordination of RKI. Project Profiles of all the works taken up under RKI will be placed before the Council of Ministers for approval. A brief synopsis of the project and regular updates of the progress of RKI projects will be placed before the council in the next meeting of the council. The Chief Secretary will be the Secretary to the meetings of the Council of Ministers as laid down in the Rules of Business of Government. To ensure fast and effective decision making, the agenda notes, minutes and all documents shall be circulated online to the Hon. Ministers in the Council and the Chief Secretary with intimation through e-mail or other online forms of communication to the staff of the Ministers.

Advisory Council*:* RKI will have an Advisory Council not exceeding 20 members with the following Composition as indicated in Government Order on RKI (Please see Annex-2). The Role of the Advisory Council is to offer guidance and advise on proposals under RKI and offer inputs on options placed before it. A draft strategy paper of the Rebuild Kerala Initiative will be submitted to the Advisory Council for its suggestions and inputs. Project Profiles taken up for implementation under RKI will be sent to all members of the Advisory Council for inputs and suggestions. The list with synopsis of Projects taken up for implementation and status update of RKI will be furnished to the Advisory Council from time to time for information.

High-Level Empowered Committee (HLEC): An HLEC with the composition shown in Annex-3. Government may from time to time nominate eminent persons as Advisors to the HLEC. The Advisors shall also be Ex-Officio Members of the Committee for decision making. A senior officer in the rank of not less than a Secretary to Government or above will be designated as the CEO of the Rebuild Kerala Initiative. The CEO of RKI is also the Member Secretary for the HLEC. The High-Level Empowered Committee (HLEC) shall have the following functions:

1. Approval of Project Profiles submitted to it for consideration by the RKI Implementation Committee (RKI-IC) for placing before the Advisory Council and the Council of Ministers.
2. Direct preparation of any project idea as is found relevant to the overall scheme and objectives of RKI for placing the same before the Council of Ministers.
3. Approval of Detailed Project Reports prepared by the RKI Implementation Committee (RKI-IC), for the Project Profiles approved by the Council of Ministers
4. Monitoring the implementation of the various packages/programs under RKI approved by the Council of Ministers.
5. Coordinating with other departments of Government as is necessary for the smooth implementation of RKI.
6. Advising Government on mobilisation of resources required for RKI.

Powers of HLEC: For the Project Profiles approved by the Council of Ministers, the HLEC shall be the authority to issue approvals for Administrative Sanctions for the various DPRs that relate to these Project Profiles under RKI. In addition,

1. The CEO of RKI shall issue Administrative Sanctions for those DPRs approved by HLEC.
2. Where the Detailed Project Report prepared varies substantially in scope or size from the Project Profile approved by the Council of Ministers, the HLEC shall issue the Administrative Sanction only with the approval of the Council of Ministers.
3. The list with details of Administrative Sanctions so issued shall be placed in the following Cabinet Meeting for information.
4. For administrative purpose (including placing the papers before the Council of Ministers, issue of Agenda Notes, Minutes etc. related to the Meetings of the Council of Ministers), the Chief Executive

Officer of RKI is also designated as a Secretary to Government under the Planning and Economic Affairs Department as Secretary (Planning & Economic Affairs Department – RKI).

HLEC Decision making: To ensure effectiveness and speed in implementation of RKI, a concurrent online mode of decision making shall be adopted. Manual process of circulating physical documents shall be avoided to the extent possible. Under this mode of decision making, the CEO of RKI shall, with the approval of the Chairman of the HLEC (Chief Secretary), upload as an Agenda item any proposal, that needs approval of the HLEC to an online portal designed for this purpose, with intimation over email/mobile to all the members as soon as any proposal is uploaded. The online portal shall have provision for the Members of the HLEC to enter their comments. Any agenda item where no member has expressed any remarks to the contrary after 7 days from the date of uploading shall be deemed to have been approved by the HLEC. The HLEC may if it so decides, meet on a designated day at an interval (weekly, fortnightly etc.) to be decided collectively. Uploaded agenda items which have not been approved and where discussions are necessary or where there is a dissent shall be discussed and resolved appropriately. Any member unable to attend a meeting may also opt to join through any online facility for communication, made available for the purpose.

RKI Implementation Committee (RKI-IC): The RKI-IC is a three-member body responsible for the implementation of RKI, with the composition shown in Annex-3. It shall perform the following functions:

1. The RKI-IC shall be responsible for preparing the various project profiles for placing them before the HLEC for their recommendation and thereafter before the Council of Ministers with the recommendation of the HLEC for approval.
2. The RKI-IC shall be responsible for preparing the Detailed Project Reports based on project profiles approved by the Council of Ministers.
3. The RKI-IC shall place the DPRs for the approval of the HLEC.
4. The details of the Administrative Sanctions issued by the CEO for projects and programmes approved by HLEC with a brief synopsis shall be placed for comments, modifications before the Meeting of the Council of Ministers.
5. Once the project profiles are approved by the Council of Ministers as the case may be, no further reference to any Government Department for sanction would be necessary. The projects under RKI would not have to be placed before the Working Group/Special Working Group envisaged for Plan Schemes.
6. For the implementation of the packages/programmes in the RKI approved by the Council of Ministers on the recommendation of the HLEC, the RKI-IC will have powers to implement the project for procurement according to the guidelines/pattern prescribed and approved by HLEC.
7. The RKI-IC will through a process of empanelment identify qualified consultants (Empanelled Agencies/Experts/Professionals) for preparation of DPRs, Program Management of Major Projects, provision of specialised services according to the guidelines/pattern prescribed and approved by HLEC.
8. For effective implementation of RKI, the RKI-IC may convene joint meetings with the Departmental or District Committees referred to herein.
9. The RKI-IC will have all incidental administrative powers for projects approved by the HLEC for fulfilling its responsibilities laid out in this proposal without further reference to Government, but RKI-IC will function under the Guidance & control of the Chief Secretary.
10. The CEO of the Rebuild Kerala Initiative shall also be the Convener for the RKI-IC.
11. The CEO will administer the day to day running of RKI and be fully responsible for the implementation of packages approved by the Council of Ministers.

RKI Secretariat: The Rebuilding Kerala Initiative will have a Secretariat consisting of a team of 3-4 professionals and a team of officers consisting of one Additional Secretary and a Section consisting of one Section Officer and three Assistants be attached to it under the Planning and Economic Affairs Department reporting directly to the Principal Secretary (Planning and Economic Affairs Department – RKI). Officers selected for this purpose from the Secretariat or otherwise, will need to have proficiency in the use of computers as the document flow for RKI will be managed through online systems only. In addition to the above, the RKI-IC may induct expert members from various fields as Consultants to RKI as is found necessary. The CEO shall be the Administrative Head of the RKI Secretariat.

Departmental Level Set-Up for Implementation & Monitoring of RKDP: Different packages under RKI will be implemented by the Departments/Agencies. Some of these packages relate to asset where the Departments or its Agencies must execute the work directly. Some of the works packages may have to be implemented for the departments by an SPV or if any such project is on the Public Private Partnership.

A Departmental Committee consisting of Secretary of the Department, Head of the Department, Head of the Implementing Agency (if any), and two persons in charge of planning/infrastructure or two or more Chief Engineers, from the concerned Department, as the case may be, will be constituted. Secretary of the Department will be the Chairman, and Head of the Department/Chief Engineer shall be the convener.

This Departmental Committee shall work with the RKI-IC to coordinate, monitor and implement the approved projects.

For ease of implementation, if any variations or deviations from existing practice in terms of procurement of goods and services, execution of contracts are needed such variations must be approved, after detailed discussions, in a joint meeting of the RKI-IC and the Departmental Committee referred to above. In according permission for such variation, care should be taken to ensure that basic principles of fairness and transparency are not compromised. Such variations or deviations permitted as above have to be reported to the HLEC.

District Level Set-up for implementation & monitoring of RKDP: A Committee shall be constituted at the District Level for the implementation and monitoring of RKI with the composition shown in the table below.

Table 62: Composition of the Departmental Committee

Designation	
1. Secretary of the Department	Chairman
2. Head of the Department	Convenor
3. Chief Engineer nominated for the purpose	
4. Two officers of the Department OR two or more Chief engineers under the concerned Administrative Department	Members

5.14 Project Identification and Selection

Typically, there will be a five-stage process for the end to end conversion of an idea into project execution or process changes. These are:

- Idea generation
- Screening and selection of projects (criteria to be developed)
- Profiling of projects/ideas

- DPR preparation/Development of legislative framework (e.g. law making, issue of orders, rules/circulars, manuals etc.)
- Administrative Sanction/Issue of laws/rules/orders/circulars/manuals etc.)

