

# **India: Resilient Kerala Program for Results (PforR)**

## **Technical Assessment (TA)**

April 19, 2021





### ABBREVIATIONS AND ACRONYMS

AADT	Average Annual Daily Traffic	H1N1	Swine Flu
AEU	Agro ecological management units	HDM4	Highway Development and Management Model
AEZ	Agro-Ecological Zone	HLEC	High Level Empowered Committee
AFD	Agence Française de Développement	IAMIS	Integrated Agriculture Management Information System
AIIB	Asian Infrastructure Investment Bank	IBRD	International Bank for Reconstruction and Development
BC	Base Case	IIITM-K	Indian Institute Information Technology and Management Kerala
CAT	Climate Action Tracker	IRC	Indian Roads Congress
CGWB	Central Ground Water Board	IRI	International Roughness Index
CRN	Core Road Network	IRR	Internal Rate of Return
CSOs	Civil Society Organizations	KFD	Kayasanur Forest Disease
DLIs	Disbursement Linked Indicators	KHRI	Kerala Highway Research Institute
DoA	Department of Agriculture	KILA	Kerala Institute of Local Administration
DoF	Department of Finance	KRIS	Kerala Rebuild Information System
DoHFW	Department of Health and Family Welfare	KSDMA	Kerala State Disaster Management Authority
DPO 1	First Development Policy Operation	KSTP	Kerala State Transport Project
DPO 2	Second Development Policy Operation	LCV	Light Commercial Vehicles
DPR	Detailed Project Report	LSGD	Department of Local Self-Government
DRF	Disaster Risk Financing	LSGIs	Local Self-Government Institutions
DRFI	Disaster Risk Financing and Insurance	M&E	Monitoring and Evaluation
DRM	Disaster Risk Management	MAV	Micro Air Vehicle
DTCP	Department of Town and Country Planning	NBS	National Building Specification
EIRR	Economic Internal Rate of Return	NHM	Water Resources Department
ENPV	Economic Net Present Value	NPV	Net Present Value
EPC	Engineering Procurement and Construction	OH	One Health
ESSA	Environmental and Social Systems Assessment	OPBRC	Output- and Performance-Based Road Contract
FPOs	Farmer Producer Organizations	PAP	Program Action Plan
FRBM	Fiscal Responsibility and Budget Management	PAP	Program Action Plan
FSA	Fiscal Sustainability Analysis	PCU	Passenger Car Unit
FWP	Forward Work Program	PCU	Passenger Car Unit
FY	Financial Year	PforR	Program for Results
GDP	Gross Domestic Product	PforR	Program for Results
GHG	Green House Gases	PMSS	Project Management Support Services
GIS	Geographic Information System	PMSS	Project Management Support Services
GoK	Government of Kerala		
GSDP	Gross State Domestic Product		
GST	Goods and Service Tax		



**The World Bank**

The Resilient Kerala Program for Results (P174778)

PMU	Project Management Unit	SFC	State Finance Commission
PWD	Public Works Department	SH&FWS	State Health and Family Welfare Society
RA	Result Area		
RBCMA	River Basin Conservation & Management Authority	TA	Technical Assistance
RKDP	Rebuild Kerala Development Programme	ULB	Urban Local Bodies
RKI	Rebuild Kerala Initiative	VOC	Vehicle Operating Costs
RKI-IC	RKI-Implementation Committee	VOTT	Visual Object Tagging Tool
RMMS	Road Maintenance Management System	WB	World Bank
		WRI	World Resource Institute
		WRM	World Resource Institute

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## **A. INTRODUCTION**

The Technical Assessment (TA) has been carried out as part of the preparation of the Program-for-Results (PforR). The purpose of the TA is to evaluate, with the support of Government of Kerala (GoK), the adequacy of Program arrangements across the four aspects of (i) strategic relevance and technical soundness, (ii) expenditure framework, (iii) results framework and monitoring and evaluation capacity, and (iv) economic justification.

The PforR Program is anchored in GoK’s Rebuild Kerala Development Program (RKDP). RKDP is the strategic roadmap developed towards achieving the vision of a resilient, green, inclusive and vibrant Kerala in the aftermath of 2018 floods. The plan 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.

The PforR will support a subset of results identified in RKDP, which GoK considers as critical to address the sectoral bottlenecks, significant to resilience building vision and builds on engagement of the World Bank in the state through Development Policy Operations and Technical Assistance. Working closely with the GoK, the TA has identified institutional mechanisms, implementation arrangements and actions that will lead to achievement of the intended results. The TA has also identified key risks to the achievement of the Program’s objectives and associated mitigation measures.

## **B. PROGRAM DESCRIPTION**

### **B.1. Government Program**

The RKDP constitutes the GoK’s medium-term roadmap for a Green and Resilient Nava Keralam (New Kerala). It serves as the Government’s overarching framework and main vehicle to operationalize a resilient recovery program and mainstream resilience in development. The RKDP is to be implemented over a period of 8 years. It aims at “the creation of a society that has sustainable livelihoods for its inhabitants and a land with modern infrastructure that cannot be undone by natural disasters”. The RKDP encompasses policy, regulatory, institutional and investment actions and programs across four crosscutting and twelve sector-based areas that are critical for resilient and sustainable recovery and rebuilding. Further, the RKDP outlines partnership, financing, and implementation modalities. The RKDP was approved by the Council of Ministers in May 2019 and launched Statewide in July 2019. The GoK has already advanced reforms laid out in the RKDP in areas such as local disaster risk mapping, performance-based contracting of roads, shifting agriculture to align with local agroclimatic conditions, establishing modern water management practices, and introducing risk-informed master planning for cities and towns. It has also initiated other critical steps towards addressing climate vulnerability and enhancing resilience — for example, instituting a ban on a broad range of single-use plastics starting January 1, 2020 and redoubling its efforts to protect the coastline against sea-level rise and erosion. An analysis of RKDP priorities details a total outlay of US\$4,993 million (INR 365,069 million) for 2019–2027.

The RKDP approach is a multi-pronged one recognizing the interdependencies between sectors and aims to enhance institutional and regulatory capacity for resilient recovery. The multi-pronged approach would mean (i) tiered engagement – state, district, and local level; (ii) multi-sectoral engagement – policy and institutional reforms, resilient strategies, capacity building; and (iii) horizontal and vertical investments – synchronized resilience mainstreaming across departments and agencies and at State and local levels. In addition, RKDP adopts a systems resilience approach rather than sectoral approach which is key to an integrated resilient recovery



program. The Rebuild Kerala Initiative (RKI) is the institutional modality or framework to operationalize the RKDP by coordinating, facilitating and driving policy shifts, institutional convergence and supporting investment on-the-ground.

A sub-set of the RKDP has been strategically selected as the government program (the program) within which the proposed PforR Program (the Program) is situated. The health scope of the Program includes promoting an integrated One Health approach to diagnose, track, and respond to disease outbreaks. Specific activities include prevention and control of diseases, strengthening of public health laboratories and public health education, and training. These activities are complemented by the National Health Mission.<sup>1</sup>

Kerala has recognized the importance of One Health (OH) approach to address the threat of emerging infectious diseases, ensuring food safety, and minimizing the impact of endemic zoonoses. With the high human activity at environment, human and animal (wildlife, domestic) interface, Kerala is prone to emerging and re-emerging infectious diseases that can impact the economy and the society. In the recent years, the State had dealt with Highly Pathogenic Avian Influenza, Lyme Disease, Nipah Viral encephalitis and Leptospirosis associated with the flood. The main lesson learnt from the management of these infectious diseases is the need to adopt a multi-sectoral and integrative approach to prevent and control diseases, and attain optimal health for people, animals and the environment. A major existing challenge in effective implementation of OH approach in the State is weak linkage and compartmentalization among different departments and agencies responsible for human and animal health and the environment. The OH approach seeks to strengthen communication and collaboration between physicians, veterinarians and allied health professionals working at the interface of human/animal health and the ecosystem. A multi-agency approach to policy making, surveillance, outbreak response, prevention and control would institutionalize an effective OH collaboration within the State.

## **B.2. PforR Program Scope**

The proposed PforR Program will support the implementation of RKDP by adopting an integrated framework to enhancing GoK's fiscal and institutional resilience against the impacts of climate change and natural disasters, including disease outbreaks at the State level and testing the on-the-ground feasibility of this integrated approach at the local level.

The sub-set of sectors to be supported under the proposed Program are Agriculture, Disaster Risk Financing & Insurance (DRFI), DRM, Fiscal & Governance, Health, Road, Urban and Water Resource Management (WRM). In terms of geography, the Program will be focused on implementation in Pamba Basin which covers the 4 districts of Idukki, Alappuzha, Kottayam and Pathinamthitta. In addition to pilot implementation in 4 out of 14 districts in the state, the Program will also support state-wide systems and institutions development for all sectors.

### **Result Areas and Activities**

**RA 1: Strengthening transversal systems for resilience.** The results will focus on strengthening transversal systems—both foundational areas and cross-cutting elements—of resilience to help the State prepare and respond systemically to the challenges posed by exogenous shocks from climate change, natural disasters, or disease outbreaks. Key objectives include (a) financial protection against disasters through sustainable fiscal and

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<sup>1</sup> A GoI program to enhance state systems to improve health outcomes, including disease surveillance and response.



debt management, (b) a comprehensive disaster risk financing (DRF) and social protection system, and (c) disaster preparedness through mainstreaming climate and disaster risk-informed urban and DRM planning. Enhanced financial protection against disasters will be achieved through the following activities:

- 1.1. **Sustainable fiscal and debt management.** Kerala's limited fiscal space and high levels of debt have severely constrained its ability to deal with major exogenous shocks. Initial steps were undertaken in the DPO to enhance revenues through a masala bond issue and a flood cess. The RKP will strengthen the GoK's ability to deal with contingent liabilities due to natural disasters and disease outbreaks. The Program will support establishment of a debt management unit in the Department of Finance (DoF) and implement a debt management plan to scale down the State's debt-to-GSDP ratio to a sustainable trajectory. The Bank will support through technical assistance (TA) activities to enhance the capacity of this unit to strengthen revenue mobilization and expenditure management.
- 1.2. **Comprehensive disaster risk finance and social protection system.** The existing system for DRF has several issues. Delays in delivering timely and adequate assistance to affected and vulnerable households is a key issue, along with the increasing burden on the State's financial resources. The RKP will support the GoK to develop a comprehensive DRF framework that bolsters the financial resilience of the Government and the communities; build a unified database of vulnerable households and a payments platform which triggers post-disaster safety net payments to the bank account of eligible beneficiaries on time;<sup>2</sup> roll out modified crop risk insurance with risks transferred to the insurers; and mobilize market-based resources, over and above the State Disaster Relief Fund, either through issuance of bonds or purchase of (re)insurance. The Program envisages disbursing disaster-related payments to the bank accounts of the female head of eligible households. Global evidence suggests that when women in the household receive funds, household spending patterns tend to shift toward consumption goods that are more beneficial to children,<sup>3</sup> and women's relative bargaining power is strengthened.<sup>4</sup> Complementing the above, decision-making capabilities and financial literacy of women will be enhanced through (i) conducting information dissemination drives for women on post-disaster safety net payments and (ii) creating help desks at the community level to achieve full coverage of bank accounts for women to receive and access payments. In doing this, the RKP will rely on programs such as Theeramythri that support self-employment and empowerment of fisherwomen. To address potential shifts in intra-household power dynamics and risks of gender-based violence (GBV) or partner violence due to channeling entitlements into bank accounts of women, the Program will strengthen community-level support systems for GBV prevention and provide referral support to victims of domestic violence.
- 1.3. **Risk-informed urban master plans for cities and towns.** Unplanned developments and lack of investments in resilient urban infrastructure and services increased the impacts of 2018 and 2019 floods and landslides. Through the earlier DPO and TA, the Town and Country Planning Act (TCP Act) was amended by the GoK to mandate risk-informed master plans by urban local bodies (ULBs), and guidelines for the use of annual plan funds were restructured to enable and encourage multi-year investments in urban infrastructure. The RKP

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<sup>2</sup> With adequate protection of the personal data collected, integrated, and processed.

<sup>3</sup> Behrman, J.R. and Hoddinott, J. (2005). Programme Evaluation with Unobserved Heterogeneity and Selective Implementation: The Mexican PROGRESA Impact on Child Nutrition. Oxford Bulletin of Economics and Statistics, 67: 547-569. <https://doi.org/10.1111/j.1468-0084.2005.00131.x>

<sup>4</sup> Independent Evaluation Group (2014). Results and Performance of the World Bank Group 2014. <https://ieg.worldbankgroup.org/sites/default/files/Data/Evaluation/files/rap2014.pdf>



will support rollout of these reforms across the State and incentivize the ULBs in the Pamba River Basin districts for adoption of risk-informed master plans and priority action plans. Beyond the Program, building on experience, the state department will support ULBs across the State to adopt risk-informed master plans.

- 1.4. **Risk-informed local disaster risk management plans.** The World Bank, through the National Cyclone Mitigation Project 2 and DPO 1, has been supporting the Kerala State Disaster Management Authority (KSDMA) to establish norms, systems, and capacities for strengthening local level disaster risk planning and management across the State. The RKP will build on this and support the formulation/updating of DRM plans with local-level climate risk information, for all the 263 Local Self-Government Institutions (LSGIs) in the Pamba River Basin districts. The Program will include (a) the development of technical tools and training in DRM, (b) multi-year investment planning integrating climate risk information at the local level, and (c) support for the development of a scoring matrix called the Disaster and Climate Action Tracker (DCAT) to evaluate local investments which are climate and disaster risk informed. DCAT will be used by the Local Self-government Department (LSGD) to establish a performance- and reward-based system for incentivizing LSGIs that mainstream climate and disaster risk in their development and investment planning.

**RA 2: Embedding resilience in key economic sectors.** This results area aims at embedding standards, norms, and practices of resilience in a sample of socioeconomic sectors—health, WRM, agriculture, and roads—to demonstrate an integrated approach to build multisectoral and multidimensional resilience. Key objectives and interventions to achieve the envisaged results are detailed as follows:

- 2.1. **Resilient public health systems.** High population density, large number of non-resident citizens and international travelers, aging population with co-morbidities, and large forest cover increase Kerala's vulnerability to large-scale disease outbreaks, especially zoonotic diseases, such as Nipah and COVID-19. Critical bottlenecks in the GoK's preparedness for disease outbreaks and pandemics include lack of health surveillance, coordination, and critical infrastructure systems at the district and local levels. The RKP intends to strengthen the public health systems of the GoK for disease outbreak preparedness and prevention. Specific activities include (a) operationalizing integrated public health laboratories (IPHLs) supporting disease surveillance and enhanced clinical case management in the Program districts; (b) establishing a One Health platform to strengthen coordination, collaboration, networking, joint surveillance, preparedness, and response to counter health hazards; and (c) implementing community-based One Health surveillance practices by LSGIs. An IT-enabled platform will be established for community-level networking of Prevention of Epidemics and Infectious Diseases (PEID) cells at medical colleges to undertake operational and applied research to inform State disease containment policies.
- 2.2. **Integrated and sustainable water resources management.** Declining ground water levels and high variation of rainfall over the years exacerbated by climate change have increased water vulnerability. There is a need for integrated water resource management (IWRM) to unlock the development potential of water resources, including making more productive use for hydropower, agriculture, fisheries, energy, and domestic needs, and reducing water-related risks and vulnerability to floods, erosion, sedimentation, environmental water stress, and pollution. A draft River Basin Conservation and Management Authority (RBCMA) Act was prepared under the DPO. The RKP will support the establishment of the RBCMA to institutionalize integrated reservoir operations, water monitoring, data collection, knowledge management, flood forecasting, and evaluation of environmental flows, for ensuring more efficient and sustainable water allocation to agriculture, irrigation, domestic, industrial, and other uses. The RBCMA will foster multisectoral and interagency coordination to build climate resilience and improve IWRM in the State. An integrated river basin plan and flood forecasting



system is being prepared for the Pamba River Basin and it will be used for developing detailed investment plans that will be supported under the RKP to mitigate impacts of climate-related events.