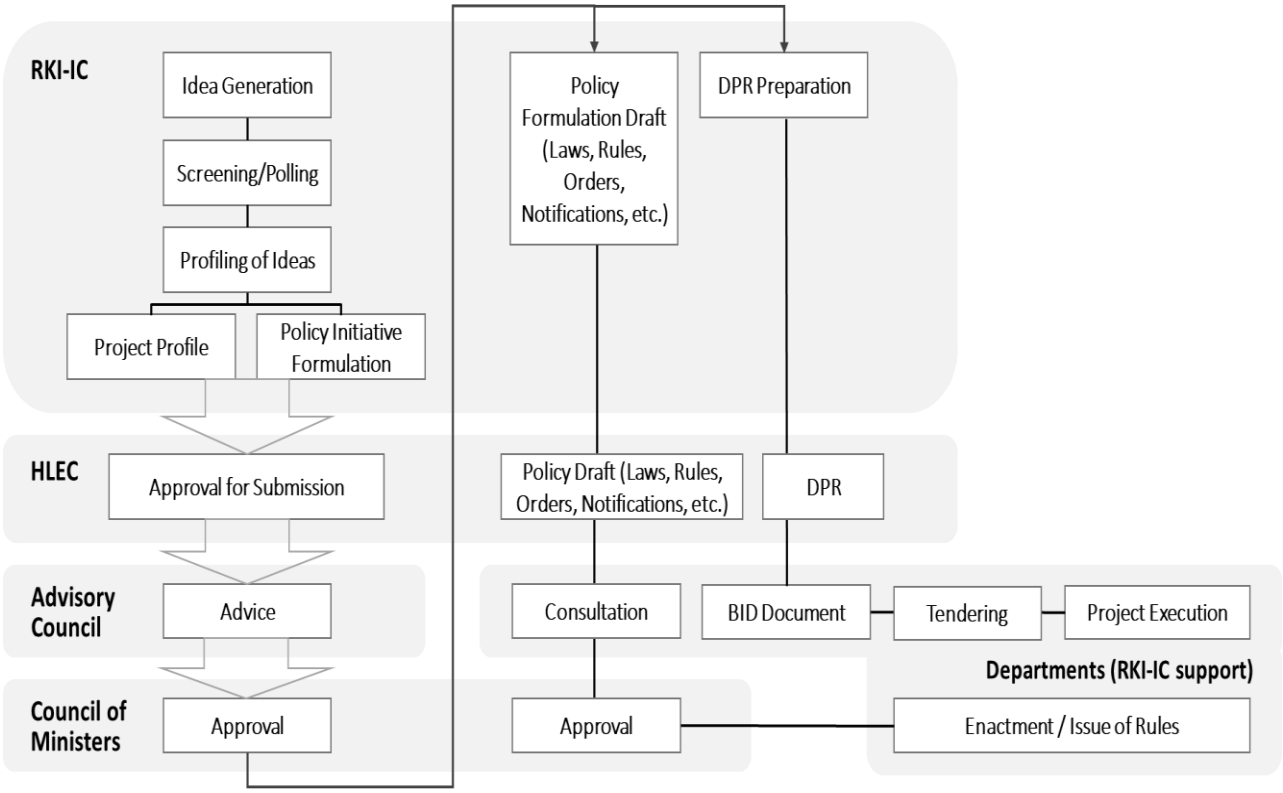
The matrix shown below illustrates the linkages of each of the stages for each channel of idea generation discussed above with the authority designated for each function.

Table 63: The Matrix of Idea Generation

<table>
<tr><th></th><th colspan="6">IDEA GENERATION (SIX TRACKS)</th></tr>
<tr><th></th><th>Development Seminars</th><th>Ideathons</th><th>Idea Exchanges for Youth from Schools, Colleges, Polytechnics, and ITIs</th><th>Identification by LSGs</th><th>Identification by Departments</th><th>Other Major Infrastructural Projects</th></tr>
<tr><td>STEP 1</td><td colspan="6">IDENTIFICATION AND SCREENING OF IDEAS FOR PROJECT FORMULATION OR FOR POLICY INITIATION
Responsibility: RKI Implementation Committee + Stakeholder Departments</td></tr>
<tr><td>STEP 2</td><td colspan="6">PROFILING OF PROJECT/POLICY INITIATIVE
Responsibility: RKI – Implementation Committee</td></tr>
<tr><td>STEP 3</td><td colspan="6">APPROVAL OF DRAFT PROJECT PROFILE/POLICY INITIATIVE
Responsibility: High Level Empowered Committee</td></tr>
<tr><td>STEP 4</td><td colspan="6">APPROVAL OF DRAFT PROJECT PROFILE/POLICY INITIATIVE
Responsibility: Council of Ministers</td></tr>
<tr><td>STEP 5</td><td colspan="6">PREPARATION OF DRAFT DETAILED PROJECT REPORT (DPR)/DRAFT POLICY FRAMEWORK (LEGISLATION, RULES, GUIDELINES, etc)
Responsibility: RKI Implementation Committee + Stakeholder Departments</td></tr>
<tr><td rowspan="2">STEP 6</td><td colspan="2">APPROVAL OF DRAFT DPR</td><td colspan="4">APPROVAL OF DRAFT DPR/DRAFT POLICY FRAMEWORK (LEGISLATION, RULES, GUIDELINES, etc)</td></tr>
<tr><td colspan="6">Responsibility: High Level Empowered Committee</td></tr>
<tr><td rowspan="2">STEP 7</td><td colspan="2">APPROVAL OF DPR</td><td colspan="4">APPROVAL OF POLICY MEASURES (LEGISLATION, RULES, GUIDELINES, etc)</td></tr>
<tr><td colspan="6">Responsibility: Council of Ministers</td></tr>
<tr><td rowspan="2">STEP 8</td><td colspan="2">PREPARATION OF BID DOCUMENTS</td><td colspan="4">LIAISONING WITH LAW DEPARTMENT/STAKEHOLDER DEPARTMENT FOR LEGISLATION/ISSUE OF ORDERS etc.</td></tr>
<tr><td colspan="6">Responsibility: RKI Implementation Committee + Stakeholder Departments + Law Department</td></tr>
<tr><td>STEP 9</td><td colspan="2">TENDERING + EXECUTION
Responsibility: Stakeholder Departments (Implementing Agencies)</td><td colspan="4">LEGAL ENACTMENTS/RULES/ORDERS/CIRCULARS
Responsibility: Law Departments/Stakeholder Departments</td></tr>
</table>

The process flow for implementation of projects under RKI is shown below:

Figure 51: Implementation Flow for RKDP



5.15 Institutional Support Framework

Financial Advisor (FA): Notwithstanding the option adopted to mobilise extra-budgetary funds for RKDP that is adopted, it would be necessary to ensure smooth operations of the off-budgetary raising funds and coordinating the release of funds to suit the RKDP cash outflow needs. Therefore, it is proposed that a financial advisor be appointed, with expertise in national and international fund raising to advise the institutions selected to mobilise funds from markets.

The FA should be selected through an international bidding process through a two-stage tendering process as per procurement standards of the World Bank and other DPs to ensure that the State will obtain financial services of the highest quality for RKDP.

Procurement Services Manager (PSM): The Rebuild Kerala Initiative is expected to be diverse in its scope and as such there will be several stages of implementation from planning, drawing up of concept paper, preparation of DPRs, drawing up of estimates, preparation of tender documents, environmental surveys and analysis including social impact assessments, work involved for land acquisition, drawing up compensation packages etc. Furthermore, many of these projects will call for international expertise and may require global tendering.

Based on the above rationale, the procurement of goods and services needed for the range of activities envisaged in RKI will pose a formidable challenge. It would be therefore efficient to contract out all procurement needed for RKI to a specialised firm. This would ensure that services are procured with greater efficiency and meet clients' needs faster while adhering to international best procurement practices regarding transparency, objectivity, competitiveness and non-discrimination. The firm selected would be the Procurement Services Manager (PSM) for RKI. It will be selected through an international tendering process using a two-bid system.

The PSM function includes:

1. Assisting the RKI Secretariat and End User Departments/Agencies in planning inputs and drafting ToRs for procurement of goods and services.
2. Based on the agreed work plan, identifying and selecting qualified experts, companies and institutions to provide the agreed inputs and proposing them to the RKI Secretariat.
3. Preparing Tender Documents for the various packages required under RKI.
4. Contract Management including checking and certification of bills for payment.
5. Developing and regularly updating appropriate procurement systems and procedures to reflect international best practices.