**2.3. Sustainable and resilient food systems.** Kerala’s agriculture faces persistent climate risks, affecting predictability in returns and viability of farming. Over the last two years, through the DPO engagements, the GoK has adopted an agroecological zone (AEZ) approach to the agriculture sector by delineating the State into five AEZs and 23 agroecological units (AEUs), based on geographic and climatic factors. It further aligned the planning, budgeting, and implementation architecture in the sector with AEZ-based approaches. To support this shift and to move toward precision farming, an Integrated Agricultural Management Information System (IAMIS) is being developed. In parallel, new guidelines for establishing crop-based Farmer Producer Organizations (FPOs) have been rolled out to promote aggregation of produce, to create volumes, and to access emerging markets. The Program will support the GoK to strengthen 16 AEUs in the Program districts to facilitate implementation of AEZ-based approaches. Further, a new agri insurance product will be developed based on a recently completed study on AEZ-based crop insurance. The Program will also support increased women’s participation in agricultural activities, which has been on the decline in the State. It will ensure greater representation of women on the boards of FPOs. Targeted support would be provided to small and scheduled caste/scheduled tribe (SC/ST) women farmers through common service center kiosks to access IAMIS for information, benefits, and other services. Priority will be given to include members of Kudumbashree’s joint liability groups and ‘sangha krishis’, who had suffered huge losses post the recurring floods, in the FPOs. In addition, business development and leadership training will be provided for women farmers to strengthen their capacities to support FPO operations. AEU staff will be sensitized to support these initiatives.

**2.4. Climate resilient road infrastructure.** The road network of the State is susceptible to natural disasters due to intense rainfall and unique terrain features. There is no integrated geographic information system (GIS)-based vulnerability and hazards risk mapping of the asset stock to develop a resilience framework for the roads sector. Additionally, a low capital outlay creates challenges for financing road improvement projects to meet resilient standards. Due to limited mechanization and poor capacities of local contractors, the State has not been able to fully adopt modern and green construction technologies. Through the DPOs and with Kerala State Transport Project (KSTP) support, the Public Works Department (PWD) has notified the core road network (CRN) of 7,000 km and established a GIS-based Road Maintenance Management System (RMMS). The CRN would entail enhanced budgetary provisions and improved climate- and disaster-resilient standards. The RKP will support upgrade of 400 km of CRN in the Program districts which shall be contracted adopting output- and performance-based road maintenance contracts (OPBRC), to address higher disaster and climate risk vulnerability. The RKP shall also support establishment of a fully staffed RMMS cell to plan and roll out similar climate-proof designs, budgeting, and implantation for the entire road sector in the state.

### **B.3. Climate Change Co-Benefits**

#### **Climate and Sectoral Vulnerability Context**

**Climate change and disasters.** The climate of Kerala is tropical monsoon with seasonally excessive rainfall and hot summer. Between 1981 and 2010, Kerala had an annual average rainfall of 2,835.5 mm, annual average maximum temperature of 31.3°C, and an annual average minimum temperature of 23.1°C. The annual average rainfall in Kerala is projected to increase by 34.7 mm to a new average rainfall of 2,870.2 mm during 2021–2050, according



to representative concentration pathway (RCP) 4.5 (low emission scenario). The districts of Kasaragod, Kannur, and Kozhikode are projected to have reduced annual rainfall between 2021 and 2050, while increases are projected for other districts. The projections remain largely similar under RCP 8.5 (high emission scenario). Under RCP 4.5, the annual average maximum temperature is projected to increase by 1.3°C to a new temperature of 32.5°C, while annual average minimum temperature is to increase by 1.1°C to a new temperature of 32.5°C. All the districts would on average have an increased annual maximum and minimum temperature of 1–1.3°C during 2021–2050. Kerala is highly vulnerable to multiple natural and anthropogenic hazards and a changing climate, given its mountainous topography and geo-hydrological features, bounded on either side by the Western Ghats and the Arabian Sea. The state is particularly prone to a host of natural hazards such as cyclones, monsoon storm surges, coastal erosion, sea level rise, tsunamis, floods, droughts, lightning, landslides and land subsidence, and earthquakes. Floods are the most common type of disaster; nearly 14.8 percent of the state is prone to flooding. Another major natural hazard is landslides, especially in the districts situated along the Western Ghats. In addition, around 50 percent of the districts in the state are susceptible to droughts. Between 1881 and 2000, Kerala has experienced around 66 droughts. Landslides also lead to soil erosion and contribute greatly to deteriorating soil quality. Sea level rise and coastal erosion is the third most common hazard, with coastal erosion affecting nearly 63 percent of the state's 580 km coastline. Sea level rise projections indicate that significant parts of Kerala in the densely populated coastal areas will be below the annual flood level by 2050. Kerala has also been frequently prone to biological disasters in the form of zoonotic diseases and viruses such as the bird flu (Avian Influenza), Nipah virus, Kayasanur forest disease, and the ongoing COVID-19 pandemic

**Agriculture sector.** The Agriculture and allied sector is extremely vulnerable to the effects of climate change and disasters, as can be seen from the aftermath of the catastrophic 2018 floods or the drought of 2017 which was declared as the worst drought to hit the state in 115 years. As per projections, the consecutive dry days (number of days with precipitation with less than 1 mm) are projected to increase in districts such as Kasaragod, Ernakulam, Thrissur, Palakkad, Kottayam, and Alappuzha, which would have implications for the agricultural sector facing drought-like conditions. 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. An increase of temperature by 2°C by 2025 would affect paddy production in Kerala. With each degree rise in temperature, rice yield would be reduced by 6 percent. Widening in temperature range along with deforestation may be detrimental to thermo-sensitive crops such as cardamom, coffee, tea, cocoa, and black pepper cultivation across the high ranges of Kerala. Heavy pre-monsoon showers (and a lethal attack by wasps) may have an impact on pepper production in the state, the main producer of the commodity in India. Increase in maximum temperature of 1–3°C during summer 2004 adversely affected thermo-sensitive crops such as black pepper and cocoa. The marine and inland fisheries sectors in Kerala (particularly the aquaculture sector) are likely to be affected as climate change affects fish stocks, resulting in decreased yield and loss of livelihood of fishermen. The changing climate has led to more frequent loss of fishing days due to bad weather; increasing loss of nets, traps, and longlines; damage to boats and shore facilities; increased loss of life among fishermen; and increased damage to coastal communities, by means of houses and farmland. The 2018 floods also brought about severe damages such as surface crusting, surface cracking, loss of soil flora and fauna such as microbes, useful fungi, earthworms, loss of nutrients due to leaching, loss of surface soil in many areas, and so on. Farmers, fishermen, and tribal population are the most vulnerable groups in the state to climate change whose livelihoods are exposed and less resilient to address the climate change. Farmers become most risky section in the State because a small change in climate will drastically affect their livelihood. Also, fishermen in the State are already at risk through reduction in fish production and their catch due to climate change. The tribals in the State have the least capacity to withstand the risk of climate change in the state.



**Water resources sector.** Climate change is likely to significantly have an impact on the water resources of the state. Though Kerala is endowed with plenty of rainfall, the state often experiences scarcity of water amid abundance. Climate-related warming of water resources, especially lakes (Sasthamcotta Lake) and rivers (Bharathappuzha), has been observed from various parts of the state.<sup>5</sup> Additionally, due to climate variability, many lakes have exhibited prolonged stratification with decrease in surface water nutrient concentration. The depth of groundwater is also affected as there has been a decline in groundwater recharge, while the extraction rates have increased over the years. The number of semi-critical blocks has increased from 18 to 30, showing the increased pressure on groundwater resources. It has also been observed that overexploitation of ground water in certain stretches of the Kerala coast has contributed to the entry of salinity into the coastal aquifers from the sea.<sup>6</sup> Various studies point out that water resources in the Western Ghats of Kerala may see a decline in water yield. A similar reduction in water yield is likely for the Western Coastal Region. Regular flooding occurs in the low areas around the backwaters and lower river reaches. At many locations in the rivers, cross-dams and check dams are constructed for irrigation or water supply. This has increased river levels upstream and may cause unwanted flooding. Due to the frequent occurrence of floods and draining of silts by rivers, ponds, lakes, and wells which are important sources of fresh water are at risk. Wetland ecosystems are also at risk of degradation due to changes in temperature and precipitation.

The backwaters of Kerala are a unique self-supporting ecosystem consisting of brackish water lying at the meeting point of freshwater from rivers and seawater. These serve as a source of livelihood for a large population including traditional fishermen and those employed in the tourism and hospitality sector. The fishermen community is highly vulnerable to climate change risks and natural disasters. They incur significant losses due to disasters, in terms of loss of livelihood and death or disability. Additionally, the degradation of water quality, increased solid waste in the bottom sediments, encroachment of eco-sensitive zones, and so on have emerged as major threats to sustainable management of these waterbodies. Saltwater intrusion has the potential to disrupt major wetland functions. Natural processes in wetlands such as denitrification and water quality management are hindered by an increase in salinity. Ecosystem and habitat destruction from saltwater intrusion is also a major concern.

**Urban sector.** Kerala is the second most rapidly urbanizing state in India. SWM services are very limited—almost all the ULBs are lacking sustainable treatment and disposal facilities with partial waste collection systems. Inadequate wastewater management and SWM services are not only affecting the quality of life in urban areas but also the water bodies surrounding the urban areas (backwaters). 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 caused by climate change. Increasing urban population and incomes have also led to increased generation of solid and liquid waste by households and industry. Due to inadequate treatment and disposal, these become significant sources of GHG emissions. A mere 18.8 percent of households in Kerala have piped water supply for drinking water needs. The situation is much worse in rural areas.<sup>7</sup>

**Transport sector.** Kerala is one of the well-connected states in the country with a road density of 590.14 km per km<sup>2</sup>, much higher than the national average of 387 km per km<sup>2</sup>. Additionally, it has an inland water transportation system and well-connected rail and airport system. The transportation sector was one of the worst hit sectors during the Kerala 2018 floods causing a standstill in Kerala. The road network of the State is prone to natural disaster due to unique terrain features—such as highlands, rolling hills and mountainous terrain, mid-lands, and

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<sup>5</sup> Department of Environment and Climate Change 2014.

<sup>6</sup> Central Water Commission 2017.

<sup>7</sup> National Statistical Office 2018.



coastal plains. The hilly areas are vulnerable to landslides often caused due to intense rainfall during monsoons which damages the road infrastructure. During the 2018 floods and landslides, around 48 percent (in km) of the total state road network was reported damaged mainly due to floods, landslides, earth slips, soil movement, and rock falls.

**Health sector.** Kerala is prone to several re-emerging infectious diseases such as highly pathogenic Avian Influenza, Lyme disease, Nipah viral encephalitis, and leptospirosis associated with the floods. Climate change affects health through three pathways: (a) directly through weather variables (such as heat, cyclones, floods, and storms), (b) indirectly through natural systems such as disease vectors, and (c) through pathways heavily mediated by human systems such as undernutrition. Climate change will lead to worsening undernutrition, expansion of zoonotic diseases, malarial and diarrhoeal diseases, and heat mortality. The issue of health and climate change is complex, with several interlinked aspects. For example, an increase in heatwaves affects outdoor workers but will also negatively affect both water quality and quantity, resulting in higher incidences of diarrhoeal diseases and less water availability for drinking and agriculture, causing malnutrition and undernutrition.

**Adaptation and Mitigation Actions**

**Table 1: Climate Adaptation and Mitigation Actions by DLI**

Prior Actions	Adaptation Actions	Mitigation Actions
<b>RA 1: Strengthening transversal systems for resilience</b>		
<b>DLI 1: Fiscal sustainability to cope with disease outbreaks and natural disasters is strengthened (USD 4,687,500)</b>		
<ul style="list-style-type: none"> <li>Conduct a feasibility study for debt restructuring and develop a debt management plan to bring the state's debt-to-GSDP ratio onto a more sustainable path.</li> <li>TA support to customize the FSA tool that adapts the Macroeconomics, Trade, and Investment Global Practice standard FSA tool for use at the subnational level.</li> <li>Conduct capacity-building workshops with DoF staff on the subnational FSA tool.</li> </ul>	<p><b>Vulnerability context.</b> Refer to (a) and (f)</p> <p><b>Intent to address identified vulnerabilities.</b> The project aims to improve sustainability of government finances and thereby increase resilience to external shocks due to disasters and climate change.</p> <p><b>Explicit link between identified climate change risks and specific project activities.</b> These interventions will improve debt management capacity and debt sustainability of the government to systemically prepare for and address exogenous shocks due to climate change, natural disasters, and disease outbreaks.</p>	
<b>DLI 2: Disaster-related adaptive safety net system of GOK is strengthened (USD 10,000,000)</b>		
<ul style="list-style-type: none"> <li>Develop a platform to distribute post-disaster payments.</li> </ul>	<p><b>Vulnerability context.</b> Refer to (a) and (b)</p> <p><b>Intent to address identified vulnerabilities.</b></p>	



Prior Actions	Adaptation Actions	Mitigation Actions
<ul style="list-style-type: none"> <li>Pilot parametric-based insurance and safety net systems that can be implemented for the fisherfolk families before the upcoming 2020 monsoons.</li> </ul>	<p>Developing an integrated database platform of vulnerable groups in the state such as fisherfolk, tribal families, women-headed households, elderly, disabled persons, post-disaster relief beneficiaries, households in vulnerable areas, and so on, including their socioeconomic and bank account information will allow identification of vulnerable and disaster-affected households, design of customized support mechanisms for specific groups, and quicker delivery of financial assistance.</p> <p><b>Explicit link between identified climate change risks and specific project activities.</b> These safety net payments will reduce the likelihood that fishermen will venture out to the seas during adverse climatic events, thus cutting down on loss of lives and assets, and develop more concrete information on risk pools and exposures for other groups to design better policies, insurances, and safety net programs.</p>	
<p><b>DLI 3: Disaster risk financing and insurance capacity of GoK and vulnerable households in the State are improved (USD 10,000,000)</b></p>		
<ul style="list-style-type: none"> <li>Develop a comprehensive DRF policy that contributes to increasing the financial resilience of the government and communities to disasters.</li> <li>Establish an institutional framework for managing the DRF system.</li> <li>Build a statewide integrated adaptive social protection system with a codified post-disaster payments platform which triggers and releases disaster payments to eligible beneficiaries in a transparent and timely</li> </ul>	<p><b>Vulnerability Context.</b> Refer to (a)</p> <p><b>Intent to address identified vulnerabilities.</b> The state will identify and develop potential public and private sources of DRF to safeguard the state finances, provide timely assistance to the vulnerable households, and to protect the economy and livelihoods against projected natural disasters and climate shocks. In addition to innovative modalities such as a flood cess and a masala bond, additional sources of finance are required to fund recovery and resilience of the State. Increased revenues from stamp duty and registration fees, and proceeds of the bond would be used to support recovery, mitigate disaster risks, and enhance climate resilience in sectors such as transportation, water, and power.</p>	