Third Party Auditor (TPA): In the context of the diverse financing arrangement and the payment process that must be managed, a Third-Party Audit performed by an audit organization that is independent of the Government of Kerala will potentially help to improve transparency and enhance trust of funding agencies. Such an audit can be by design, free of any conflict of interest if safeguards are built in to ensure the independence of the audit organization. A TPA with the expertise of handling major infrastructure/public projects with international experience can be identified through a transparent bidding process.

Capacity Building for Departments and Special Purpose Vehicles: Additional support to governmental entities will be provided under the project in the form of training for operations and maintenance, disaster risk management activities, institutional capacity building, information management etc. will also strengthen the capacity of these groups to improve and ensure sustainability of workfare and management of potential future disasters. Support will be provided by international donor agencies, multi-lateral partners, and think/do tanks like IDFC Institute.

Chapter 6: Monitoring and Evaluation of RKDP

6.1 Background and Rationale

The RKDP presents a roadmap for a Nava Keralam. To do so, it encompasses key sectors of the economy such as agriculture, animal husbandry, fisheries, forestry, land, livelihoods, roads and bridges, transportation, urban services and infrastructure, water supply and sanitation, and water resources management. Further, binding the key sectors together, the RKDP also addresses cross-cutting priorities, among them, climate change and disaster risk management, environment, open data and public sector strengthening. With the multitude of interventions and sectors involved in this roadmap, it is imperative to institute a robust monitoring and evaluation (M&E) mechanism from an early stage.

The need for such a comprehensive and effective M&E system is driven by the following:

- As a direct response to the floods of 2018, through the RKDP the Government "*envisions a green and resilient Kerala where higher and ecologically safe standards of infrastructure, improved conditions of living and new major development projects ensure that people and assets are able to withstand the onslaught of future disasters".* [G.O.(P)No.16/2018/P&EA]. A rigorous monitoring and assessment is essential to ensure that the objective of rebuilding a Green and Resilient Kerala is achieved through the ambitious goals of the RKDP.
- Public consultations held by the GoK on the RKDP have created a partnership. The Government is accountable to the public and their expectations that the Programme will *"enable Kerala's resilient recovery and catalyse transformational shift towards risk-informed socio-economic development through supporting sustainable communities, institutions, livelihoods and putting in place major infrastructure".* [G.O.(P)No.16/2018/P&EA]
- Public and private resources (including national, state, multilateral and bilateral development partners, and market-based and community-based funds) will be used to implement the RKDP. Care should be taken to ensure efficiency and transparency in the implementation through clear processes of accountability. This structure will support the efficient use of financial resources.
- There is strong commitment, both from the administration and politically, to the aims of RKDP. Therefore, progress must be regularly assessed to mitigate any reputational risk and pre-emptively course-correct through identifying and addressing underperforming projects.
- Given the multi-sectoral nature of RKDP it is critical that M&E incorporate the necessary legal and institutional structure to facilitate collaboration and coordination among institutions. Consequentially, M&E will review processes, policies, programs and projects related to reforms.
- The success of the RKDP will depend on an effective M&E mechanism that regularly assesses original conditions, versus progress made, versus target goals.

6.2 Monitoring and Evaluation Framework

A M&E cell will be established in the RKI Secretariat, which will be responsible for the overall monitoring of physical and financial progress, and key outputs and outcomes, as per RKI's agreed results framework. Key Programme-level indicators for M&E are organized along the following framework:

Table 64: Monitoring and Evaluation Framework

	Process (e.g. 6-monthly progress reports, new protocols, new structures, etc.)	**Outputs** (e.g. Master plans, new management systems, infrastructure built, studies, mapping, analysis, etc.	**Outcomes** (e.g. better performance, reskilling, population benefitted, efficiency gained, livelihoods protected, etc.)
Policy Interventions	Indicators and targets to be defined, that will become the basis of the Monitoring and Evaluation framework.		
Institutional Interventions			
Investment Interventions			

- An independent agency or consultant will be appointed by RKI to develop a web-based monitoring system that will be maintained at the RKI Secretariat. Information on results, complied from the Management Information System (MIS), will be disseminated publicly on the RKI webpage on a semi-annual basis, providing user-friendly information.
- Monitoring will be done at various levels, depending on the type of intervention or activity: project/activity, community, district, and local government, line departments, etc. against agreed performance benchmarks and results indicators. The MIS mechanism will be responsible for aggregating the information and producing half yearly progress reports to be submitted to the supervising committees. Monitoring, where relevant, will be undertaken in a gender disaggregated manner that will allow assessment of issues related to inclusion.
- An independent agency or consultant will be appointed by RKI to track results, including establishing baselines and tracking progress on a regular basis. At the end of the Programme period, an independent agency or consultant will undertake an evaluation of the RKDP.
- Third party audits of procurement and contracts and social/community audits or surveys of beneficiary satisfaction will be conducted in a random fashion throughout the life of the project. These audits will particular attention to the impacts on women, children, differently abled and the SC/STs.
- Finally, a grievance mechanism will also be established as a separate and parallel unit to RKI with a web-enabled mechanism for filing and addressing any complaints related to RKI implementation processes and beneficiaries. This mechanism will encourage feedback from the public, departments, government, and any other stakeholders. A protocol for addressing grievances will be published.

6.3 Institutional Arrangements and Implementation

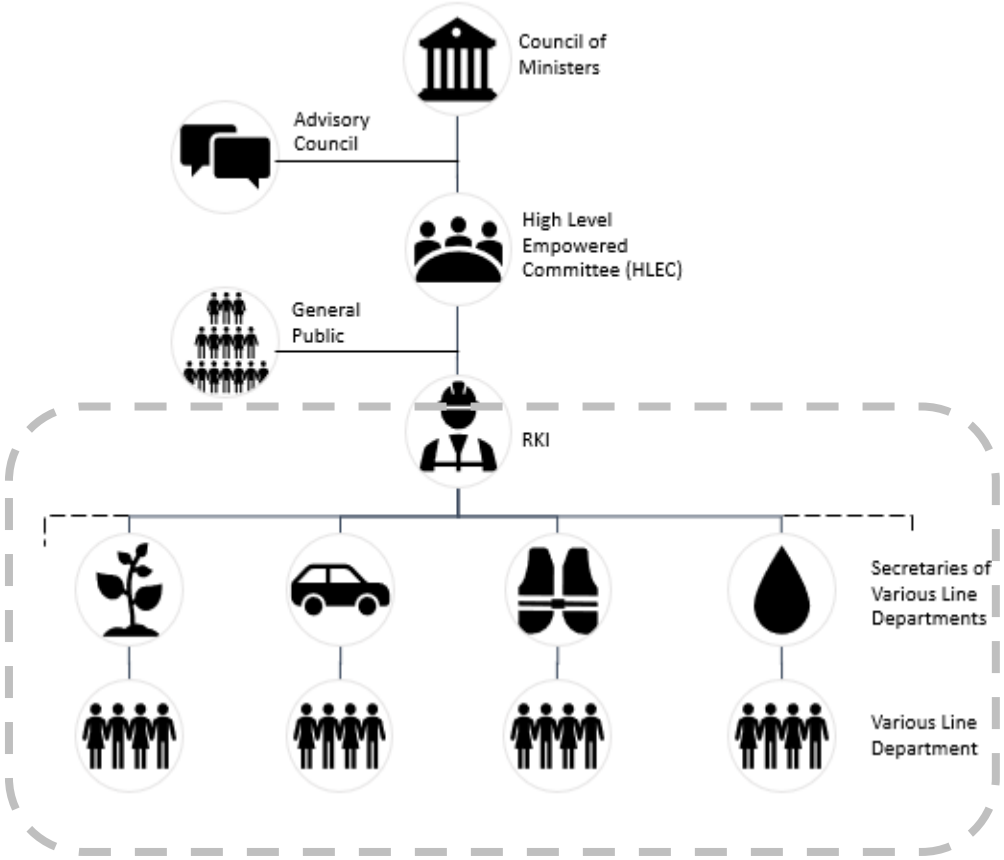
The M&E structure will effectively scrutinize the objectives, policies, programs and targets of the Programme during implementation. The RKI Secretariat will act as the coordinating agency for Kerala's reconstruction efforts to build ecological, technical and social safeguards through M&E. The RKI will play

a central role in the coordination, oversight, and M&E of the progress of the recovery. The institutional arrangements for M&E will be as follows:

- Communities/NGOs/civil society entities: inputs into programme design, feedback on outputs and outcomes;
- Individual departments/agencies: process and output monitoring of progress on physical, financial and institutional indicators associated with each participating department or agency;
- RKI: overall process, output and outcome monitoring, as well as impact assessments in target areas of the RKDP;
- HLEC: technical oversight and review of half yearly progress reports and the M&E results, guidance on Programme improvements, administrative decisions on Programme implementation, actions and course corrections;
- Advisory Council: high level review and guidance on half yearly progress reports, Programme implementation, actions and course corrections; and
- Council of Ministers: review of routine progress, outputs and outcomes, guidance on all Programme M&E, final decisions on Programme implementation, actions and course corrections, per progress and M&E reports.

The HLEC will serve to monitor and evaluate the implementation of the RKDP and the performance of the RKI. It will be chaired by the Chief Secretary, convened by the RKI CEO and consist of the RKI Secretariat, the representatives of the concerned departments and agencies and technical experts. The secretarial services of the Committee will be carried out by the RKI Secretariat. The HLEC will convene every six months and, additionally, as frequently as required. It will be responsible for evaluating the Plan implementation, monitoring developments regarding objectives, steering programming and budgeting activities, reviewing Annual Programme Progress Reports, recommending them to the Chief Minister/Cabinet as well as ensuring the preparation of Programme Evaluation Reports. These Reports will be shared with the the Advisory Council and the Council of Ministers for review. A schematic of this monitoring feedback loop of responsibilities, reporting, and review is presented in the Figure below.

Figure 52: Institutional Arrangements for Monitoring and Evaluation



Responsibilities and Accountabilities
Review and approve progress report. Advise downward.
Private Sector, NGOs, and other Stakeholder input incorporated
Advice on RKI's progress reports on entire RKDP. Guidance on resource mobilization Vetting proposals that are cleared by cabinet
Public input gathered by RKI and incorporated into progress report (regularly made public)
Compile and review RKDP 6-monthly progress reports based on each Line Secretary report. Hold Secretaries accountable for incorporating public / Council feedback
Compile M&E report to RKI every 6 months. Update implementation plans on the basis of RKI feedback.
Data gather, monitoring project implementation Report upwards to Secretary every 3 months

Programme Monitoring and Steering Committee

Responsibilities: Convene as required, min. every six months. Evaluate implementation, monitor developments regarding objectives, steer programming and budgeting activities, review Annual Programme Progress Reports, recommend them to the Chief Minister/Cabinet, and ensure preparation of Programme Evaluation Reports

6.4 Results Framework/Key Performance Indicators

The following is the draft Results Framework for the RKDP implemented through the RKI. The Results and the Performance Indicators noted below are a suggested draft at this stage. Following the launch of the RKDP, a firm will be recruited to finalize the Results Framework, establish baselines and support the RKI and other stakeholders in setting up RKDP-related results monitoring arrangements.

Table 65: Result and Performance Indicators Framework

RESULTS FRAMEWORK	PERFORMANCE INDICATORS				
Outcome 1: Enhanced institutional and financial capacity for managing disaster risk and climate change through RKDP					
Result	Baseline	2020	2021	2022	2023
Six-monthly progress reports are submitted on RKDP implementation within 60-days of each six-month period.					
A programme evaluation is prepared within 3-months of completion of RKDP programme period.					
At least 25% of infrastructure is rebuilt following build-back-better principles.					
At least ₹21,000 crore is mobilized for recovery and reconstruction.					
A Flood Cess on GST is issued to mobilize at least ₹1000 crore.					
A masala bond is issued to mobilize at least ₹3000 for recovery and reconstruction.					
A diaspora bond is issued to mobilize at least ₹2000 for recovery and reconstruction					
At least ₹3500 crore of RKDP programs benefit poor communities or households directly					
At least 1,000,000 women and children benefit from RKDP programs					
Outcome 2: Enhanced institutional and financial capacity for managing Disaster Risk and Climate Change					

RESULTS FRAMEWORK	PERFORMANCE INDICATORS				
The State Disaster Management Plan, incorporating disaster risk reduction and climate resilience principles, policies and standards, is updated and published					
New protocols for enhancing emergency preparedness and response capacity of various departments are established and made fully operational					
XX emergency response centers are established and operationalized at the district level					
Outcome 3: Critical infrastructure and services recovered/restored across Water Resource Management sector					
RBM Act is approved and RBM Authority is established and operational.					
State Level Command Centre for integrated and effective coordination of reservoir operations of all dams in the State is established.					
River Basin Management Authority is developed and approved water resource management strategy for Kerala.					
River Basin Management Authority has developed and implemented river basin management plans for Kuttanad and Kole floodplains.					
Integrated basin plans are prepared for priority basins.					
XXX kilometers of irrigation works are completed from ongoing irrigation projects.					
XXX kilometers of community micro irrigation system are completed.					
XXX kms of irrigation structures are restored of flood damages.					
Outcome 4: Critical infrastructure and services recovered/restored across Water Supply and Sanitation sector					

RESULTS FRAMEWORK	PERFORMANCE INDICATORS				
New policy and institutional framework for improved water supply services are adopted.					
Annual Performance Report and Citizen Report Cards are publicly disclosed by KWA.					
Kerala's State Sanitation and Waste Management Programme adopted by the GoK.					
XXX kms of drinking and bulk water distributions are established.					
XXX new household piped water connections are provided.					
XXX households of vulnerable communities such as women headed households, SC/ST, fisher-folk and disabled are provided better access to water services and sanitation					
XXX kms of infrastructure established for collection, treatment, and disposal of sewerage					
Non-Revenue Water reduced to at least 35% in three city corporations (Trivandrum, Kochi and Kozihkode)					
O&M cost recovery increased to at least 50% at state level					
Outcome 5: Critical infrastructure and services recovered/restored across Agriculture sector					
Agroecological zones are notified along with agroecological management units.					
Capital investment and action plans developed and implemented for at least two agroecological zones.					
Agriculture minimum support pricing policy is revised and made operational.					
"Agriculture 4.0" ICT-GIS-based Decision Support System (DSS) is developed for evidence-based, data-driven development in agriculture.					

RESULTS FRAMEWORK	PERFORMANCE INDICATORS				
Agriculture value chains are established for at least two crops, including strategic plans for agro-marketing.					
Agriculture risk insurance uptake is expanded to at least xx%.					
XXX soil health and advisory clinics established.					
XXX acres of flood affected plantations rejuvenated.					
Outcome 6: Critical infrastructure and services recovered/restored across Roads and Bridges sector					
Core road network standards are adopted, and core road network is notified.					
State Road Transport Strategy/Master Plan developed by PWD, to address institutional and resource fragmentation					
Priority road works are completed for at least XXX kms of state highways, major district roads and other priority roads to new standards.					
Road Maintenance Management System (RMMS) is developed and made fully operational by PWD					
Performance based contracting is introduced for 25% of the core road network design, construction and maintenance.					
Outcome 7: Critical infrastructure and services recovered/restored across Transportation sector					
Transport Sector Reform Group is set up in the Transport Secretariat that includes multi-modal issues.					
Modify and approve the Kerala Metropolitan Transport Authority Bill. Kerala Metropolitan Transport Authority formed and upgraded					

RESULTS FRAMEWORK	PERFORMANCE INDICATORS				
using the Unified Metropolitan Transport Authority upgradation as a model.					
XXX Transport Department officials are reskilled with the latest transportation developments.					
Comprehensive Transportation Strategy/ Master Plan developed by xxx on the development potential of an integrated multi-modal transport system.					
Analytical plans of high-speed corridor developed, as a detailed investigation of need and feasibility. Supplementary conceptual plans based on 10-year projection developed.					
Operationalize XXX schemes for Intelligent Transport Management Systems					
Action plan prepared for enhancing public bus Transport on State Road network with focus route rationalization, bus contracting models for inter-city operations, transport tax reforms, public transportation subsidies, and dealing with urban congestion					
XXX schemes analysed and identified as pilot cases for implementing Land Value Capture as revenue generation for public transportation investments					
Outcome 8: Critical infrastructure and services recovered/restored across Urban sector					
Decentralized Plan Guidelines are revised to reduce fund fragmentation and facilitate multi-year project planning by LSGIs.					
Municipal cadre structure is revised and notified to improve capacity of ULB to deliver services.					
Municipal Infrastructure Manual is developed and approved to improve the quality and resilience of municipal infrastructure.					