Prior Actions	Adaptation Actions	Mitigation Actions
<p>manner.</p> <ul style="list-style-type: none"> <li>• Assist the State in mobilizing additional funds, over and above the funds available in the SDRF, from the market either by issuance of bonds (impact bond/infrastructure resilience investment bonds/catastrophe bonds) or purchase of (re)insurance.</li> </ul>	<p><b>Explicit link between identified climate change risks and specific project activities.</b> Development of a comprehensive DRF policy, institutional framework for managing the DRF system, statewide integrated adaptive social protection system, and issuance of bonds (impact bond/ infrastructure resilience investment bonds/ catastrophe bonds) or purchase of (re)insurance will contribute to increasing the financial resilience of the government and communities to disasters and climate shocks.</p>	
<p><b>DLI 4: ULBs developed and sanctioned risk-informed Urban Master Plans and Priority Action Plans (USD 7,500,000)</b></p>		
<ul style="list-style-type: none"> <li>• Submission of the draft amended TCP Act to the State Assembly for approval</li> <li>• Technical support for               <ul style="list-style-type: none"> <li>○ Development of capacity-building program for risk-informed planning</li> <li>○ Development of detailed guidelines for risk-informed planning</li> </ul> </li> </ul>	<p><b>Vulnerability context.</b> Refer to (a) and (d)</p> <p><b>Intent to address identified vulnerabilities.</b> Detailed risk information and geospatial data will strengthen the Kerala TCP Act which permits regulation of natural hazard prone areas and risk-informed urban planning to adapt and mitigate current and projected climate and disaster vulnerabilities. Multi-year municipal infrastructure investments are critical for sectors such as drainage, sanitation, and SWM for resilient infrastructure development and sustainable service delivery during disasters.</p> <p><b>Explicit link between identified climate change risks and specific project activities.</b> Preparation and notification of risk-informed master plans, and multi-year municipal infrastructure investment planning and budgeting will ensure resilient recovery to Kerala 2018 floods and ensure that the state is well equipped to face any climate or disaster shocks in the future.</p>	<p>The master plans developed under this DLI includes features such as solar-powered facilities, rainwater harvesting, environmentally responsive building (efficient and sun responsive envelope, natural ventilation, passive cooling), green spaces, integrated transport network which reduces the need for motorized conveyance, energy efficient lighting and appliances, efficient modes of public transportation, and so on that contribute toward mitigation actions.</p>
<p><b>DLI 5: Climate risk Information integrated into local DRM plans (USD 17,500,000)</b></p>		
<ul style="list-style-type: none"> <li>• Develop local body DRM plans.</li> <li>• Develop a scoring matrix</li> </ul>	<p><b>Vulnerability context.</b> Refer to (a), (b), (d), and (f)</p>	



Prior Actions	Adaptation Actions	Mitigation Actions
<p>or the CAT that will help identify and track investments that are climate and DRM informed.</p> <ul style="list-style-type: none"> <li>Initiate a process to downscale the climate models and structure the information such that it can be used by the local bodies.</li> </ul>	<p><b>Intent to address identified vulnerabilities.</b>            The state will adopt the amended State Disaster Management Plan as required by the National Disaster Management Act of 2005 and update Local Disaster Management Plans. These plans will include vulnerability and disaster risk profiles for each local body with draft state-level hazard and vulnerability grid maps using downscaled climate models. These plans will ensure improved capacity for inclusive emergency, disaster, and climate risk management at local level. This will result in a paradigm shift from a relief-centric approach to a proactive and comprehensive futuristic disaster management covering all aspects from prevention, mitigation, and preparedness to response and recovery to projected disaster and climate risks. KILA will provide the necessary training to the local bodies for effectively using the climate information in their planning and development process.</p> <p><b>Explicit link between identified climate change risks and specific project activities.</b>            Downscaling climate models can help provide data on granular atmospheric features such as cloud cover, airborne particles, and local pollution sources that can have a big impact on local climate. Such granular data paired with localized temperature, precipitation, wind speed and other climatology data can help inform the planning authorities and policy makers to take informed steps for various sectors. This information can help identify extreme weather events on the smaller scale that are specific to that area such as storms, high-intensity rainfall that can lead to flash floods, heat stress, and so on. Such datasets are also helpful to identify urban heat island effects specific to urban or metropolitan areas and provide important information for local adaptation decisions. Temperature and rainfall data at higher resolution can help inform cropping pattern for agriculture sector, specifically for rainfall-dependent farmers. Local day-to-day temperature and precipitation conditions can help better</p>	



Prior Actions	Adaptation Actions	Mitigation Actions
	<p>understand how these conditions influence the spread of vector-borne diseases such as malaria and dengue. These climate projections can also help inform projections of water availability which affects several sectors such as agriculture, industries, power plants, drinking water and sanitation, and so on.</p>	
<p><b>RA 2: Embedding resilience in key economic sectors</b></p>		
<p><b>DLI 6: Capacity to track and respond to zoonotic disease outbreaks of human importance in a timely manner through the One Health platform enhanced at the local level (USD 15,000,000)</b></p>		
<ul style="list-style-type: none"> <li>• Review the IDSP and community surveillance data and documentation.</li> <li>• Conduct interviews with One Health teams and community surveillance team members.</li> <li>• Review data generated by the PEID cells through documentation and select site visits.</li> </ul>	<p><b>Vulnerability Context.</b> Refer to (a) and (f)</p> <p><b>Intent to address identified vulnerabilities.</b> The project will support management of emerging and re-emerging infectious diseases by adopting a multisectoral, multidiscipline, integrative approach to prevent and control diseases to attain optimal health for people, animals, and the environment.</p> <p><b>Explicit link between identified climate change risks and specific project activities.</b> Establishment and operation of One Health coordination structures and IT-enabled PEID cells will help communities monitor and deal with climate-induced diseases. Specific training programs/workshops will enhance capacity of health workers to respond to these identified disease outbreaks and post-disaster needs.</p>	
<p><b>DLI 7: Integrated River Basin Management Plan developed for Pamba Basin and implementation commenced (USD 10,000,000)</b></p>		
<ul style="list-style-type: none"> <li>• Submit draft RBCMA Act to the State Assembly for approval.</li> <li>• Review existing investment designs and preparatory studies for new investments for climate resilience.</li> </ul>	<p><b>Vulnerability context.</b> Refer to (a), (b), (c), and (e)</p> <p><b>Intent to address identified vulnerabilities.</b> The RBCMA Act will conserve and regulate water resources within the State to ensure improved river basin planning and water</p>	



Prior Actions	Adaptation Actions	Mitigation Actions
<ul style="list-style-type: none"> <li>Initiate the design of and equipping the RBCMA.</li> <li>Commence integrated river basin planning, integrated reservoir operations, and flood forecasting for selected river basins.</li> <li>Conduct intensive training of operational staff in various technical areas, including data acquisition and management, and hydrologic and hydraulic modelling.</li> <li>Procure monitoring instruments/equipment to fill critical data gaps.</li> </ul>	<p>infrastructure operations management for climate and disaster resilience.</p> <p><b>Explicit link between identified climate change risks and specific project activities.</b> The RBCMA will facilitate and ensure its sustainable management, allocation, and utilization for different sectors such as agriculture, industrial, drinking, inland transport, commercial, and others.</p>	
<p><b>DLI 8: Farmer Producer Organizations (FPOs) have increased access to new and organized markets (USD 15,000,000)</b></p>		
<ul style="list-style-type: none"> <li>Promotion and strengthening of FPOs across the state</li> <li>Rollout of the IAMIS</li> <li>Promotion and strengthening of agro-ecologically relevant farming systems across the state through realigned crop assistance schemes and stakeholder capacity building.</li> </ul>	<p><b>Vulnerability context.</b> Refer to (a) and (b)</p> <p><b>Intent to address identified vulnerabilities.</b> AEZs are based on geographical, ecological, and climatic conditions. The agriculture development plans based on AEZs will help formulate and adopt most suitable farming systems and practices based on climate projections for the zone. The state will build resilience through adoption of agro-ecologically relevant farming practices that will lead to biosphere restoration, ecological balance and improved soil quality and water retention capacity. Training and capacity building of DoA staff and farmers on information and communication technology-based agriculture service delivery solutions will enhance their knowledge about shifting climatic patterns and climate-smart agriculture practices.</p> <p><b>Explicit link between identified climate change risks and specific project activities.</b> The rollout of the AEZ-based agricultural systems will help shift to cropping practices of more climate-resilient crops and increase</p>	<p>Activities to reorient the farmers to an AEZ-based approach will strengthen farmers’ access to appropriate advisory, agri-inputs and financial support, and restructuring of crop-assistance schemes on AEZ basis and facilitate support to farmers on adoption of climate-resilient agriculture practices (such as reduction in fertilizer use and paddy production) that will lead to non-CO<sub>2</sub> GHG emissions reductions from agricultural practices and technologies.</p>



Prior Actions	Adaptation Actions	Mitigation Actions
	the coverage and uptake of agriculture risk insurance which will enhance resilience of farmers to climatic and disaster shocks.	
<b>DLI 9: CRN is meeting resilient standards in the Pamba Basin with sustainable asset management practices established (USD 35,000,000)</b>		
<ul style="list-style-type: none"> <li>Support implementation of RMMS with a fully functional climate module.</li> <li>Implement resilient CRN road infrastructure and long-term OPBRCs in selected districts along the Pamba River Basin.</li> </ul>	<p><b>Vulnerability context.</b> Refer to (a) and (e).</p> <p><b>Intent to address identified vulnerabilities.</b> Adopting resilient standards and performance-based management contracts for the CRN as well as streamlining sector institutional frameworks will enhance resilience of the road sector to increasing vulnerability to natural hazards and climate change. This includes interventions on drainage systems, landslide risk mitigation to maintain enhanced resilient standards, and strengthening of institutional capacity and systems to address climate change risks.</p> <p><b>Explicit link between identified climate change risks and specific project activities.</b> Establishment of web- and GIS-based RMMS with a climate module will support systems for better sector planning and budgeting and adoption of innovative approaches to climate and disaster resilient road maintenance and management. The project will support resilient road infrastructure pilots and maintenance program in the Pamba Basin and develop sector climate resilience strategy, manuals and guides for sustainable design and resource conservancy efforts including NBS.</p>	Kerala can aim to properly connect and increase the coverage/ease of use of the public transportation network. This will contribute to a modal shift and reduction in GHG emissions.
<b>Front-end Fee to be paid pursuant to Section 2.03 of this Agreement in accordance with Section 2.05 (b) of the General Conditions (USD 312,500)</b>		

## C. PROGRAM STRATEGIC RELEVANCE AND TECHNICAL SOUNDNESS

### C.1. Program Strategic Relevance

The Program strategic relevance is High. Kerala is vulnerable to climate and disaster risks. The state is exposed to hydrometeorological and geophysical hazards and faces challenges in building resilient communities and infrastructure in the context of climate change. Kerala is highly vulnerable to natural disasters and the changing



climatic dynamics given its location along the seacoast 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. Between 1981 and 2010, Kerala had an annual average rainfall of 2,835.5 mm, annual average maximum temperature of 31.3°C, and an annual average minimum temperature of 23.1°C. As per projections, the annual average maximum temperature is projected to increase by 1.3°C to 32.5°C, while annual average minimum temperature is to increase by 1.1°C to 32.5°C. All the districts would on average have an increased annual maximum and minimum temperature of 1–1.3°C during 2021–2050. In case of precipitation, according to climate projections for the period 2021–2050, the districts of Wayanad, Idukki, Kottayam, and Pathanamthitta are projected to experience a large increase in the number of extremely wet days, while Trivandrum is projected to experience a slight reduction in such days. Further, the models point to an increase in erratic diurnal rainfall with reduced monsoon rainfall, which could increase flooding and surface run-offs and reduce groundwater recharge from rainfall.

**In addition to climate change risks, Kerala has been severely impacted by COVID19 pandemic and is vulnerable to zoonotic diseases.** High levels of urbanization and population density, tourist inflows, regular inward and outward travel of non-residents (over 18 million international arrivals each year), and an aging population (with nearly two thirds of population aged 45 years or above ) with co-morbidities made Kerala susceptible to infection and spread. Kerala state has experienced recurrent outbreaks of zoonotic diseases during past decade including Nipah Virus, Swine Flu (H1N1), and Kayasanur forest disease (KFD). In addition, the state experiences recurrent outbreaks of Chikungunya and Dengue. The ongoing COVID-19 pandemic has clearly demonstrated the vulnerabilities of state for future diseased outbreaks. Large forest covers increase state vulnerability for diseased outbreaks, especially zoonotic diseases.

**Disasters have a significant impact on Kerala's fiscal resilience and on economic development.** The state has run high fiscal deficits in recent years, which has resulted in a steady increase in the state's public debt-to-GDP ratio. This deterioration in fiscal performance was primarily driven by gradual increases in committed expenditure - especially on salaries, while own tax revenues have remained relatively low as a share of Gross State Domestic Product (GSDP). The COVID-19 pandemic has affected the near-term outlook for Kerala; not only has the growth outlook deteriorated significantly, but so have fiscal prospects. The key revenue streams of Kerala – tourism and remittance income – are sectors which have faced direct impact of the pandemic.

**GoK's response to pandemic has been encouraging but requires long-term measures.** The GoK responded proactively through a robust response plan at the early onset of the disease, based on learnings from the Nipah virus outbreak experience in 2018 and building on the institutional and policy actions carried out under the DPO 1. An initial spike of new COVID-19 cases occurred, beginning in late March 2020, declining to zero daily cases by mid-May 2020. A second spike occurred in mid-May 2020, primarily due to returning expatriates and migrants from other States, as the lockdown eased. As of December 6, 2020, there have been 632,000 cases and 2,390 deaths. Of this, 568,000 (89.8 percent) cases have recovered. Although Kerala is one of the top three States in India in terms of new case rate (15% of new cases as on December 6, 2020 are from Kerala) and has a high test-positivity rate (9.9 percent vs. national average of 6.8 percent), its mortality rate (0.3) and transmission rate (1.55) are still on the lower side. To deal with the COVID-19 and other disease outbreaks in the future, the GoK needs to further strengthen its disease outbreak warning and response systems and commence recovery from the current crisis amidst serious economic and fiscal constraints.



**Building resilience and reducing vulnerabilities to disasters and disease outbreaks in Kerala requires a multi-disciplinary and multi-pronged approach.** The resilience deficit in Kerala that contributed to 2018 and 2019 floods 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. Addressing these require systemically building the capability of the GoK to carry out an integrated and coordinated set of policy, institutional and budgetary changes, over time. The RKDP is thus anchored in a common but differentiated approach that (i) recognizes common vulnerabilities and threats to communities and assets from disasters and climate change, (ii) while also takes into account the different levels of vulnerability, development, and coping capacities across the various sectors and districts. The multi-pronged approach envisaged under RKDP encompass (i) tiered engagement – state, district, and local level; (ii) multi-sectoral engagement – policy and institutional reforms, resilient strategies, capacity building; and (iii) horizontal and vertical investments – synchronized resilience mainstreaming across departments and agencies and at State and local levels. In addition, in the aftermath of COVID19 and exposure to zoonotic diseases, Kerala is also committed to implement OH approach to address structural challenges in early surveillance to coordinated responses. OH, by design, is a collaborative, interdisciplinary approach, linking many different forms of knowledge and expertise.

**The proposed Resilient Kerala PforR is one incremental — and important — step in a programmatic engagement between the GoK and the WB that is codified under the State Partnership.** The scope of the Program is closely aligned with the priorities of the RKDP and driven through the RKI institutional framework. While the RKDP has a broader mandate, the Bank support is focused on crosscutting areas and critical sectors where the impact on enhancing resilience will be most significant and our support would provide the greatest value addition. The Program builds on DPO 1 and the prior actions achieved under DPO 2, a broader set of past and ongoing sectoral engagements and investment projects, a programmatic technical assistance program and partnerships. The Program’s contextual relevance is amplified due to exigencies arising from COVID-19. The Program operates at the State and local levels, as well as balances between institutional actions at the state level and expenditures on the ground. Additionally, the State Partnership has led to iterative strengthening of financing, policy and institutions for resilience in Kerala. The table below highlights the sectoral progress achieved through the programmatic engagement.