RESULTS FRAMEWORK	PERFORMANCE INDICATORS				
Town and Planning Country Act is amended to include risk-informed master planning.					
Capital Investment Plans are developed by at least XXX ULBs.					
GIS based risk informed master plans are prepared by XXX cities.					
₹XXX crore investments are undertaken in municipal infrastructure by ULBs.					
Outcome 9: Critical infrastructure and services recovered/restored across Forestry sector					
Field units of Forest Department are realigned with Revenue Administration boundaries.					
An inter-sector working group on slope protection is established.					
XXX Local Action Plans for Climate Change (LAPCC) are developed and implemented.					
600 individuals from VSSs and EDCs are trained on vulnerability reduction and LAPCC.					
XXX management action plans prepared for ecologically sensitive zones around Protected Areas.					
Habitat improvement of 20,000 ha is undertaken.					
XXX abandoned/illegal mines and quarries near forest are rehabilitated.					
Voluntary relocation of critically located human habitations is completed for 640 ha.					
Outcome 10: Critical infrastructure and services recovered/restored across Animal Husbandry and Livestock sector					
Animal Husbandry Department restructured, functional efficiency improved by x%					

RESULTS FRAMEWORK	PERFORMANCE INDICATORS				
XXX schemes implemented incentivizing responsible livestock management practices, including biowaste management and animal carcass disposal, farming off-season duck rearing, etc.					
XXX VPCs are established in taluks without VPCs					
XXX livestock are geo-tagged for real-time monitoring of movement, traceability of produce, disease outbreaks, vaccination, health, etc.					
XXX modern abattoirs are established in key centers.					
Outcome 11: Critical infrastructure and services recovered/restored across Livelihoods sector					
Policy framework is developed and adopted for leased land farming to help the farmers on leased land be resilient to future disasters.					
'Responsible Tourism' policy framework updated to account for disaster and climate risks.					
Crisis Management Fund (CMF) is established and made functional for micro-entrepreneurs and women JLGs engaged in leased land farming.					
Comprehensive ICT/MIS systems are established to track producers/artisans/ Kudumbashree entrepreneurs to improve targeting of support services and provide proactive support.					
MRCs are established at Southern, Central and Northern regions to assist microenterprises in services such as packing, branding, quality assurance, appropriate technology, procurement and marketing support					
XXX households of the most vulnerable communities such as SC/ST, fisher-folk and					

RESULTS FRAMEWORK	PERFORMANCE INDICATORS				
disabled are provided grants to address loss of livelihoods and livelihood.					
XXX women, youth and SC/ST are provided with skill upgradation training.					
Outcome 12: Critical infrastructure and services recovered/restored across Land sector					
Kerala Land Administration and Management Act is adopted for a unified land register and cadastre system.					
Kerala Land Records Mission is operationalized, unifying and modernizing the land records and registry map work of the State.					
XXX land records are digitized.					
Outcome 13: Critical infrastructure and services recovered/restored across Fisheries sector					
Deep sea fishing policy is formulated and adopted.					
XXX Matsyabhavans are modernised with e-governance, man power allocation etc.					
Disease surveillance and control laboratory is established for tracking of diseases.					
XXX fish multiplication centres for marine and fresh water fishes are established for providing good quality advanced fingerling to the benefactors.					
XXX ha of brackish water, resevoir, other water bodies are utilised for growing fish in cages.					

ANNEXURE

Annex-1: DRAFT Detailed Investment Programme

Immediate recovery, reconstruction and long-term resilience building efforts, post disaster is critical in poverty reduction and recovery of losses. Similarly, investments for adoption of higher standards towards rehabilitation and reconstruction, with technical safeguards is more important than rebuilding for the sake of recovery. In this context, inclusive development for shared prosperity is the underlying principle adopted by RKDP. All priority programme and reforms are to be implemented with resilient features as the overarching umbrella to ensure that infrastructure, assets and livelihoods of the people of Kerala become less vulnerable to future shocks and disasters.

Having said so, the above could only be achieved with substantive investments in critical sectors such as roads, Water resources management, urban and rural infrastructure, land use planning and management, agriculture, etc. to name a few – to reignite the economy of the State. While the details of the overall financial requirements are detailed in the table later, the brief note on activities proposed for investments in these sectors are given below:

Highways

Core Road Networks: Rehabilitation /reconstruction/improvements of key carriage ways totalling to approximately 6,000 kms across the State i.e. a combination of state highways and major district roads have been identified as Core Roads Network including those affected by the floods. The prioritization of core road network will be broadly based on but not limited to economic importance, connectivity to growth centres, strategically important corridors, traffic volumes, share of commercial vehicles, public transport routes, access routes during emergencies, trunk access roads to schools, hospitals, and transport terminals/hubs, etc.

These investments are expected to contribute to more efficient emergency response and rapid restoration of core road network which is critical for transportation of emergency goods, materials, and ambulances in times of disaster. These efforts will also be complimented with systems and to support strategic investment decision making, efficient resource allocation and asset management through application of performance contracts for 10 years to ensure quality in design and construction by contractors.

Rural Infrastructure:

Rural Roads: Reconstruction and Rehabilitation of 330 roads which are major link roads with resilience features to address climate changes and increasing traffic volumes in 8 flood affected districts of Alappuzha, Ernakulam, Idukki, Kottayam, Palakkad, Pathinamthita, Thrissur, & Wayanad. Application of similar criteria for roads in other districts is being evaluated and documented. Hence, investments in the medium and long term are cited as “To Be Decided (TBD)” in the table below.

To enhance resilience and longevity of the roads, PMGSY standards will be strictly applied in the design and construction, with performance contracts having 4-5 years maintenance period, to improve quality of the road constructed and accountability of the contractors. Introduction of long-term O&M contracts is envisaged to move away from the traditionally fragmented and annual contracting processes followed by Local Bodies.

Rural Water Supply – The focus of the investments proposed is to move towards providing reliable potable drinking water supply, through large infrastructure and community managed operations to

facilitate and introduce new avenues for revenue generation for long-term sustainability of operations and investments, in the Gram Panchayats across the 14 districts in Kerala, currently not fully covered piped water supply (PWS). Focus towards improving and linking local resources to provide for optimum utilization of both physical and financial resources is included to encourage community led operation and maintenance of water supply systems. Critical inputs to both existing operations and those proposed includes investments to improve and monitor quality of drinking water from both supplies and own sources to support reduction and elimination of emergence of any potential water borne diseases, and reduction in non -revenue water.

Additional investment proposed is to facilitate revenue generation through productive use of nearly 200 acres of land available across various KWA installations, to generate power (40MW of solar power) for both utility operations and supply of excess power to power production/distribution companies for onward sale of the same.

Urban Infrastructure

Urban roads: Reconstruction and Rehabilitation of 305.2 kms of urban roads using PMGSY standards covering 8 flood affected Municipalities of Wayanad, Pathinamthita, Idukki, Kottayam Alappuzha & Ernakulam. These are major link roads within the cities and are critical to the local economy. Again, 4-5 years of performance-based O&M contracts will be undertaken. Long term upgradation of all urban roads is being prepared. Hence, investments in the medium and long term are cited as 'TBD".

Urban Water Supply – Investments proposed water supply in urban areas are for supply potable drinking water (piped household connections) to 19,664,430 population, spread across larger municipalities and their urban sprawl in the 14 districts. It is also proposed to establish 24x7 water supply to households in the municipal corporation areas of Trivandrum and Kochi to benefit population of 1,265,000 in the next three years, while the same would be installed and made operational in other municipalities progressively over the period of 5-7 years to benefit population of approximately 11,865,000 in these areas.

Urban & Rural Sanitation: Another key investment in the rural and urban sector is sanitation. Proposals under consideration includes establishment of sewerage and septage treatment plants (STPs) in the major municipal corporations/municipalities across Kerala to ensure safe disposal of waste water and septage. Sewerage and septage generated in these municipalities, their urban sprawl area consisting of over 13 million population and about 5 million rural population in the areas within a radius of 50 kms, will be treated and disposed safely. These facilities will be further supported for efficient utilization of their capacities through establishment of systems for collection and disposal of septage from individual households/ small commercial establishments thereby to reduce / pollution of local water resources and maintaining clean environment in both urban and rural areas.

Water Resources Management: Proposed investments are directed toward sustainable water conservation & rejuvenation of water bodies and storage structures to store flood waters and recharge depleting groundwater table in all districts in the State. Investments will be based on scientific data based and judicious utilization of water resources and energy to reduce water consumption by at least 25% with a target of achieving 50% over a period of 5-7 years. Further, irrigation infrastructure needing investments will be designed and established based on a interlinked grid basis within each basin to ensure access and allocation of water to all users viz – agriculture, drinking water, industries and other utilities, are strictly need based for optimum utilization of water and improve operational efficiency of storage facilities in the State.

The objective is to achieve increased crop yield per hectare by an average of at least 25-30% (depending on the soil conditions and crops planted) with lesser water consumption and facilitate movement towards sustainable multi-cropping practices, meet irrigation needs in the rain shadow belt, power generation,

and drinking water needs, repair and restoration of irrigation structures/assets damaged by the floods in the State.