**Table 2: Progress made through Resilient Kerala Program**

	<b>Baseline</b>	<b>Progress under DPO1 and other engagements</b>	<b>Aim of PforR</b>	<b>Trajectory of actions and expected results</b>
<b>Transversal systems for resilience:</b> Through the proposed RKP, earlier DPO, and TA, the aim is to establish a solid Statewide foundation for disaster risk planning, management and financing, and thus enhance the State’s capabilities to mitigate causes of major disaster and disease outbreak events, prepare better for any such events, and respond more effectively should such events materialize.				



	Baseline	Progress under DPO1 and other engagements	Aim of PforR	Trajectory of actions and expected results
Fiscal	Highly stressed state finances with no systems in place and limited fiscal space to respond to largescale exogenous shocks.	Revenue mobilization was enhanced by establishing a flood cess and mobilizing long term resources from markets. Outside the DPO, the GoK took steps	Debt sustainability will be enhanced by establishing a debt management cell in the DoF and implementing a debt management action plan. GoK will also leverage markets for risk financing and strengthen adaptive safety net systems.	These measures together with TA for strengthening expenditure management and PFM systems, will ensure that GoK is better positioned to deal with contingencies arising from disasters and other shocks
Disaster Risk Management	Weak state level systems and absence of local level preparedness to mitigate and respond to disasters and disease outbreaks.	Norms, systems, and capacities for strengthening local-level DRM across the State were put in place.  Emergency protocols at State level were improved to include climate change and disease outbreaks.	All 263 Pamba Basin LGs will undertake local DRM plans and multi-year investment planning, integrating climate risk information and applying DCAT.  ULBs in Pamba Basin will be capacitated in risk-informed master planning, and four ULBs will adopt master plans. LSGD will provide block grant incentives to LGs that enhance climate and risk sensitivity in their capital investments and ULBs that adopt risk informed master plans.  Technical tools and training in DRM and DCAT to evaluate local investments that are climate and disaster risk informed will be developed at the State level.	Risk informed master plans and local level DRM plans that integrate climate, disaster and disease outbreak information will form the bedrock of a holistic local system of resilience planning, management and investments. They will also serve to inform and strengthen resilience aspects of local level sectoral plans. These plans will bring together technical experts, elected representatives and the community in their formulation, implementation and monitoring.
Urban	Lack of master planning, major infrastructure gaps and weak controls caused unchecked and haphazard development in urban areas, contributing to greater disaster risks.	Amendments to TCP Act were proposed to mandate risk-informed master plans by ULBs, and guidelines for the use of annual plan funds by ULBs were restructured to support multi-year investments in resilient urban infrastructure.		
<p><b>Enhancing resilience in key socioeconomic sectors:</b> building on the transversal systems, key socioeconomic sectors, namely health, WRM, agriculture and roads will embed resilience principles in their planning and investments, and strengthen their institutional capacities to address challenges of climate change, disasters and disease outbreaks. Not only will each sector become more resilient, but, at the local level, synergies will be drawn across sectors to bring to bear an integrated approach to resilience in planning, institutional capacities and investments.</p>				
Health	High vulnerability to zoonotic diseases, and while the State managed Nipah outbreak well, it needs integrated disease surveillance and response systems.	State has recognized the importance of Gol's One Health approach but no local level coordination platform or community based surveillance systems exist.  Not part of DPO engagement.	Public health systems will be strengthened to identify and manage disease outbreaks in Pamba districts by operationalizing IPHLs for better disease surveillance and clinical case management, and by rolling out One Health platform to enhance coordination, collaboration, surveillance, preparedness, and response at local level.	Improved capacity to track and respond to zoonotic disease outbreaks of human importance in a timely manner. The disease outbreak surveillance and response platform together with local DRM systems form the vanguard of local resilience, bringing together LGs, line agencies and communities.



	<b>Baseline</b>	<b>Progress under DPO1 and other engagements</b>	<b>Aim of PforR</b>	<b>Trajectory of actions and expected results</b>
<b>WRM</b>	Lack of IWRM, including weak coordination among agencies, low institutional capacities and gaps in critical investments, contributing to water related disaster events, and poor economic and ecological management of water resources.	Draft RBCMA Act was prepared to establish RBCMA, which will manage river basins and water resources more strategically. Further, work was started on integrated river basin management plans and flood forecasting systems for Pamba and Periyar river basins.	RBCMA will be established and operationalized at the State level for integrated reservoir operations, river basin planning and IWRM.  Integrated river basin management plan for Pamba will be implemented, including critical investments.	Major rivers and river basins across the State will benefit from improved planning, management and investments.  Pamba Basin districts will benefit from early warning services and flood protection measures, and more prudent use of water resources that will benefit agriculture, industrial, human and other water uses.
<b>Agriculture</b>	Climate and disaster vulnerable agriculture practices and lack of risk protection, impacting food security and poor viability of farming in the State.	Move to ecological agriculture practices through adoption AEZ-based approach, delineating the State into five AEZs and 23 AEMUs, and shifting budgets to support new approach.  IAMIS established and guidelines for establishing crop-based FPOs rolled out.	AEZ-based approach will be rolled out statewide, including shifts in budgets, personnel, extension services and mainstreaming of IAMIS for farmers.  16 AEUs in Pamba districts and associated FPOs will be supported end-to-end to effect the change to AEZ-based approach, and ag risk insurance expanded and deepened to farmers in these districts.	Shift to agriculture practices based on local ecology and strengthening agri-value chains will enhance resilience of farming and food security, while expanding agri-risk insurance will better prepare farmers against exogenous shocks.
<b>Roads</b>	Road networks, especially CRN, in the State are poorly constructed and maintained, making them highly vulnerable climate change and disasters and rendering them inoperable during emergencies.	A 7000 km CRN, which is critical for the State, was designated, and resilient standards were adopted for the CRN.  A GIS-enabled RMMS was established in PWD.  A performance-based road maintenance contract model was adopted to apply to select CRN corridors.	An RMMS cell will be operationalized in the PWD to plan and manage resilient road network across the State, and the RMMS cell will develop a FWP for the CRN.  At least 400 km of CRN in Pamba districts will be upgraded and maintained to resilient standards with provisions for disaster response modules through long term performance-based contracts.	More resilient construction, rehabilitation and maintenance standards will reduce the vulnerability of road network to climate change and natural disaster events.  CRN improvements in Pamba districts will ensure that they are operable during future disasters, enhance farmer access to markets, and reduce vehicle operating costs and travel times, and serve as a model for the CRN in the State.

## C.2. Program Technical Soundness

**The Program’s design rests on solid technical bases and global best practices.** The PforR rests on the accepted premise that sustainable recovery to natural disasters and diseased outbreaks require a concerted effort with



equal focus on public investment planning systems, sectoral plans, social protection and infrastructure investments. The PforR operation also builds on lessons from similar World Bank projects, that coordination across multiple sectors supported at the highest levels of government was the most effective approach for shaping a program of resilient investments. The presence of RKI, an institutional mechanism built over last two years with mandate and demonstrated ability to coordinate sectors, provides a solid foundation for the operation. In addition, ensuring of shared design principles across sectors for effective resilience building; (i) democratized bottom-up resilience plans; b) combination of investments, policies and programs; and iii) equal focus on building safety nets for shocks while addressing the causes for stresses, adds to the technical soundness. Each of the sectors have also built their technical design based on analytics done as part of Technical Assistance for DPO1 and DPO2 such as a roadmap prepared for mainstreaming climate change and disaster risk management for the state with support of World Resources Institute (WRI) for disaster-prone sectors in the state. To name a couple of specific technical analyses and international best practices.

- The Program builds on a strong Fiscal Sustainability Analysis (FSA) done as part of DPO2. World Bank provided Technical Assistance support to the Department of Finance in the form of a customized FSA tool that adapts the standard FSA tool of World Bank for use at the sub-national level.
- Disaster Risk Management (DRM) Plans at the local level to be institutionalized under the operation has been prepared based on vulnerability and disaster risk profiles developed with hazard and vulnerability grid maps prepared by the Kerala State Disaster Management Authority (KSDMA).
- Resilience to zoonotic diseases will be addressed through OH approach which ensures that all relevant sectors and disciplines across the human – animal – environment interface are involved to address health in a way that is more effective, efficient, or sustainable.
- AEZ based approach to agriculture is accepted as a step-up in agriculture planning from traditional soil-based or climate-based crop promotion of cropping systems to a more agro-meteorological approach combined with economic factors too.

**The Program builds on strong government ownership.** The Rebuild Kerala Development Programme (RKDP) was approved by the High-Level Empowered Committee (HLEC) chaired by the Chief Secretary, top-most bureaucrat in the state, and later approved by Council of Ministers headed by Chief Minister. RKDP preparation also involved extensive discussions and deliberations led by Secretaries of key departments, heads of departments and their functional agencies. The proposed operations have also been approved by HLEC.

**The geographic boundary selection of Pamba river basin is appropriate.** The main vulnerabilities associated with the floods — emblematically — follow the course of the river, starting from the basins and reservoirs upstream, to the intense developments in the cities and towns midstream, through to farms and livelihoods downstream. Addressing the underlying drivers of floods and landslides and better preparing the GoK for future disasters, therefore, follows the course of the river: upstream, through integrated water resources and reservoir management; midstream, through improved land use planning and management, infrastructure and services; and downstream, through ecologically sound agriculture and irrigation practices. Specifically, the choice of Pamba Basin for the operation is also significant. The river, approximately 176km long, encompasses a basin area of about 2235sq.km and stretches over four key districts of the State viz., Idukki, Kottayam, Pathanamthitta and Alappuzha. The Basin was also one of the most affected with 34% of fatalities recorded in the catchment area in addition to



significant losses in agriculture, livestock, houses, and public infrastructure. More importantly, the area is a microcosm of the state with dense tropical monsoon forests, semi urbanized settlements and with the rice bowl of Kerala in its lowlands and thus, a canvas where a multi-sectoral resilience approach demonstrated can have a multiplier impact and scope for scalability.

**Beyond the broader approach, the specific sector approaches are also technically sound and built on analytics done. To share a few:**

- **The fiscal pillar aims to improve sustainability of government finances and thereby increase resilience to external shocks.** This objective is closely aligned with the priorities of the RKDP in terms of enhancing the resilience of the state's fiscal framework. The Program builds on DPO 1 and the prior actions achieved under DPO 2, a broader set of past and ongoing sectoral engagements and investment projects, a programmatic technical assistance program and partnerships. The Program's contextual relevance is amplified due to exigencies arising from COVID-19. The COVID-19 pandemic has put the State, in general, and, more specifically, the implementation of the resilience reform program under enormous fiscal and operational stress. The RKDP, which was prepared based on detailed sector-specific analysis, forms the primary technical foundation of the Program. At a secondary level, the Program is also informed by the DPO 1, analytical studies, sector-specific TA activities, and lessons learned from other Bank-funded projects and programs in Kerala, which includes national and state-level operations. The policy reforms that are critical to building resilience as identified under the RKDP, were supported under DPO 1. In preparing the DPO 2, the GoK has deepened the initial set of policy reforms described at the beginning of the State Partnership through a set of interlinked prior actions on macro-fiscal management including revenue enhancing measures. The need for improving the sustainability of government finances has also emerged from the sub-national fiscal sustainability analysis carried out in close cooperation with the GoK. As the GoK proceeds with the policy reform agenda, strongly building on the reforms in all these sectors, the proposed Program supports implementing agreed policies with much-needed capacity building, process improvement, and department-level institutional actions.
- **Disaster risk finance and insurance strategy is the need of the hour.** As witnessed by the recent floods (in 2018 and 2019) and diseased outbreaks (Nipah virus in 2017, and COVID in 2019-20), Kerala is vulnerable to increasing risk of climate change and diseased outbreaks. Extreme precipitation events, flooding, and landslides 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 enough reserves to respond when disasters strike. Additionally, recognizing also that many households and especially poor households are not insured, both the State Disaster Management Plan as well as the Disaster Management Act 2005 have rules/guidelines to partially compensate uninsured victims of disasters (against loss in principal residence and permanent disability/death). This compensation scheme makes GoK implicitly binding the compensation of the uninsured victims of disasters. The Government of Kerala (GoK) recognizes the urgent need to invest in climate adaptation and disaster resilience, and to set aside funding for disaster response. In addition, the program is also relevant as GoK must situate financial protection of the budget against disaster shocks within a larger decision framework for contingent financing.
- **Institutionalization of Disaster Risk Management and Climate considerations in the state's development process is central to the operations and resilience agenda.** As a first step, the government in its flagship



program, RKDP, identified the key challenges in DRM in the state. Subsequently, the GoK updated and published the State Disaster Management Plan, incorporating disaster risk reduction and climate resilience principles and policies and including emergency management and outreach to vulnerable communities. Over the past year, the GoK has initiated a process to develop DRM plans incorporating protocols for emergency response. Given the decentralized nature of planning and development in the state, the GoK through the PforR, will aim to create an incentive mechanism that encourages the local bodies to adopt and implement local development plans that incorporate DRM and climate consideration. Though ambitious, this is an important reform that will change the way development is approached at the grassroots level in the state.

- **The program incorporates three significant departures from the current approach that the GoK has adopted in the local level Disaster Risk Management (DRM) and planning process.** First, the local level DRM Plans, the first of their kind in the country are being developed based on risk profiles at the local level. These plans include the necessary emergency protocols and a list of resources available at the local level. Second, Kerala is the first state in India that intends to downscale climate models and use that information at the local level for planning and development. The granularity of the information that will be provided to the Local Bodies through this process will enable them to identify and prioritize investments that help reduce their vulnerability to climate change. Third, the GoK is planning to develop the Climate Action Tracker (CAT) tool that will give it the ability to track the investments towards climate change that are made by the local bodies. To start with, the GoK will conduct an assessment to understand what portion of the total investments at the local body level are climate sensitive. In the subsequent years, after training the representatives of the local bodies, GoK will incentivize local bodies to increase the total percentage of investments that are climate sensitive. This will be done by providing untied funds beyond the devolved funds.
- **Risk-informed master planning needs internal capacities to implement regulatory and planning reforms undertaken.** Amendment to Kerala Town and Country Planning Act 2016 has been undertaken by GoK with support of World Bank Technical Assistance. The proposed amendments mandate and enable the preparation of risk-informed Master Plans in all the Urban Local Bodies (ULB), have provisions to facilitate implementation of the Master Plans and give the state government the power to step in if the ULB does not prepare and sanction the plans as prescribed in the law. However, there are limitations of technical capacity that can constrain the enforcement of the law. These limitations exist both at the state level, in the Department of Town and Country Planning, and in the ULBs. The program proposed aims to overcome this capacity constraint. The program proposes three major interventions to promote risk-informed planning: (a) technical capacity building; (b) establishing guidelines and systems for preparing risk-informed plans; and (c) demonstrating and refining the system through pilot Master Plans.
- **The program will support investments to address climate and economic resilience through AEZ and value-chain approach.** The state has a diverse geographical landscape and comprises of 5 major AEZs, with a wide variety in cropping pattern, soil type, water use, access to incentives and market infrastructure. A key bottleneck in Kerala's agro-resilience has been the lack of any diversified approach to address farmers' distinct challenges in these AEZs. To address this, RKDP envisaged and further, through World Bank supported DPO1 initiated an AEZ based approach to agriculture planning and budgeting. The Program aims to strengthen resilience (economic and climate) by strengthening AEZ-based production systems, new risk financing instruments, technology-enabled service delivery and value-chain based market access approach. The program focus and design is technically sound as it aims to converge on the results through institutional realignment and farmer-level investments. Farmer-level investments would include incentives for farmers to



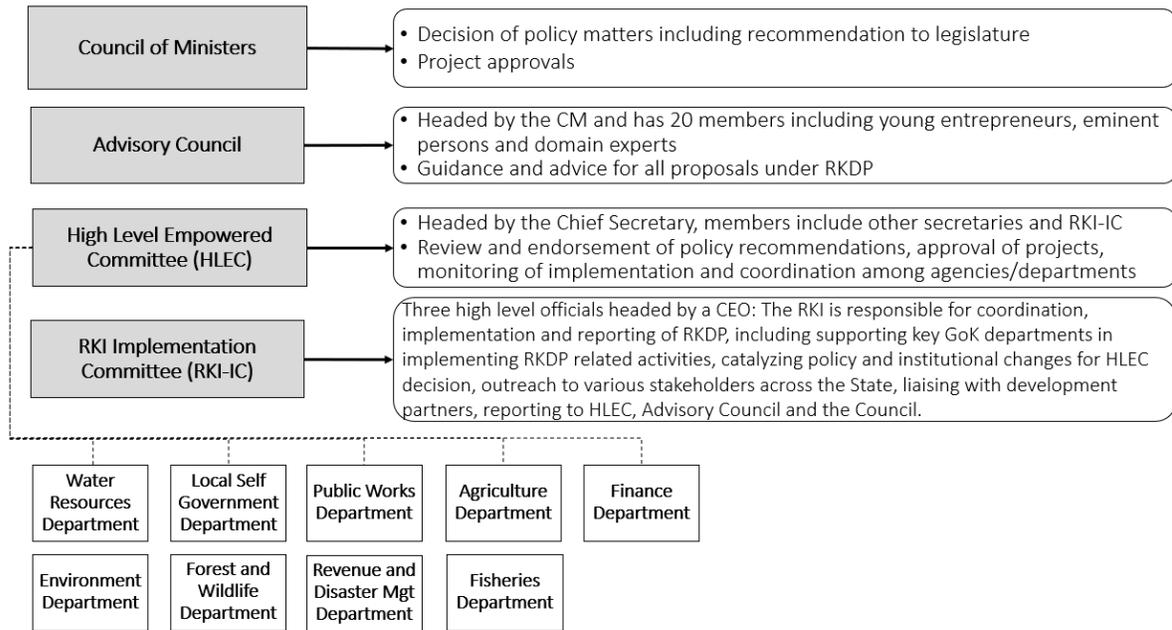
adopt suitable crops based on climate and economic factors and for strengthened access to markets through farmer producer organizations (FPO). Institutional re-tooling shall include technology-enabled service delivery and a single-delivery platform.