Land management systems: The investments proposed for land revenue consolidation is primarily to support establishment of a platform and related networks and systems to digitize records and processes by unifying title deeds registry, record of rights, field books and maps, land registration processes, cadastral mapping, etc. and related physical infrastructure to secure the system and physical records, to facilitate land administration, zoning and development activities.

Agriculture and Animal Husbandry:

Agriculture: The objective is to support realignment of department operations at ground level in accordance with the reorganized 5 agro-ecological zones to serve the sector better. Proposed investments are for bringing in significant changes in efficiency and resilience to the sector by supporting targeted resource allocation (including input subsidies), inputs, extension services, market development, mechanization, water management etc., relevant farming systems land use planning, soil quality monitoring, mapping suitable crop varieties to enhance production to achieve increased crop yield, and production clusters for improved market development and trade integration;; recasting agro-insurance and agro-credit policies to enhance coverage with inclusiveness. Other supporting investments includes establishment of ICT based management systems to improve productivity of the staff operations to provide end-to-end services to the farmers and markets.

Animal Husbandry: Key Investments proposed are to ensure last mile service delivery of animal health care services for disease prevention and monitoring systems of livestock to enhance production and quality of both dairy and other by-products. Other investments include establishment of district level hygienic

Table 66: Sectoral Financial Requirement

Sector	Implementing agency	Investments required in Rs. crore			Total in Rs. crore
		Short term	Medium term	Long term	
Rural Roads.	LSGD	247.94			247.94
Urban roads		86.90			86.90
Roads in Municipal Corporations areas	Municipal Corporations	7.53			7.53
State Highways & key feeder roads	Public Works Department	986.62	295.20	717.80	1,999.62
Water Resources Management -	Water Resources Department	435.00	2,036.89	2,100.00	4,571.89
Rural Water Supply	Kerala Water Authority	470.00	9,488.00		9,958.00

Urban Water Supply	Kerala Water Authority	3,584.00	1,495.00	4,300.00	9,379.00
24x7 water supply in Municipal corporation areas	KWA+ Municipal Corporations	555.00	2,235.00		2,790.00
Revenue Land consolidation	Land Commissioner	100.00	100.00		200.00
Urban Sanitation	KWA+ LSGIs	356.00	1,479.00		1,835.00
Urban & Rural Sanitation -	KWA+ LSGIs	746.40	2,985.60		3,732.00
Agriculture	Dept. of Agriculture	1,035.00	665.00		1,700.00
Animal Husbandry	Dept of AH	199.00			199.00
Grand Total		**8,809.39**	**20,779.69**	**7,117.80**	**36,706.88**

Table 67: Detailed Sector-wise Investment Plan

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
Rural Roads	Reconstruction and Rehabilitation of LSGD Roads using PMGSY standards covering 8 Districts. Construction contracts shall have 4-year maintenance period.	LSGD - Gram Panchayats	Resilient Recovery of the LSGD's major link roads under Gram Panchayats in the districts of Alapuzzha, Ernakulam, Idukki, Kottayam, Pallakad, Pathanamithitta, Thrissur, & Wyanad - 330 roads	247.94	June 2019 to June 2020	November 2019 to December 2021 + 4 years Maintenance
Urban Roads	Reconstruction and Rehabilitation of LSGD Roads using PMGSY standards covering 7 Municipalities. Construction contracts shall have 4-year maintenance period.	LSGD -Urban Local Bodies (ULBs)	Resilient Recovery of theLSGD's major link roads in the municipalities of Wyanad, Pathinamthitta, Idukki, Kottayam Alapuzzha & Ernakulam - 254 kms	86.90	June 2019 to June 2020	November 2019 to December 2021 + 4 years Maintenance
Corporation Roads	Reconstruction and Rehabilitation of LSGD Roads using PMGSY standards covering 1 Municipal Corporation. Construction contracts shall have 4 year maintenance period.	LSGD - Thrissur Municipality	Resilient Recovery of the LSGD's major link roads in the municipality of Thrissur - 51.24 kms	7.53	June 2019 to March 2020	November 2019 to March 2021 + 4 years Maintenance
	Total- A	342.37				
Water Resources Management	Completing the Idamalayar Irrigation Project including the construction of Link Canal	Water Resources Department	To diverting waters of Periyar River for irrigating cultivable land (i.e. approx. 29,036 ha) in Periyar and Chalakudy	150.00	June 2019 to April 2020	April 2020 to December 2024

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
	and Branch of Low level canal		basin area in the districts of Ernakulam, Idukki, & Thrissur. Work to be designed after detailed technical study			
	Completion of ongoing original works of Muvattupuzha Valley Irrigation Project	WRD	Improve irrigation facilities to Increase in agricultural production in **35,619 ha** in the districts of Ernakulam and Idukki	50.00	April 2019 to January 2020	January 2020 to February 2021
	Completion of remaining canal works undertaken in Banasura Sagar Project	WRD	Improve irrigation facilities to Increase in agricultural production in **3,825 ha** in Wayanad District	125.00	April 2019 to January 2020	January 2020 to February 2021
	Completion of remaining works in Karapuzha Irrigation Project	WRD	Improve irrigation facilities to Increase in agricultural production in **8,721 ha** in Wayanad District	110.00	April 2019 to January 2020	January 2020 to February 2021
	Providing community micro irrigation system through Minor, & Major irrigation schemes including lift irrigation schemes	WRD	Savings in water and energy. Increased crop yield of xxxx hectres /per croping season in al districts	150.00	June 2019 to April 2020	April 2020 to December 2022
	IWRM Based solution for eco system restoration of rain shadow belts in Palakkad district	WRD	Sustainable development of the area by scientific and judicious utilization of natural resources. Increased cropping area by xxx ha and crop yield	403.89	June 2019 to April 2021	November 2019 to December 2023

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
			by xxx % shifting to multicropping practice for crops eg. Xxxxx,xxxxxx,xxxx, to reduce water consumption in Palakad district			
	Sustainable Water Conservation by interlinking of ponds and traditional storage structures	WRD	Sustainable water conservation & rejuvenation of water bodies and storage structures to store flood waters and recharge depleting Groundwater table in all districts in the State.	1,100.00	June 2019 to December 2020	January 2020 to July 2026
	Implementation of prioritized projects proposed under various watershed masterplans	WRD	Various activities for development of sustainable water shed Interventions in all districts to improve water resources management	1,000.00	April 2019 to September 2020	January 2020 to December 2025
	Rectification/restoration of damages occurred to irrigation struct ions/assets during floods of August 2018	WRD	Repair and restoration of irrigation structures/assets damaged by the Floods in August 2019	1,483.00	January 2019 to Septemmber 2019	May 2019 to May 2023
	Total - B	**4,571.89**				

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
Rural Water Supply	Bulk Supply facilities completed. Establishment of Drinking water distribution networks and household connections	KWA	Supply potable drinking water to **5,488,072** population in the Gram Panchayats of Kovalam, Neyattinkara, Parassala, Pathanabapuram, Aruvikkara, Vamanapura, hdayamangala, Punalur, Kottarakara, Kundara, Chattannooor,PaKunnathur, Thiruvalla, Ranni, Chenganoor, Kanjirapally, Poonjar, KAduthuruthy, Vaikoam, Kunnamkulum, Aranmula. Konni, Alappuzha, Ettunmanoor, Vaikom, Thodupuzha, Udumbanchola, Kochi, Thrithala, Pattambi, Kondotty, Perithalmanna, Dharmadam, Kuthuparamba, Irikkur, Kalliasherry, Kasargod, Uduma, Tripunithura, Muvattupuzha, Ottapalam, Kalliaserry, Mangattidam, Trikaripur, and Kanhangad;	5,637.00	April 2019 to January 2020	May 2019 to March 2022

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
	Establishment/completion of Bulk water supply and distribution systems and networks with Household connections		Supply potable drinking water to **2,462,465 population** in the Districts of Pathinamthita Kottayam Ernakulam, Thrissur, Malappuram, Kannur, Kasaragod Thiruvananthapuram, Kollam, Alappuzha, Idukki, Wayanad	3,601.00	April 2019 to May 2020	May 2019 to March 2023
	Proposals being prepared for submission to National Water quality scheme for establishment of supply and distribution networks		Supply potable drinking water through distribution networks in the Gram Panchayats of Kongad, Nenmara, Shrnur, Peerumade, Tarur and Mannarkad in the **districts** of Palakkad and Idukki to benefit **population of 683,183**	436.00	April 2019 to January 2019	May 2019 to June 2021
	Improvement of Water Quality through upgradation of labs to support regular water quality checks/monitoring		Improve and monitor quality of the potable drinking water supplied to the population in all districts	34.00	April 2019 to January 2020	May 2019 to December 2021
	Installation of Solar Power units in KWA land in 14 locations to support operations		Utilization of 200 acres of land available at KWA installation sites to produce **40 MW power** to support energy requirements for its operations	250.00	April 2020 to May 2021	September 2021 to December 2023