- **The river-basin based approach to addressing water resources management is important to mitigate climate-risks in Kerala.** The Pamba River Basin, amongst others in Kerala, experienced catastrophic flooding in August 2018 and 2019, with tens of thousands of homes damaged and scores of casualties. Post-flooding assessments suggest that some of the damage was caused by uncoordinated and poorly timed (and communicated) releases from Pamba Dam, Kakki Dam, and Anathode Dams and widespread unregulated construction and poor management the basin. Currently, limited modeling tools are being applied to manage the State’s water resources, and there is no uniform or consistent platform for the WRD to perform water balances, assess land use-change scenarios, or address climate change impacts to increase resilience. Further, there are no models linked to reservoir operations to support planning and management of storage, water supply, flood management or plan for environmental flows.

### **C.3. Program Institutional Framework and Implementation Arrangements**

A Project Management team is housed within Rebuild Kerala Initiative (RKI) and been functioning for over a year. Project Management Support Services (PMSS), as named, is responsible for the implementation, coordination, monitoring and evaluation of the Program. The PMSS is expected to provide technical, management and secretarial support to RKI and line departments involved, including their executing agencies and other partner institutions/stakeholders in investment planning, technical exploratory studies, development of sectoral policies, training and capacity building, technical reviews, in addition to program monitoring and evaluation, progress monitoring, reporting, communication, grievance redress and feedback, etc. with respect to projects funded under RKDP including World Bank supported PforR. Currently, there are 8 full-time experts (including procurement, financial management etc.) as part of PMSS, who support RKI and counterpart sector departments. PMSS will leverage technology-enable platform approach to ensure PforR operations is managed effectively by RKI. Kerala Rebuild Information System (KRIS), a management information system, is under development. Implementation arrangements for the Program is led and coordinated by RKI through departments of Agriculture, Finance, Public Works, Local Self Government (LSGD), Revenue and Water Resources Management.

**Figure 1. RKI Institutional Framework: Roles and Responsibilities**



## D. EXPENDITURE FRAMEWORK

The Program expenditure framework is derived based on current baseline and associated estimations for interventions: The expenditure program is based on departmental level work plans designed to achieve the DLIs and the overall results. The expenditure proposed for individual activities is commensurate with their scale and complexity and facilitates efficient execution. The Program cost primarily comprises of associated incremental costs and essential activity support cost included in the government program. In specific, the Program expenditure includes key proportionate expenditures towards system establishment for unified beneficiary database, debt management, disaster risk financing, identified departmental modernization and capacity building, incremental performance grant to ULBs and LSG in Pamba Basin, building key roads like Sabarimala roads in Pamba basin, agriculture transformation support in the Pamba basin covering four Districts, 16 Agro ecological management units (AEUs) and 264 Krishi Bhavans (local bodies); promotion and strengthening of OH approach health systems for pandemic readiness.

A large part of the funding will be directed towards institutional strengthening, systems development and resilient investments. Program expenditure will primarily include departmental modernization cost, capacity building, capital expenditure support, financing access, IT hardware, software development, training and capacity building and essential operational costs at implementing agencies as well as minor or high priority investments to demonstrate integrated multi-sector resilience in Pamba Basin. For establishing sustainable resilient approach in GoK, the Program recognizes the importance of strengthening human resource capacity, who ultimately become the champions of these reforms in long run. Given the critical importance to building capacity, the Program expenditure framework includes salary cost of key departmental human resource which represents 23% of the Program cost.



The proposed Resilient Kerala PforR (the Program) aims to support and incentivize the GoK in a transformational shift to build long-term fiscal and institutional resilience to climate change, natural disaster and disease outbreaks. Hence, the Program expenditure framework has been established along the economic classifications emerging on account of the different stratification measures required to achieve the Program PDO. The table below shows the overall Program expenditure composition by entity involved and economic classification of expenditures.

A detailed expenditure framework (in USD million) for the Program, implementing agency-wise, is as shared below.

**Table 3: Program Expenditure Framework for FY 2021-26 (in USD million) by Implementing Agencies and associated expenditure components**

Implementing agency	Expenditure Components	Government Program	PforR Program
<b>Department of Finance</b>	<b>Consultancies, IT hardware, software development, training, salaries and operational costs</b>	<b>92.03</b>	<b>71.45</b>
	Modernization of Finance Department and Training of Staff	1.23	0.62
	Salary & Wages and departmental of Finance Department (50% program related)	23.64	18.92
	Management of Debt - Expenditure connected with the issue of new loans and sale of security	31.15	15.92
	Consultancies for evaluation and modernization support	36.00	36.00
<b>Local Self Government Department</b>	<b>Creation of Capita assets, Performance grants and salary &amp; wages</b>	<b>748.49</b>	<b>144.74</b>
	Funds for Development Expenditure - 5Th SFC Recommendations - Grants for The Creation of Capital Assets	575.75	-
	Engineering Wing for Local Self Government Institutions (staff cost to support Pampa Region)	56.49	56.49
	Un-tied performance Incentive Grant	116.25	86.25
<b>Department of Health and Family Welfare</b>	<b>Consultancies, infrastructure support, access to financing, IT hardware, software development, training and capacity building and operational costs</b>	<b>122.25</b>	<b>113.86</b>
	Prevention and Control of Diseases	77.72	72.72
	Public Health Training	30.13	20.87
	Public Health Laboratories	19.40	19.40
<b>Water Resource Department</b>	<b>Consultancies, IT hardware, software development, training and maintenance cost</b>	<b>79.37</b>	<b>41.98</b>
	Minor irrigation program: Green Kerala	14.59	-



Implementing agency	Expenditure Components	Government Program	PforR Program
	Modernization of The Department And E-Governance, Design Wing and Hydro Information System	28.34	5.44
	Consultancies for evaluation and modernization support	36.44	36.44
<b>Department of Agriculture</b>	<b>Consultancies, minor infrastructure support, Financing access, IT hardware, software development, training and capacity building and operational costs</b>	<b>440.89</b>	<b>41.11</b>
	Crop Development Programs (Rice Development, Vegetable promotion, Pulses and Tubers, Coconut Development, Spices Development). PforR Program:	319.88	-
	Soil Health Management, Productivity Improvement and Augmenting production of planting materials through departmental farms.	60.16	16.35
	Agro Service Centers and Service Delivery strengthening	3.36	2.54
	Krishi Padasala- Approach to promote AEU based cultivation.	3.80	3.80
	Office Automation and IT infrastructure	19.66	4.20
	Value Addition program support to FPOs in post-COVID assistance and economic recovery	34.03	14.22
<b>Public Works Department</b>	<b>Construction and maintenance, consultancies, IT hardware, software development, training and capacity building and operational costs</b>	<b>208.64</b>	<b>106.85</b>
	KHRI - Center for Excellence: modernization	19.57	9.00
	Sabarimala Roads Project: Capital expenditure	30.82	30.80
	Special Repairs to Communications (OPBRC)	30.00	30.00
	Post Flood Projects Under the Rebuild Kerala Initiative	128.25	37.05
<b>Department of Planning (RKI)</b>	<b>Consultancies, IT hardware, software development, training</b>	<b>10.00</b>	<b>10.00</b>
	Program management and other consultancies support	10.00	10.00
	<b>Total</b>	<b>1,701.65</b>	<b>530.00</b>

The Technical Assessment also analyzed fiscal considerations on Program, including the government’s overall medium-term budget trajectory and its implication for the financial sustainability of the PforR Program and vice-versa. The state has run high fiscal deficits in recent years but adopted a Fiscal Responsibility and Budget Management (FRBM) Act in 2003 (including an amendment in 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. Since FY17/18, the fiscal deficit has gradually declined from 3.8 percent of GSDP to less than 3 percent of GSDP in FY19/20. However, the fiscal consolidation in FY19/20 has been achieved by cutting expenditures significantly (given otherwise declining revenues). Public debt is estimated to have remained stable at around 30 percent of GSDP, only marginally above



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the 29.67 percent target set under the state's FRBM Amendment Act, 2018. Due to COVID19, it is estimated that revenues will fall short of budget estimates by a significant 26 percent and fiscal deficit is expected to widen significantly since the government's obligations under various welfare schemes increased amid the lockdown. However, as growth recovers in subsequent years, debt will stabilize at around 38 percent of GSDP in FY22/23 and start to decline thereon. The PforR focus areas are critical for the state's medium and long-term recovery from COVID19 impact and will thus be of fiscal priority too.



**Table 4: Program Expenditure Framework for FY 2021-26 (in USD million) by Implementing Agencies and annual projections**

Implementing Agency	Expenditure Classification	Government Program [p]	Program for Results (PforR) [P]						External Funding <sup>8</sup> (to be confirmed)		
			FY 2021-22	FY 2022-23	FY 2023-24	FY 2024-25	FY 2025-26	Total	IBRD	AIIB	AFD
Department of Finance	Consultancies, IT infrastructure (hardware, software), training, salaries and operational costs	92.03	9.75	15.59	17.85	16.56	11.70	71.45	15.00	15.00	55.00
Local Self Government Department	Incentive Grants, Training and Capacity building and operational expenditure	748.49	21.63	26.40	36.23	31.38	29.10	144.74	25.00	25.00	45.00
Department of Health and Family Welfare	Consultancies, capital expenditure support, access to finance, IT infrastructure (hardware, software), training and capacity building, salary and operational costs	122.25	22.15	23.71	22.71	22.71	23.59	113.86	15.00	15.00	5.00

<sup>8</sup> The total amount of AIIB funding will be US\$ 125 million. The total amount of AFD funding tentatively planned as Euro 100 million (US\$ 120 million equivalent), pending confirmation from DEA...



Implementing Agency	Expenditure Classification	Government Program [p]	Program for Results (PforR) [P]						External Funding <sup>8</sup> (to be confirmed)		
			FY 2021-22	FY 2022-23	FY 2023-24	FY 2024-25	FY 2025-26	Total	IBRD	AIIB	AFD
			Water Resources Department	Consultancies IT infrastructure (hardware, software), software development, training and capacity building	79.37	2.89	6.98	4.08	14.88	13.14	41.98
Department of Agriculture	Consultancies, minor Infrastructure support, Financing access, IT infrastructure (hardware, software), training and capacity building and operational costs	440.89	9.02	9.40	8.17	7.49	7.03	41.11	20.00	20.00	-
Public Works Department	Infrastructure Expenditure, consultancies, training and capacity building	208.64	21.10	36.30	32.40	11.78	5.27	106.85	40.00	40.00	-
Department of Planning (RKI)	Consultancies, capacity building,	10.00	2.00	2.00	2.00	2.00	2.00	10.00	-	-	-



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The Resilient Kerala Program for Results (P174778)

Implementing Agency	Expenditure Classification	Government Program [p]	Program for Results (PforR) [P]						External Funding <sup>8</sup> (to be confirmed)		
			FY 2021-22	FY 2022-23	FY 2023-24	FY 2024-25	FY 2025-26	Total	IBRD	AIIB	AFD
	training and PMU support										
		1,701.65	88.54	120.37	123.44	106.80	90.86	530.00	125.00	125.00	120.00

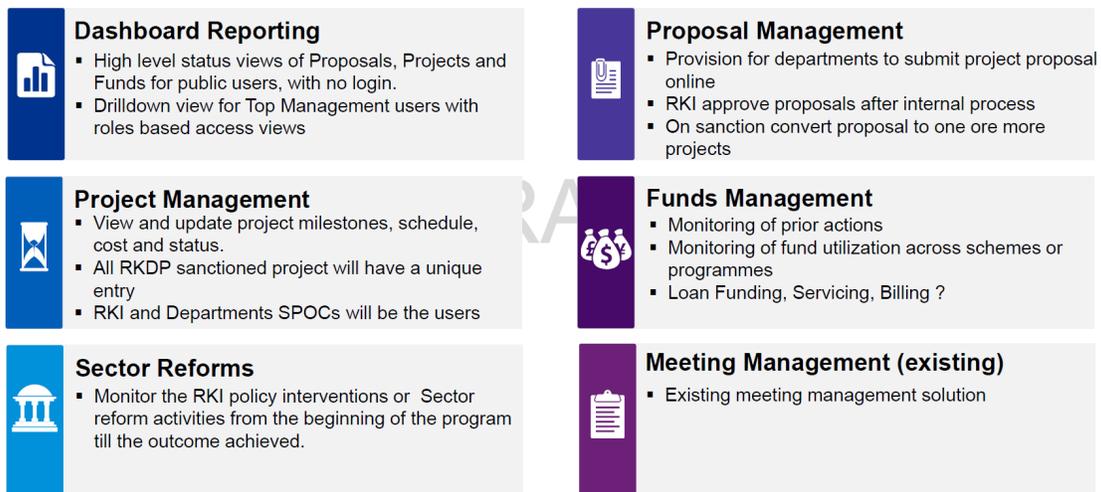


## E. MONITORING & EVALUATION (M&E) CAPACITY

Rebuild Kerala Initiative (RKI), the coordinating agency for the program, will be overseeing the monitoring of the program implemented across sectors by varied sectoral institutions. RKI has designed a robust Management Information System (MIS), Kerala Rebuild Information System (KRIS), to oversee the implementation of diverse set of investments supported by RKI. KRIS on roll-out is expected to provide a dynamic platform in which users at all levels can view and interact with project schedule, cost and status. The five core modules of KRIS area: a) Dashboard reporting; b) Proposal management; c) Project management; d) Fund management and e) Sector reforms. Indian Institute Information Technology and Management Kerala (IIITM-K), an autonomous Government affiliated institution, has been entasked with the technology implementation and deployment of the MIS. The roll-out is expected to happen by June 30, 31, 2021.

**Figure 2: Kerala Rebuild Information System (KRIS)**

### Modules



Beyond the information system, the human resources responsible in-house for the role are in-place. A firm has been hired to undertake the role of Project Management Support Services (PMSS) and has supported the design and development of the information system amongst other management roles. The PMSS has a technical expert on M&E and can provide the necessary support to RKI in further systems development and capacity building on the subject.

In addition to MIS, the following monitoring & evaluation activities would be undertaken by RKI with technical support of World Bank: a) *Overall Impact Assessment* to assess the impact of the operations. The overall impact assessment will have a base-line survey, mid-term survey and follow up survey.; b) *Sectoral (Thematic) Evaluations* where required especially where innovations are being attempted; c) *Process Monitoring* and *Periodic Tracking surveys* to assess if the key assumptions of theory of change with respect to inputs and processes required to



achieve the results. RKI will also facilitate compilation of good practices emerging from the operations for knowledge sharing amongst stakeholders within the state and outside.

Reporting progress on the Results Framework will be the responsibility of RKI. The PMU housed at RKI with support of MIS will help in preparation of the report which shall be put up to RKI-Implementation Committee (RKI-IC). On the approval of RKI-IC, chaired by CEO, RKI, the annual Program Results Report (including reporting on all PDO-level and intermediate results indicators, evidence of results related to DLIs, and evidence of compliance with requirements of the PAP) shall be shared with World Bank. The reports will be submitted every six months.

## **F. ECONOMIC ANALYSIS**

### **F.1. Overall Economic Justification**

The Program supports actions to advance policies and strengthen institutions statewide for attaining multidimensional resilience and pilots to embed resilience in an integrated manner across key economic sectors at the local level. The targeted beneficiaries of RA1 and RA2 are the entire population of Kerala and the population of the 4 districts of in the Pamba basin -- Idukki, Kottayam, Pathanamthitta and Alappuzha. The program generates the following key benefits, some of which are non-quantifiable:

- More sustainable State and local government finances through debt management and revenue enhancement measures.
- Speedier economic recovery through Social Safety Net, disaster risk planning and COVID-19 response.
- Reduced incidence of deaths and illnesses through strengthened COVID-19 response and preparedness for future disease outbreaks.
- Reduced vehicle operating costs and increased commuter time and money savings through rehabilitation and maintenance of vulnerable roads.
- Reduced damages to roads and major infrastructure from floods through improved WRM practices, granular flood forecasting, rehabilitation of vulnerable roads, and improved disaster management plans.
- Increased farmer incomes through targeted support for new and existing Farmer Producer Organizations, strengthened crop insurance programs, granular flood forecasts and improved WRM practices.
- Employment creation through labor-intensive construction works.

The recent disasters may undermine the progress that the GoK has made in reducing poverty and promoting shared prosperity if immediate recovery, reconstruction, and long-term resilience building efforts are not undertaken. The total damages and losses of the 2018 floods and landslides are estimated to be around US\$3.74 billion (INR 26,718 crores) and total recovery needs at around US\$4.25 billion (INR 31,000 crores). The State also incurred major damages due to flood and landslides in 2019 and 2020. The losses were amplified by inadequate water resources management, poor early warning systems and protocols, unplanned development in disaster-prone areas, and poor-quality infrastructure. The needs are largest for the Infrastructure sectors -- transportation, water, sanitation and hygiene, power and irrigation -- followed by social sectors, productive sectors and cross cutting sectors.

Natural disasters, climate change and disease outbreaks also have significant indirect costs on the state economy and the Government. They also result in indirect costs through reduced economic growth, increased poverty and inequality over time, health costs, loss of productivity, higher rehabilitation and maintenance costs of infrastructure, increased service delivery costs, among others.



Actions to support Environmental sustainability, inclusive growth, and impacts on the health of the people in the long run have been crowded out by the by the COVID-19 induced supply-side shock. The economy and the GOK's revenue-generating potential has been affected by the lockdown which began in March 2020. To bring the economy back to normal, the GOK has increased expenditures to i) control the spread of pandemic, ii) provide financial assistance to the vulnerable population, and iii) support livelihood generation. As a result, the GOK's fiscal position has deteriorated considerably. A recent DoF commissioned study projected 2020-2021 revenue shortfalls of US\$ 4.34 billion (INR 33,455 crores). A closer review of look at the national and the state fiscal stimulus packages reveals that environmental sustainability and inclusive growth has been crowded out.

Actions to support Environmental sustainability, inclusive growth, and long run population health have been crowded out by the COVID-19 induced supply-side shock. The economy and the GOK's revenue-generating potential has been affected by the lockdown which began in March 2020. To bring the economy back to normal, the GOK has increased expenditures to i) control the spread of pandemic, ii) provide financial assistance to the vulnerable population, and iii) support livelihood generation. As a result, the GOK's fiscal position has deteriorated considerably. A recent DoF commissioned study projected 2020-2021 revenue shortfalls of US\$ 4.34 billion (INR 33,455 crores). A closer review of the national and the state fiscal stimulus packages reveals that environmental sustainability and inclusive growth has been crowded out.

The Program outputs primarily comprise of public goods and address market failures associated with externalities, warrant public and government financing. Regulated water releases upstream increases framer productivity and infrastructure damages from disasters downstream. Customized and climate-informed extension services increase farmer productivity and alleviates poverty. Early detection of disease through surveillance significantly reduces its spread and the higher direct and indirect costs of treatment. The public good characteristics and the externalities associated with them reduce their attractiveness to the private sector and merit public and government financing.

The World Bank's involvement would leverage global experiences and good practices to instill sound policies and to test integrated approaches to multidimensional resilience and to respond to and recover from COVID-19. The program is small compared to the size of the economy and does not have fiscal implications. It provides the needed support to sustain the GOKs vision for a resilient Kerala.

Actions to advance policies and strengthen institutions create the necessary enabling environment for making the state more resilient to current and future shocks. They are not amenable to quantitative cost benefit analysis because of the multiple and diffuse channels through which they operate, and the long-time frames over which they produce results. Establishing risk informed master plans is a pre-requisite for reducing exposure to future risks but in and of itself do not generate benefits without the investments that follow. Similarly, establishing insurance markets will enable the value creation once markets become operational through optimal risk transfers.

Quantitative economic analysis of the sector programs under RA2 indicate they are economically viable. The four sector pilots under RA2 target demonstrate an integrated approach to building resilience along the Pamba river basin comprising of four most affected districts in the 2018 floods -- Idukki, Kottayam, Pathanamthitta and Alappuzha. Each pilot focuses on a specific sector -- roads, agriculture, health, and water resource management. The economic benefits of the sector interventions can be quantified to varying degrees. The quantitative economic analyses, where feasible, suggest that these interventions are economically viable. The following is a summary of those assessments. The more detailed analyses for each sector pilots are contained in the subsequent sections.



## F.2. Summary of Sectoral Quantitative Analysis

The road sector pilot investments are expected to provide an economic rate of return of 15-38 percent. The road sector investments rehabilitate about 400 km of roads to climate-resilient standards. Quantifiable benefits include reductions in vehicle operating costs, and time savings in moving passengers and freight. Unquantified benefits include increased road safety, reductions in GHG emissions, job creation, and reductions in disease and disaster response times. The investments are based on projected traffic volumes for the next 30 years with bridge designs for 100-year floods, and culverts and drainage systems designs that factor 25- and 10-year discharges in urban and rural areas respectively. These pilot investments also support the identification and refinement of best practices for rehabilitating the entire CRN across the State. The economic analysis is conducted using HDM4 model and based on the applicable guidelines from the Indian Road Congress.

The One Health Approach is cost-effective in reducing the adverse population and animal health impacts of zoonotic diseases. Kerala is particularly vulnerable to zoonotic disease outbreaks due to the size of its livestock population, climate, and high incidence of domestic and international travel. Early detection, early diagnosis and early control measures, as advocated in the One Health approach, is most effective in reducing the costs of controlling outbreaks. The use of this approach is novel for Kerala and much of India. A review of the worldwide experience suggests that upfront disease surveillance and diagnosis investments can mitigate the need for subsequent treatment costs about three or more times larger, if a disease outbreak were to occur and an order of magnitude higher were the disease to turn into a pandemic. Controlling disease outbreaks reduces economic disruptions and hence losses in economic growth, increases in poverty and inequality, productivity losses, and increases in service delivery costs. As an innovative program, it is appropriately included as a pilot.

The agriculture program is targeted towards crops with high potential for value addition and towards increasing the incomes of the vulnerable poor. The Program aims to increase farmer incomes by supporting formation of new and strengthening of existing FPOs in the four Pamba river basin districts. Conventional ex-ante cost benefit analysis is not applicable for them because of the demand driven nature of these programs. The analysis instead focused on the targeting of crops for support through the Program and the value addition of a similar World Bank funded program in Tamil Nadu. The results indicate that the FPO support program is targeted to crops with high potential for adding value and supporting the poor. Initial results from Tamil Nadu demonstrate the potential of such an approach. The safety net and insurance programs are targeted towards providing rapid support to the most vulnerable population.

The Water sector pilots are expected to reduce flood damages through more granular and timely forecasts and improve the allocation of water resources across multiple uses. The direct benefits of the program would come from reduced loss of lives, the number of people affected economic damages. Increased lead times on the flood warnings of 24 hours have been shown to reduce economic damages by 10 to 35 percent. The analysis uses 5%, a conservative estimate that is consistent with a forecast accuracy of 50%. A simplified cost benefit analysis using benchmarks indicates indicated an IRR of 12 to 30%. The indirect benefits are more efficient and effective planning and water reservoir operations leading to increased hydropower generation and reliable water supplies for agriculture, drinking water and industrial uses.



## Roads

In the aftermath of the 2018 floods, the Public Works Department (PWD) prioritized 800 km out of 1,600 kms of flood and landslide impacted roads for rehabilitation using resilient standards in accordance with the road sector reforms under the RKDP. Based on the Detailed Project Reports, the PWD selected 27 roads (688 km) for climate resilient rehabilitation for a total investment of \$432 million. Out of the central and southern cluster of roads, about 174 kms of roads for a total investment of \$110 million lie in the four districts of the Pamba River Basin. The Engineering Procurement and Construction contracts for these roads are currently being tendered with Item Rate contracts of 18-30 months duration and 5-year maintenance periods.

The quantifiable benefits include reductions in vehicle operating costs and time savings in moving passenger and freight. The unquantified benefits include increased road safety, reductions in GHG emissions, job creation, and reductions in disease and disaster response times. The investments accommodate projected traffic volumes for the next 30 years and are designed to meet climate resilient standards established by PWD. The pilots will have a larger impact through the lessons and best practices which are to be adopted in rehabilitating the statewide core road network (688 km).

These investments complement policy and institutional reforms for developing and applying scientific data in managing road sector assets under the RKDP. The road sector constituted approximately 30% of the State's total estimated recovery needs following the 2018 floods and landslides. The RKDP envisions interventions to build resilience in the Core Road Network (CRN)<sup>9</sup> in the state to climate risks. In early 2020, the PWD Maintenance Wing updated the CRN (7000 km) through a scientific assessment. The PWD developed and sanctioned a new contracting model for long term maintenance of the CRN to climate resilient standards. A web and GIS based Road Maintenance Management System (RMMS) with a climate module is being established currently and is expected to be operational in 2021. The RMMS will guide the statewide sector planning and budgeting for the CRN. Initially, around 380 km of the CRN with an investment of about US\$42 million are expected to be contracted under 7-year Output and Performance based Road Contracts (OPBRC). This includes around 283 km of roads with an investment of US\$ 30 million in the Pamba Basin. The proposed PforR supports both of the above programs.

## Scope

The scope of the economic analysis is investments for building climate resilience in the 8 roads spanning 174 km and associated assets in the Pamba River Basin for an estimated total project costs of INR 827 crore for which Detailed Project Reports are available. They were commissioned by the PWD under the Kerala State Transport Project II. The 7 roads in the Kottayam, Pathanamthitta, and Alappuzha districts were assessed in Package IV covering the Southern districts while the 1 road in the Idduki district was assessed in Package III covering the central districts. The length and the total project cost of these roads are summarized in Table 1.

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<sup>9</sup> CRN refers to 15-20% of the state road network comprising of primarily State Highways and Major District Roads that caters to 70-80% of state traffic and logistic demand.



**Table 5: Details of the project stretches<sup>10</sup>**

Road No.	District	Section	Road length (km)	Total Project cost (INR Crore)
1	Kottayam	Gandhinagar-Medical College-BabuChazhikadan Rd Kottayam- Parippu Rd-AthirampuzhaLiessue- KaippuzhaMannanam- Pulikkuttissery-Parolickal- Muttappally Rd	20.2	1088
2	Kottayam	VadayarChandappalam- Mulakkulam Rd and VadayarKallattippalamMuttuchira Rd	22.5	1088
3	Pathanamthitta	PathanamthittaAyroor – Muttukudukkallathupadi – MuttukudukkaPrakkanam – PrakkanamElavumthitta - KulanadaRamanchira – ThannikkuzhyThonnamala Rd	28.2	1032
4	Pathanamthitta	Mallapally, Komalam Paduthodu KallooparaChengaroorKomalamKavungumprayarPat takala, TMV Rd	23.1	1040
5	Pathanamthitta	MalamekkaraKunnathukalaChalaPuthenchanda factory Junction Azad Junction Rd	7.9	294
6*	Idukki	Neyyassery - Thokkumbansaddle Rd (MDR)	31.9	1502
7	Alappuzha	Thattarambalam – Michel Junction - Kochalumood Rd Mangankuzhy – Pandalam Rd	18.7	1134
8	Alappuzha	Veeyapuram - Edathua Rd Kuttanad Alappuzha Edathua – Puthukkary - Mambuzhakkary Rd Kidangara-Kunnamgary-Kumarangary- ValadyMulakkamthurrthy Rd	21.5	1091
	Total		173.9	8269

\*This is Road number 5 in the package III while other roads are in package no IV.

### **Approach**

The cost benefit analysis assessed the economic internal rate of return (EIRR) and economic net present value (ENPV) of each of the project roads separately. All of the analyses were based on the overall guidelines stipulated by the Indian Roads Congress and use the World Bank Highway Development and Management Model (HDM-4). The benefits of the road were computed relative to a baseline situation without the project when the project road was maintained with minimum maintenance. All costs and benefits were evaluated in economic prices and exclude taxes and grants and reflect adjustment to wages that would prevail in a competitive labor market.

The analysis assumed that all roads would be constructed over a 24-month period (2021-22) with 40% of the costs incurred in the 2021 and 60% in 2022, and that the roads would commence providing the added benefits starting in 2023. The analysis was carried out over a 25-year period reflecting the useful life of the road asset. The analysis quantified three specific benefits for each road:

- reduced vehicle operating costs (VOC)
- the value of time saved by passengers and

<sup>10</sup> Based on DPRs August – September 2020.



- the value of reduced transit time for goods transported on the roads.

The project design and cost for each road was based on the expansion of the roads, as needed, to accommodate projected traffic volumes for the next 30 years and the upgrading of bridges to accommodate a 100-year return flood and culverts and drainage systems to accommodate discharges following a 24-hour rainfall intensity with 25-year return periods in urban areas and 10-years in rural areas. Projected traffic volumes were estimated from base year (2020) traffic volumes and traffic growth rate projections. Likewise, return periods for rainfall intensity and flooding were estimated from an analysis of historical data climate data.

**Baseline Traffic**

Base year traffic volumes were estimated for homogenous sections of each road for different vehicle categories based on classified traffic volume counts averaged over the three-day survey period (Table 2). Road numbers 2, 5 and 8 had two, one and three homogenous sections, respectively. Likewise, road numbers 1, 3, 4, and 7 had eight, six, eight, and two homogenous sections, respectively. All 7 of these roads were in semiurban areas and primarily carried local passenger traffic and were not expected to generate, induce, or divert traffic. The traffic composition in the surveys also did not exhibit any seasonality, so the daily averages in the survey are representative of the annual average daily traffic. Road number 6 which runs through the primarily rural Idukki district also primarily carries local traffic but fuels sales data at nearby fuel stations indicated a slight seasonality in traffic volumes. So, the annual average daily traffic for this road was estimated from the average daily traffic results by applying a seasonality factor adjustment for the different vehicle classes.