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
	Total - C	# of beneficiaries - 8,633,720	9,958.00			
Urban Water Supply	Bulk Supply facilities completed. Establishment of Drinking water distribution networks and household connections	KWA	Supply potable drinking water to 2,960,308 population in 15 Municipalities in the districts of Alappuzha, Kottayam, Palakkad, Malappuram, Wayanad Kottayam Idukki, Ernakulam, Thrissur, Malappuram, Kannur and 18 Gram panchayats in the urban sprawl of these municipalities	3,404.00	April 2019 to January 2020	May 2019 to June 2021
	Bulk Supply facilities completed. Establishment of Drinking water distribution networks and household connections proposed for ADB funding		Supply of Potable drinking water for a population of 825,149 in the municipalities Palakkad, Kollam, Kozhikode, Kannur, Kasaragod	600.00	April 2019 to June 2020	30% to be completed by March 2021, balance 70% by December 2023
	Supply of uninterrupted drinking water supply in the cities of Thiruvanthapuram and Kochi - proposed for ADB funding		To establish 24x7 water supply in Trivandrum and Kochi to benefit population of 1,265,000	1,850.00	April 2019 to June 2020	30% to be completed by March 2021, balance 70% by December 2024
	Measures for uninterrupted Drinking Water supply distribution network system		To establish 24x7 water supply in the municipalities in all the	940.00	April 2019 to June 2022	May 2021 to June 2025

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
			districts to benefit **population of 11,865,000**			
	Establishment for full Water Supply with production and distribution		To ensure all remaining municipalities in the districts of Kottayam, Thrissur, Palakkad, Kozhikode, Kasaragod, Malappuram to benefit the remaining urban and rural areas in the urban sprawl totalling **population to 2,573,953**	5,375.00	April 2019 to June 2023	20% to be completed by March 2021, balance 80% by December 2026
	Total - D	**# of beneficiaries - 19,664, 430**	**12,169.00**			
State highways and key Feeder roads	Mukkada Edamon Athikkayam Kakkudumon Mandhamaruthy Road	PWD	Rehabilitate/reconstruct/improvements of key carriage ways across the State which were affected by the floods and improve associated peripheral roads to enhance resilience and access during disasters and trade in normal times	80.00	April 2019 to March 2020	February 2020 to December 2021
	Pathanamthitta- Ayroor– Muttukudukka Illathupadi – Muttukudukka Prakkanam – Prakkanam Elavumthitta - Kulanada Ramanchira – Thannikuzhy Thonniamala			112.46	April 2019 to March 2020	February 2020 to December 2021
	Edathua – Thayamkary- Kodupunna- Ramankary- Mancombu Kavalam Vikas Marg Road- Kannady Jn – Thattasserry- -			108.00	April 2019 to March 2020	February 2020 to December 2022

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
	Neelamperoor-Kurichi Road					
	Gandhinagar-Medical College-Babu Chazhikadan Road-Kottayam-Parippu Road-Athirampuzha Liessue-Kaippuzha-Mannanam-Pulikkuttissery-Parolickal-Muttappally Road			87.80	April 2019 to March 2020	February 2020 to June 2023
	Improvements to Painavu Thannikandom Asoakkavala road			84.00	April 2019 to March 2020	February 2020 to June 2021
	Idukki Neriyamangalm road			96.20	April 2019 to March 2020	February 2020 to Deccember 2021
	Improvements to riding quality of Chemmannar Gap road			83.40	April 2019 to January 2020	February 2020 to June 2021
	Thrissur Kuttippuram Road (SH 69)			119.92	April 2019 to January 2020	February 2020 to June 2021
	Rahabilitation of Nenmara-Nelliampathy Road			122.84	April 2019 to January 2020	February 2020 to June 2021
	Improvements to Koyilandy Thamrassery Mukkam Areekode Edavanna (KTMAE- SH 34)			204.80	April 2019 to January 2020	February 2020 to June 2021

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
	Rehabilitation of Vythiri-Tharuvana road			83.00	April 2019 to January 2020	February 2020 to June 2021
	Mananthavady LAC-Improvements to Mananthavady - Vimalanagar - Kulathada - Valad HS - Periya road			99.20	April 2019 to January 2020	February 2020 to June 2022
	Edoor – Companynirath - Angadikkadavu– Charal - Valavupara - Kacherikkadavu - Palathumkadav road			88.00	April 2019 to January 2020	February 2020 to June 2022
	Other key damaged highways and feeder roads and bridges in the districts of Idukki, Alappuzha and Patthinamthitta			630.00	September 2019 to October 2020	February 2021 to June 2024
	Total - E	**1,999.62**				
Revenue	Land registration and cadastral mapping needs assessment, and business process review; ICT system design, process reengineering; Digitalization assessment and plan; Mass survey and registration campaign piloting	Land Commissioner	To complete digitization of land records in Kerala and modernization of record rooms to maintain the records facilitate land administration, zoning and development activities	200.00	April 2019 to January 2021	September 2019 to June 2022
	Total - F	**200.00**				

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
Urban Sanitation	Establihsment of Sewerage Disposal and Treatment	KWA and Municipalities	To establish STP to ensure safe disposal of waste water and septage and treatment of Sewerage in the **municipalities Thiruvanthapuram, Kozhikode and Alappuzha** to benefit **population of 1,285,527**	1,725.00	April 2019 to December 2019	20% will be completed by March 2021 remaining works will be completed by 2023
	System for re-use of treated water from STPs (including treatment and distribution)		To distribute treated water to industrial and other commercial users near the cities of Thiruvanthapuram, Kochi, Kasargode, Kollam	110.00	April 2019 to December 2020	10% will be completed by March 2021 and remaining works will be completed by 2023
Rural Sanitation	Establihsment of Sewerage Disposal and Treatment		To establish STP to ensure safe disposal of waste water and septage and treatment of Sewerage in the **rural areas of Pathhinamthitta** to benefit a population of 200,000	40.00	April 2019 to December 2019	20% will be completed by March 2021 remaining works will be completed by 2023
Urban and Rural Sanitation	Establihsment of Sanitation and Sewerage infrastructure in Kerala		To provide sanitation infrastructure for maintaining clean environment for **13 million urban and 5 millon rural population**	2,750.00	April 2019 to March 2020	20% will be completed by March 2021 remaining works will be completed by 2023

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
	Establishment of infrastructure for collection & transportation of septage		To provide infrastructure for septage collection and treatment to service **80% of urban and 30% rural population** to maintain a clean environment	942.00	April 2019 to March 2020	20% will be completed by March 2021 remaining works will be completed by 2023
	Total - G	**5,567.00**				
Agriculture	Infrastructure for establishment of Agro-ecological Management units	Department of Agriculture	Realignment of department operations at ground level in accordance with the newly reorganized 5 agro-ecological zones to serve the sector better	200.00	April 2019 to March 2020	September 2019 to December 2021
	Geo-spatial Decision support system -Agri 4.0 - ICT Backend platform to support agriculture operations in the State		To provide end-to-end services to farmers to improve agriculture productivity in the State	50.00	June 2019 to August 2019	October 2019 to December 2020
	Capacity building of staff of DoA		Capacity and knowledge enhancement in alignment with the restructured agro-ecological zones	50.00	April 2019 to March 2020	September 2019 to December 2021
	Promotion of cultivation of key identified crops as per agro-ecological zones and support establishment of value chains		To initiate shift in production of crops identified under each agro-ecological zones to increase productivity, value addition, and income farmers	700.00	April 2019 to March 2020	30% by December 2020, balance by December 2022

Sector	Brief Description: Project/Investment (including key components/elements)	Department	Objective (Limited to RKDP)	Estimated Outlay in Rs. crore	Timeline for Preparation	Timeline for Implementation
	Establishment of soil health and advisory clinics for last mile service delivery		To collect and monitor soil health and feed into the decision support systems to provide advisory services to farmers to improve productivity and quality	250.00	April 2019 to March 2020	30% by December 2020, balance by December 2023
	Rejuvenation of flood affected plantations		Support to recover flood damaged plantation	150.00	April 2019 to March 2020	September 2019 to March 2021
	Rehabilitation of flood affected Infrastructure in Kuttanad and Kole areas		Support to construct damaged and washed away bunds and related sluice gates in place of new pump sets to regulate water flow in the channels	300.00	April 2019 to March 2021	September 2019 to March 2021
	Total - H	**1,700.00**				
Animal Husbandry	Establishment of modern abattoirs in all key centres in each district	Dept. of Animal Husbandry	To ensure hygiene practices of supplying meat is established	100.00	April 2019 to March 2020	September 2019 to March 2021
	Last mile animal care, health and disease preventions services		Establishment of mobile veterinary services units to provide on-site service delivery and monitoring	75.00	April 2019 to March 2020	September 2019 to March 2021
	Installation of RFID tags on livestock for improved monitoring and 10,00,000 rectoral thermometers		To monitor health of livestock and monitor	24.00	April 2019 to March 2020	September 2019 to December 2021
	Total - I	**199.00**				
	Total of A+B+C+D+E+F+G+H+I	**36,706.88**				