The different vehicles categories were aggregated to the Passenger Car Unit using standard conversion factors recommended in the IRC Guidelines IRC-106-1990 for the seven roads situated in semi-urban roads and IRC-102-1988 for Road no 6 situated in rural area. The PCU was used to estimate peak traffic flows and to assess the need for capacity augmentation.

**Table 6: Distribution of Average Annual Daily Traffic (AADT) for Selected Road Sections – 2020**

No	Road Section (Road NO/Section No)	Vadayar- Chandappalam Mulakkulam Rd (2.1)	Vadayar- Kallattippalam Muttuchira Rd (2.2)	Chala road Junction- Azad Junction (5)	Veeyapuram - Edathua (8.1)	Edathua Mampuzhakkary (8.2)	to Kidangara – Thuruthy (8.3)
Vehicle Category							
1	2 Wheeler	2178	1860		2333	2339	836
2	Auto	266	508	148	268	1364	194
3	Car/Jeep/taxi	364	1022	247	1527	1047	574
4	Mini Bus	8	21	7	64	37	19
5	Standard Bus	4	119	9	151	9	9
6	LCV-6	57	166	61	289	130	240
7	2-axle	3	31	6	33	13	19
8	3-axle		4		35	3	5
9	MAV				1		
10	Agri Tractor				2	1	
12	Cycle	125		11	103	67	17



16	Others	1	1		5	4	1
	Total Vehicles	3006	3747	1432	4811	5014	1914
	Total PCUs	2814	4395	1453	5445	6024	2247

**Baseline Traffic Projections**

Traffic volumes on each road over the project lifetime were projected based on estimated growth rates in the annual average traffic volumes. The growth rates for the 2020-2025 period were estimated separately for passenger and freight vehicles in the state based on the road transport demand elasticity, population/passenger growth rates, growth rates in relative per capita state incomes and overall state domestic product (See Table 3). The demand elasticity and the traffic volume projections were reduced by 10% for each subsequent 5-year period relative to the prior 5-year period. The growth rates for two axle trucks were held to approximately 50% of the growth rate of trucks for the 2020-2025 period and held constant at 2% per year from 2026 onwards to circumvent negative growth rates in this category.

**Table 7: Summary of Projected Growth Rates in Average Annual Daily Traffic**

Vehicle Category	2020-2025	2026-30	2031-35	2036-40	2041-2045	2046-50
2 & 3 Wheeler	6.22	5.59	5.03	4.53	4.08	3.67
Car/Jeep/taxi	5.53	4.97	4.48	4.03	3.63	3.26
Minibus/ Standard bus	3.00	2.7	2.43	2.19	2.00	2.00
LMV/LCV	6.96	6.27	5.64	5.08	4.57	4.11
2-axle Truck	2.70	2.00	2.00	2.00	2.00	2.00
All Trucks	5.55	5.00	4.5	4.05	3.64	3.28

The resulting projected traffic volume in terms of Passenger Car Units over the project duration for selected road sections are summarized in Table 4. Hourly variations and in the traffic volume and origin-destination survey results were used to estimate the peak hour PCU. Each road section was considered for capacity augmentation by comparing it to the design service volume of different carriageway types to provide Level of Service C, which adds capacity when projected traffic volume exceeds 70% of the peak hour PCU.

**Table 8: Summary of Projected Growth Rates in Average Annual Daily Traffic (PCUs)**

Year	Vadayar- Chandappalam Mulakkulam Rd (2.1)	Vadayar- Kallattippalam Muttuchira Rd (2.2)	Chala road Junction- Azad Junction (5)	Veeyapuram - Edathua (8.1)	Edathua Mampuzhakkary (8.2)	to Kidangara - Thuruthy (8.3)
2020	2814	4395	1453	5445	6024	2247
2025	3750	5797	1932	7132	8041	3002
2030	4869	7450	2505	9117	10458	3881
2035	6164	9354	3174	11415	13273	4913
2040	7945	11510	3936	14006	16471	6091
2045	9291	13892	4783	16860	20030	7402
2050	11083	16488	5706	19974	23878	8828



The design service volume of the different carriageway recommended in the IRC 106-1990 is summarized in Table 5. The capacity augmentation analysis indicated the need to expand capacity in 38 km of the roads in the study. These include expansions of road section 1.1 in 2020 with a further expansion in 2032, of road section 1.3 in 2024 and further expansion in 2043, of road section 3.1 in 2038, of road section 7.1 in 2020 and a further expansion in 2026, and of road section 7.2 in 2029.

**Table 9: Recommended Design Service Volume (PCUs per Hour)**

Type of Carriageway	Design Service Volume (PCU/ Hour)
2-Lane (two way)	1200
2- Lane (one way)	1900
4-Lane Undivided (two way)	2400
4-Lane divided (two way)	2900
6-Lane Undivided (two way)	3800
6-Lane divided (two way)	4300

### Road Sector Project Costs

The project capital costs for each of the roads are summarized in Table 7. They include civil construction works, land cost, utility shifting costs, Environmental Safety and Emp Costs. All roads are assumed to be constructed over a 24-month period and to begin delivering full benefits starting in 2023. For economic analysis, these financial capital costs are adjusted to exclude taxes. The total construction costs are assumed to include 70% of non-traded items which are revalued using a standard conversion factor of 0.90. Unskilled labor is assumed to comprise 30% of the construction costs and revalued using a shadow wage rate factor of 0.9.

**Table 10: Project costs and phasing**

Road	Road Sections	Capital Cost	Construction Period	Construction Phasing	Fully operational
1	1.1-1.3	1088.3	2021-2022	40% & 60%	2023
2	2.1-2.2	986.3	2021-2022	40% & 60%	2023
3	3.1-3.6	1031.6	2021-2022	40% & 60%	2023
4	4.1-4.8	1040.3	2021-2022	40% & 60%	2023
5	5	294.3	2021-2022	40% & 60%	2023
6	6.1-6.5	1501.6	2021-2022	40% & 60%	
7	7.1-7.2	1134.0	2021-2022	40% & 60%	2023
8	8.1-8.3	1090.9	2021-2022	40% & 60%	2023

The economic analysis includes both annual routine maintenance and periodic maintenance to BC overlay with tack coat every five years. Where needed, the periodic maintenance also includes slab replacement and joint sealing every five years. The annual routine maintenance is assumed to be carried out even in the absence of the project. The annual routine maintenance costs for 2-lane road paved shoulder is INR 281,610 per km per year in 2020-2021. The costs for other roads configuration were estimated applying Equivalence factors to this cost. The periodic maintenance is assumed to be at higher level under the project scenario. Without the project the periodic maintenance comprises of 25 mm BC tack coat applied every 5 years at a cost of INR 278 per sqm. With the project



the project 30 mm BC + tack coat is applied every 5 years at a cost of INR 331 per sqm.<sup>11</sup> Slab replacement and joint sealing at a cost of Rs 97 / m are included as a part of the periodic maintenance when needed. The standard conversion factor of 0.9 was applied to all of maintenance costs for the economic analysis.

### **Road Sector project Benefits**

The direct benefits accruing from the proposed road projects include reduced vehicle operating costs (VOC) and reduced travel time for passengers and transit time for freight. The benefit streams were computed annually over the 25-year benefit period (including the 2 year construction period) based on the projected traffic volumes and composition. These have been estimated from the HDM4 model for both with and without project scenarios for each vehicle category.

The HDM4 model comprehensively predicts the performance and operating costs of motorized vehicles in the selected fleet. The computations are based on inputs regarding the pavement characteristics, roughness, traffic characteristics, geometric conditions, and vehicle characteristics. The road characteristics for each road is based on the findings of the road inventory survey for the “without project scenario” and the proposed improvements to it for the “with project scenario”. Motorized vehicle performance predictions include average speed with the free flow of traffic and under congested conditions and the consumption of various inputs for vehicle operations. These include predictions of the quantity and costs of fuel, oil, tire and parts, crew and maintenance labor, vehicle depreciation, finance, and overhead.

The HDM4 model estimates the average speed in km/hr by vehicle type for the road condition and traffic volumes. The time savings for passengers were valued in accordance with IRC SP 30, 2009.

The estimates were based on an average occupancy of 4 persons for car/taxi and 45 persons for bus in accordance with the traffic survey results. The VOTT worked out to INR 79.80 per hour for the average car passenger, INR 40.8 per hour for 2-wheeler, and INR 50.4 per hour for the bus passenger. The reduced transit time for goods were valued using the inventory method. The VOTT worked out to INR 144 per hour for an LCV, and INR 445 per hour for 2 axle, 3 axle trucks and MAV.

### **Road Sector Project Cost Benefit Analysis**

The base case analysis compared the costs and benefits of each of the proposed roads relative to a no project situation. The IRR% for all roads are 15% or higher indicating the economic viability of the proposed upgrades to make the roads climate resilient (See Table 8). The EIRR for Road no 6 in Idduki is higher at 38% reflecting the existing unrehabilitated damages from the 2018 floods and the proposed construction of two sections or new roads for a total length of 5.3 km. This represents the only greenfield road sections included in proposed program. The NPV for all roads except road no 6 were calculated using a 12% discount rate. The discount rate used for Road number 6 in Idduki was 9% and is justifiable given the districts higher incidence of poverty, tribal population and proportionately higher damages during the 2018 floods.

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<sup>11</sup> The periodic maintenance costs vary from one road to the next by less than 2%. The costs for the 30 mm BC is about 20% higher than the cost of 25 mm BC.



**Table 11: Economic viability analysis – Base Case**

Road	EIRR%	EPNV (INR Million)
1 Gandhinagar-Medical College-BabuChazhikadan Rd Kottayam- Parippu Rd- AthirampuzhaLiessue-KaippuzhaMannanam- Pulikkuttissery-Parolickal-Muttappally Rd	17.5%	475.47
2 VadayarChandappalam- Mulakkulam Rd and VadayarKallattippalamMuttuchira Rd	17.5%	472.40
3 PathanamthittaAyroor – Muttukudukkallathupadi – MuttukudukkaPrakkanam – PrakkanamElavumthitta - KulanadaRamanchira – ThannikkuzhyThonnamala Rd	15.8%	308.10
4 Mallapally, Komalam Paduthodu	14.8%	238.23
KallooparaChengaroorKomalamKavungumprayarPattakala, TMV Rd		
5 MalamekkaraKunnathukalaChalaPuthenchanda factory Junction Azad Junction Rd	16.5%	101.17
6 Neyyassery - Thokkumbansaddle Rd (MDR)	37.9%	1916.0*
7 Thattarambalam – Michel Junction - Kochalumood Rd Mangankuzhy – Pandalam Rd	16.8%	414.46
8 Veeyapuram - Edathua Rd Kuttanad Alappuzha Edathua – Puthukkary - Mambuzhakkary Rd Kidangara-Kunnamgary-Kumarangary-ValadyMulakkamthurrthy Rd	19.9%	865.20

Sensitivity analysis was carried out to assess project viability with changes to the assumptions used in the base case. These included (i) 15% increase in the capital costs; (ii) 15% decrease in motorized traffic growth rate, (iii) 15% increase in vehicle operating costs, (iv) 15% reduction in the value of travel time saved for passengers and freight and (v) changes in all the assumptions (i) through (iv), representing the worst-case scenario. All of the IRRs remained above the 12% cutoff for all roads in all scenarios except for Roads 3, 4, and 5 in the worst case scenario (see Table 8). Even in these cases the IRR is still higher than 10% indicating the robustness of the economic viability of the road sector projects.

**Table 12: Sensitivity analysis – Base vs. Worst Case\***

Road	EIRR%	EPNV (INR Million)
1 Gandhinagar-Medical College-BabuChazhikadan Rd Kottayam- Parippu Rd- AthirampuzhaLiessue-KaippuzhaMannanam- Pulikkuttissery-Parolickal-Muttappally Rd	12.5%	39.9
2 VadayarChandappalam- Mulakkulam Rd and VadayarKallattippalamMuttuchira Rd	12.2%	13.9
3 PathanamthittaAyroor – Muttukudukkallathupadi – MuttukudukkaPrakkanam – PrakkanamElavumthitta - KulanadaRamanchira – ThannikkuzhyThonnamala Rd	10.9%	-95.3
4 Mallapally, Komalam Paduthodu	10.3%	-153.2
KallooparaChengaroorKomalamKavungumprayarPattakala, TMV Rd		
5 MalamekkaraKunnathukalaChalaPuthenchanda factory Junction Azad Junction Rd	11.6%	-9.4



6	Neyyassery - Thokkumbansaddle Rd (MDR)	27.2%	1349.0
7	Thattarambalam – Michel Junction - Kochalumood Rd Mangankuzhy – Pandalam Rd	12.1%	4.9
8	Veeyapuram - Edathua Rd Kuttanad Alappuzha Edathua – Puthukkary - Mambuzhakkary Rd Kidangara-Kunnamgary-Kumarangary-ValadyMulakkamthurrthy Rd	14.4%	257.7

\*15% increase in capital costs, 15% decrease in VOC and VOTT and 15% decrease in motorized traffic growth rates

### Health

The health component of PforR aims to increase resilience to outbreaks of zoonotic diseases using the One Health Approach. Control of a zoonosis requires early and rapid actions. A typical outbreak may originate with a pathogen in wildlife that is passed to and among livestock and then transmitted to humans. The spread of the disease and the costs to control are difficult to slow or reverse by the time it has started to spread among humans. This evolution is similar to that HIV/AIDS, which is a zoonotic disease. Hence, early detection at the source of the disease in animals, early and accurate diagnosis, and rapid disease control measures are all essential for an effective control program.

Kerala is particularly vulnerable to zoonotic disease outbreaks due to the size of its livestock population, climate, and high incidence of domestic and international travel. One Health refers to the collaborative efforts of multiple disciplines working together to attain optimal health for people, animals and our environment. Case studies show that the collaboration across service providers in multiple disciplines introduces efficiencies in service delivery resulting in cost savings of 10 to 15%. One Health is novel for Kerala and much of India as well. Jaipur reduced human rabies cases to zero by vaccinating and sterilizing dogs compared to others states where cases increased in the absence of program to control the disease at the source.

Assessing the costs and benefits of a control program for zoonotic disease is challenging for several reasons -- rapid onset of the disease, the high and immediate cost of controlling it, and the limited information on the epidemiology of new diseases. Worldwide experience indicates the losses from the last six major outbreaks could have been averted through upfront investments in disease surveillance and diagnosis a third to a half of the losses. Had the diseases turned into a pandemic, the payoffs would have been an order of magnitude higher. Case studies show that the typical country needs investments of \$1 to \$2 per veterinary livestock unit (VLU) per year to put in place a robust system of surveillance and diagnosis for controlling all outbreaks. For the four districts of the Pamba Basin, this translates to a need for \$84 to \$168 million.

Controlling disease outbreaks also has several indirect benefits. These include fewer economic disruptions and hence losses in economic growth, decreased poverty and inequality, decreased productivity losses and decreased service delivery costs. As an innovative program for Kerala it is appropriately included as a pilot for subsequent scaleup.

### Agriculture

The GoK initiated broad transformative programs to build agriculture resilience through the RKDP under three pillars: adoption of an agro-ecological (AEZ) based model, strengthening support to farmer producer organizations (FPOs), and re-engineering institutional framework for last-mile delivery. The GoK has completed a comprehensive assessment of institutions to repurpose them to deliver on an AEZ/AEMU approach and to leverage technology



for service delivery. These programs are will be implemented statewide in a phased manner. They are expected to build a more resilient, profitable and attractive agriculture sector in Kerala.