Annex-2: Government Order Operationalising the Rebuild Kerala Initiative

File No.CPMU-3/45/2018-PLGEA

GOVERNMENT OF KERALA

Abstract

Planning & Economic Affairs Department – Rebuild Kerala Initiative (RKI) – Comprehensive guidelines for Operational Strategy and Institutional Framework – Approved – Orders Issued

Planning & Economic Affairs (CPMU) Department

G.O.(P)No.16/2018/P&EA Dated,Thiruvananthapuram, 09/11/2018

Read 1 GO(P)No.14/2018-P&EA dated 20.10.2018

2 GO(P)No.15/2018-P&EA dated 27.10.2018

ORDER

The magnitude of the disaster caused by the rains and floods in August 2018 is unprecedented in the history of Kerala. Government have issued several orders to provide relief to those affected and repair/ restore the infrastructure. The Government of Kerala is of the resolve that it is not enough that the State merely undertake a rehabilitation and restoration plan in the aftermath of this natural disaster. This calamity should be taken up as a challenge and as an opportunity to rebuild the State to ensure better standards of living to all sections of society. Higher standards of infrastructure should be adopted in repair and reconstruction. New major projects should be envisioned for the State. Ecological safeguards and standards should be built into the structures that will be constructed to equip new and restored assets to better withstand the onslaught of such floods in the future.

2. Government has issued the Operational Strategy and Institutional Framework vide reference 1st and 2nd cited above . But it has come to the notice that some aspects regarding financial support and utilisation of funds were not specified in those orders .

3. In order to bring comprehensive guidelines for Rebuild Kerala Initiative (RKI) , Government have issued following orders for the Operational Strategy and Institutional Framework of Rebuild Kerala Initiative (RKI), appended as Annexure I and II, in supersession of the Government orders read above.

4. A detailed framework and the separate mechanism is necessary to co-ordinate various activities/administrative measures for the Rebuild Kerala Initiative. Rebuild Kerala Initiative (RKI) aims to rebuild Kerala in a speedy and effective manner to co- ordinate various activities comes under it and to give a proper direction to the programme.

5. The Institutional Framework proposed for Rebuild Kerala Initiative is governed through Council of Ministers, Advisory Council, High Level Empowered Committee (HLEC), RKI-Implementation Committee and Institutional Support Mechanism. The Chief Executive Officer of the HLEC shall be designated as a Secretary to Government under the Planning and Economic Affairs (RKI) Department.

6. The entire rebuilding process of post flood Kerala comes under the framework Rebuild Kerala Initiative (RKI) and the whole process shall be done with the administrative support of Rebuild Kerala Secretariat to be formed for the purpose under Planning and Economic Affairs Department.

7. Section VI of Operational Strategy and Institutional Framework annexed with this order dealing with deployment and utilisation of funds for speedy execution has the approval of Finance Department.

(By order of the Governor)
DR. VISHWAS MEHTA
ADDITIONAL CHIEF SECRETARY

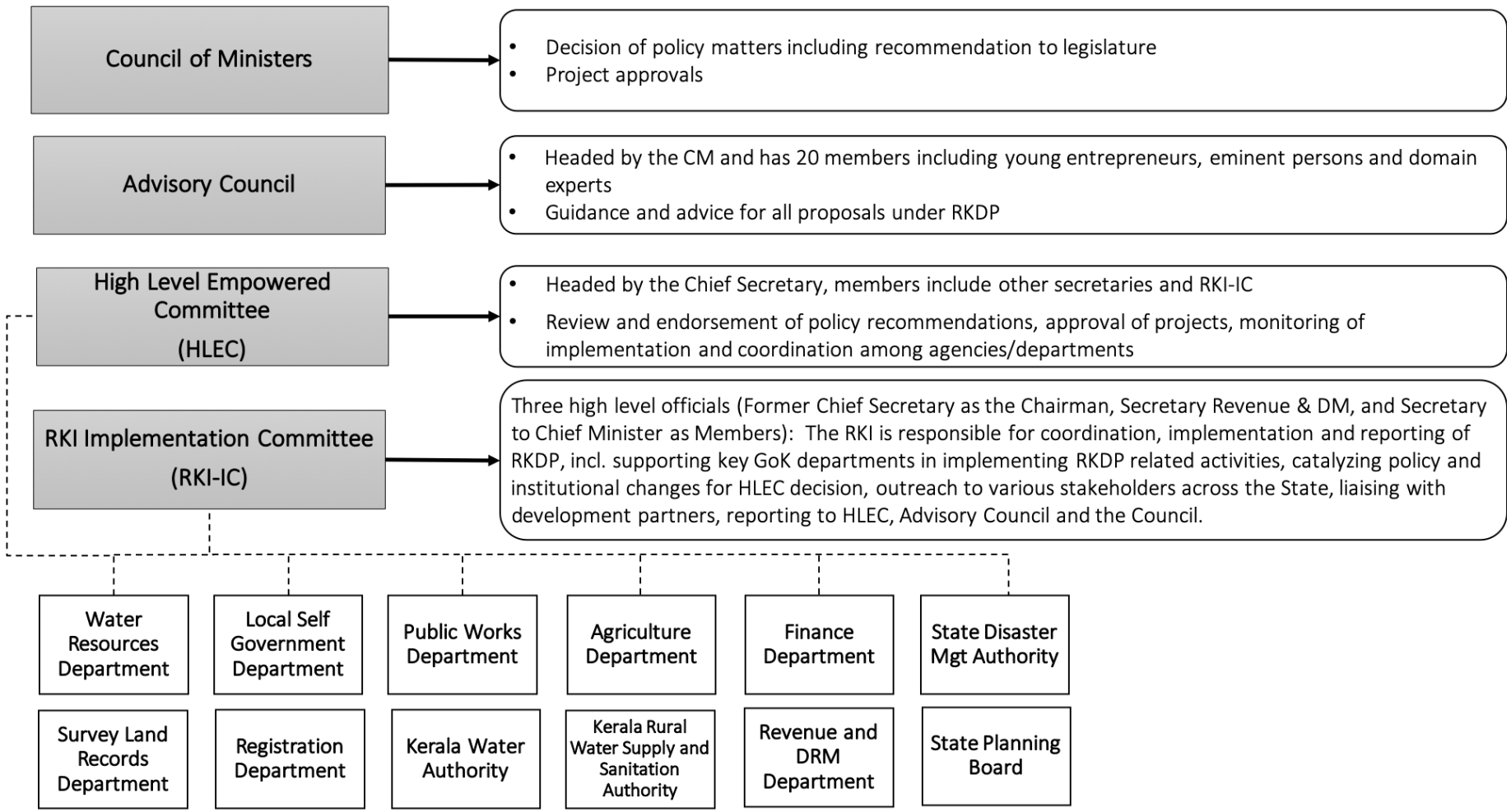
To:

The Chief Executive Officer, RKI Secretariat
The All Additional Chief Secretaries/Principal Secretaries/Secretaries/Special Secretaries
The Accountant General (A&E/Audit/G&SSA/E&RSA), Kerala, Thiruvananthapuram
All Heads of Departments
All District Collectors
All Departments/All Sections including Law and Finance Departments in the Secretariat
All Members of different Committees under RKI
The Private Secretary to Chief Minister/Other Ministers/Leader of Opposition
General Administration (SC) Department vide Item 2602 dated 07.11.2018
Special Secretary to Chief Secretary
The Executive Assistant to Chief Secretary
The Member Secretary, Kerala State Planning Board
The Secretary to Governor with covering letter
The Director of Treasuries
The Director, Information & Public Relations
Web & New Media
Stock File/Office Copy

Forwarded /By order

Section Officer

Annex-3: Institutional Setup for Rebuild Kerala Initiative



Caveat

The proposed interventions, studies, and projects in this report for each sector are initial proposals which have not been vetted in detail for their feasibilities. Further, other priority projects may also emerge from the process.