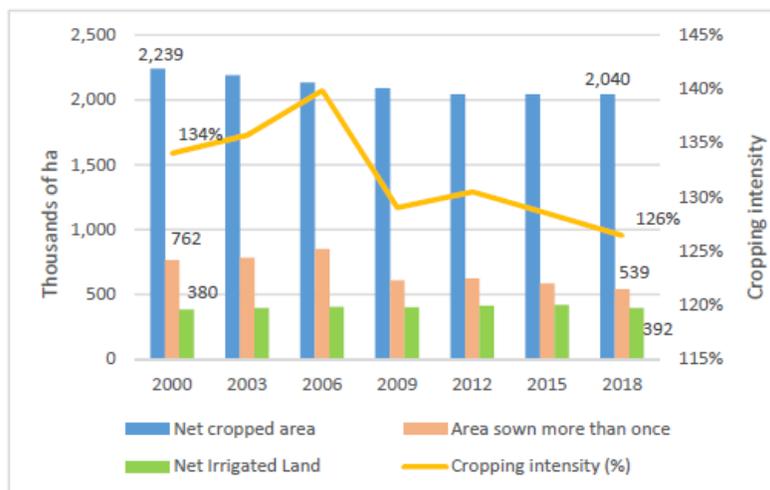
The pilot programs under RA2 of the PforR support the creation of 13 new FPOs and the strengthening of 13 Farmer Producer Organizations (FPOs) in the four districts of the Pamba Basin, spanning 16 Agro ecological management units (AEMUs) and 264 Krishi Bhavans (local bodies). The PforR also supports the statewide promotion of agro-ecologically relevant farming systems through the IAMIS system. The economic analysis only focuses on the support for the FPOs which has a total cost of \$34 million inclusive of Government contributions and PforR support. While the program has identified broad crop categories for support, the specific FPOs, crops and initiatives to support is to be selected during project implementation.

Conventional ex-ante cost benefit analysis is not applicable for them because of the demand driven nature of these programs. Instead, the analysis seeks to identify current barriers in the agriculture sector to assess areas where support to FPOs could add value and the value addition of a similar World Bank funded program in Tamil Nadu. The results indicate that targeted farmer support through FPOs could increase farmer incomes and supporting the poor. Initial results from Tamil Nadu demonstrate the potential of such an approach.

### Sector Overview

The Kerala agricultural sector is particularly vulnerable to flooding and climate change. Kerala receives annual rainfall of about 3000mm with about 60% occurring in June to September. The monsoon pattern in recent years has changed and rainfall has become erratic in the state. Kerala has also experienced major flooding events in each of the past few years. About a quarter of the damages incurred in the 2018 floods were in the agriculture sector. Kerala has four major types of farming systems – rice based in the lowlands with summer vegetables, pulses or oil seed, rubber plantations, coconut based mixed cropping and homesteads with trees, food and fodder crops and livestock. The total cropped area has been declining over the past few decades. The land that is sown more than once has also shown in steady decline partly due to the slow growth in irrigation. As result cropping intensity had declined from a peak of over 140% in 2006 to around 125% in 2018.

**Figure 3: Land area and cropping intensity**





The overall production of a key crop, rice, has declined by 30% since 2000 despite productivity increases of over 20% during this period. This is partly due to the high cost of paddy production in Kerala. Part of this can be attributed to the relatively high wage rate for field labor, which had been consistently more than double the Indian average.

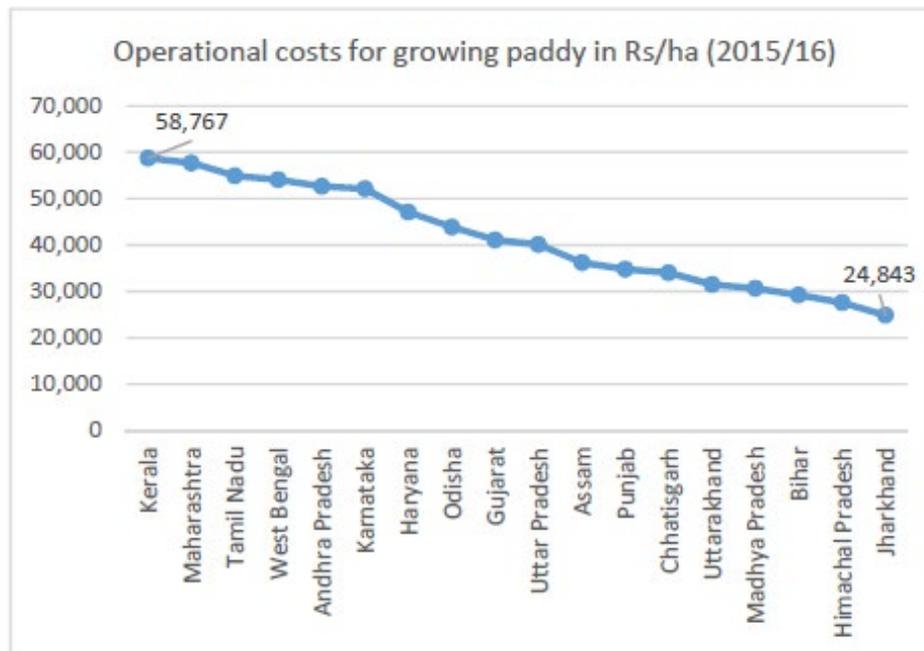
The area under pulse cultivation has likewise declined to about 1992 ha (0.1% of gross cropped area) in 2018 despite a profitability margin comparable to other commodities. Pulses are an important source of protein in the daily diet and are also important for maintaining soil fertility.

The area of vegetable and fruit cultivation has not significantly declined over the last decade. A DoA support program was able to mitigate a brief decline between 2010-14. However, the local demand for vegetables outstrips local supply by around 68%. The imported vegetables are cheaper and stress the local supply chain. While the cultivated area for fruits has remained steady over the years, they mask growth in some fruits (jack, mango, papaya, banana) and decline in others (pineapple).

A number of schemes are in place to support the vegetable sub-sector including through the Block Level Federated Organizations (BLFO). The State Horticulture Mission has the VFPC program to support commercial farmers vegetable and fruit farmers and the HORTICORP that supports procurement, processing, storage and marketing of horticultural products.

The cultivated area for cash crops has also declined but not as fast as food crops. As a result, cash crops account for about 20% of the cultivated area by 2018, compared to 14% in 2000.

**Figure 4: Operational costs for growing paddy in Rs/ha (2015/16)**





**Table 13: Change in cultivated area and production 2000-2018 for key crops**

Commodity	Area in 2000 (in ha)	Area in 2018 (in ha)	Variation in area	Production in 2000 (in MT)	Production in 2018 (in MT)	Variation in production
Paddy	349,774	194,235	-44%	770,686	521,310	-32%
Pulses	10,985	1,992	-82%	8,571	1,937	-77%
Tapioca	111,922	70,193	-37%	2,531,752	2,697,319	7%
Rubber	472,900	551,115	17%	572,820	540,775	-6%
Coffee	84,139	84,976	1%	60,470	66,465	10%
Tea	34,793	30,205	-13%	61,955	62,230	0%
Coconut	925,035	760,443	-18%	5,680	5,230	-8%
Cashew	89,403	39,720	-56%	65,547	25,629	-61%
Pepper	198,406	85,141	-57%	47,543	37,955	-20%
Cardamom	41,491	39,080	-6%	6,585	18,350	179%
Banana	39,046	62,106	59%	398,145	565,829	42%
Ginger	11,264	4,370	-61%	41,344	18,979	-54%
Tumeric	3,971	2,777	-30%	8,362	8,822	6%
Arecanut	81,941	94,580	15%	83,337	108,516	30%

### Challenges and Opportunities

There is great variation in the cost of production per hectare and profit margins per ha indicating the significant potential for increasing farmer income and value through support to targeted crops. Vegetables and fruits have the highest possible gains per ha while paddy remains profitable, it adds relatively less income to farmers.

**Table 14: Cost of cultivation of important crops in Kerala 2016-2017**

Commodity	Cost of Cultivation per hectare in Rs.	Cost of Household Labour per hectare in Rs.	Total Cost of Cultivation per hectare in Rs.	Value of Output per hectare in Rs.	Profitability per hectare in Rs.
Banana	182,921	41,159	224,080	500,319	276,239
Cardamom	134,526	22,351	156,877	373,933	217,056
Pepper	77,019	24,410	101,429	317,987	216,558
Pineapple	212,010	7,783	219,793	409,141	189,348
Tapioca	95,899	32,630	128,529	309,762	181,233
Cowpea-Autumn	108,761	67,185	175,946	313,444	137,498
Arecanut	72,041	15,243	87,284	210,160	122,876
Tumeric	120,755	47,334	168,089	250,017	81,928
Bitter Gourd (Autumn)	84,721	53,100	137,821	218,006	80,185
Cowpea-Winter	119,638	62,635	182,273	252,546	70,273
Cowpea-Summer	131,286	68,960	200,246	268,868	68,622
Coconut	67,062	9,838	76,900	128,467	51,567
Bitter Gourd (Summer)	154,825	71,255	226,080	276,723	50,643
Bitter Gourd (Winter)	130,756	64,441	195,197	236,599	41,402
Ginger	235,296	43,063	278,359	319,149	40,790
Paddy-Summer	54,109	5,794	59,903	86,612	26,709
Paddy-Autumn	52,818	7,705	60,523	86,172	25,649
Paddy-Winter	59,600	6,693	66,293	90,072	23,779



Agriculture in Kerala is characterized by the high land fragmentation, low mechanization and slow growth in irrigation. Land has become increasingly fragmented, with about 58% of the cultivated area, cultivated by marginal farmers with less than 1 ha that comprise 96% of farms. Further land fragmentation only exacerbates the already low levels of mechanization limiting the productivity growth possible through land preparation and harvesting operations at scale. Collectivizing farmer action through FPOs is one avenue through which this constraint can be relaxed.

**Table 15: Cultivated Land Fragmentation 2011**

Farm Size	Number of Farms (%)	Total Area ('000 ha)
<1 ha	6,580 (96%)	886 (58%)
1 -2 ha	180 (3%)	282 (19%)
>2 ha	71 (1%)	343 (23%)

Changing climates are also expected to shift these margins as specific areas become more suitable for some crops and less for others. Collection of the pedologic, hydrologic, terrain and climate characteristic of each area and the dissemination of actionable guidance is becoming increasingly important for making farmers resilient.

**Efficiencies in Service Delivery**

Following the 2018 floods, the DoA undertook an institutional review which identified that frontline grassroot institutions like Krishi Bhawans were administratively burdened and could be more effective in providing extension services by leveraging technology, building a knowledge base, the adoption of the agroecological approach and reorganizing to provide better support. Based on the review, the DoA has taken steps to reorganize itself so frontline extension services are primarily focused on customized service delivery.

DoA’s adoption of the agro-ecological approach and reorganize itself accordingly reduces the its cost of service delivery. Staff will be able to focus on a more limited set of crops, schemes, and approaches that are applicable in their respective areas. Cost of service delivery should also decrease through the IAMIS knowledge portal. More importantly, the informed guidance that DoA can provide is likely to reduce the risks that FPOs would have encountered.

**Lessons from the Tamil Nadu Project**

The neighboring state of Tamil Nadu enacted a similar program of support to farmers and FPOs which can confirm or invalidate the potential for such programs to add value to farmers. The program is currently under implementation and an initial set of assessment of several value chains have been completed. Both the ex-ante assessment of the costs and benefits of the extension services through FPOs and the initial value chain assessment of several crops provides insights for the economic valuation of this component.

The ex-ante economic analysis developed three value-chain models – millet production and processing, dairy production and processing and coir production – representing farm, off-farm and non-farm and off-farm types. A total of 10 interventions were assessed including technical assistance to improve farming practices, provision of improved inputs (seed and breed), equipment and support services for aggregation, cleaning and processing and business support services. These interventions are like the services that the PforR might be expected to support



through the FPOs. Unlike the PforR the Tamil Nadu also supported small enterprises. The discussion below only focusses on the models and interventions relevant for the PforR.

The financial model of each value chain ascertained the financial viability and profitability of each value chain. Each intervention was assessed based on the incremental inflows and outflows including the cost of financing. Cost benefit ratios for each intervention were between 1.0 and 1.52. The primary benefits of the program were increased farmer income and employment generation.

**Table 16: Economic Analysis Outputs**

Individual/Farmer	Incremental net benefits per INR investment	Incremental Labor (working day/year)
Farmer	0.73	22
Producer Group	0.45	119
Producer Collective	2.05	250

The analysis indicated that every unit of investment would generate 0.73 in incremental revenue and 22 additional days of work per year for farmers. The corresponding numbers for FPOs are between 0.45 and 2.05 incremental net benefits and 119 days of additional work for produce groups and collectives.

**Implications for the PforR**

If similar types of benefit would be realized through the support of FPOs in this project, the primary benefits of this component would be increased income for farmers and employment generation. The program is expected to support 12500 beneficiaries through 26 FPOs across the four Pamba river Districts program economic costs for this component is \$12.7 million excluding taxes. There are no recurrent anticipated beyond project completion as the GoK requires FPOs to become sustainable to receive continued support.

The PforR program is focused on supporting farmers, so the base case number assumes the beneficiaries from the value chain with only farmers. The benefits are computed using the incremental net benefits and valuing the added employment generated at the opportunity cost of labor by converting the prevailing rural wages in Kerala by a conversion factor of 0.8. The scheme is assumed to be effective for 70% of the beneficiaries. The economic analysis is carried over a 20-year period. In the base case the program would generate an NPV of \$21 million at a 12% discount rate, and an IRR of 43%.

A sensitivity analysis was conducted to assess the variations in benefits and costs for different lags in the realization of benefits, survival rates, and cost increase, and the inclusion of some collective arrangements might engage in. IRRs remain within acceptable values, well above the discount rate used for the analysis in all cases.

**Water**

The water sector pilots focus on operationalizing an integrated water resource management for the Pamba basin including a flood forecasting and warning system. The direct benefit of the program would come from water allocation efficiencies, reduced economic damages, reduced loss of life and people affected from floods and



extreme precipitation events. The 2018 floods have shown that the existing flood forecasting and warning capabilities are not inadequate for protecting against severe floods.

The full cost of the IWRM component including both the GoK and PforR contributions are \$42 million over 4 years. An incremental cost benefit analysis was conducted just for the flood forecasting portion of this component. The costs and benefits of the IWRM plan are not included in the analysis as the specific contents of the plan will only be known towards the end of the project.<sup>12</sup> The analysis applies the methods and approaches used in the National Hydrology Project adapting it to the current project context and updating it based on the current state of knowledge.<sup>13</sup>

Kerala already has some capacity to support flood forecasting and flood warning that were developed under NHP-II. The costs in this portion of the project focus on existing deficiencies in the 4 districts of the Pamba River Basin. Adding these capacities are expected to take 2 years at which they will begin to deliver protections. The associated equipment is assumed to require annual O&M costs of 10%. The analysis is carried over 10 years the lifetime of the equipment.

### **Benefits**

The analysis uses a modified sectoral approach for measuring the avoided damages and losses from a flood forecasting program. The approach analyses the proportion of damages and losses that are preventable and the proportion of those preventable losses that are avoidable with the hydromet system for different sectors.<sup>14</sup> While the productivity gains from better resource management are not included, water supply that becomes available are valued in the sector they are made available.

Avoided damages from using flood forecasts are estimated from historical (last 20 years) annual average losses and projecting them into the future.<sup>15</sup> The baseline damages are estimated the expected value of damages from historical floods. The average annual damages are estimated at \$43 million based in the limited historical data for the floods since 2000. This under likely estimates the AAL in the face of added risks from climate change.

NHP-II data indicates that 24-hour forecasts are 90 percent accurate. However, the literature suggests that only a fraction of the affected people take aversive action to protect themselves. As a conservative estimate the analysis assumes that only 50% of lives are saved from a 24-hour forecast. The statistical value of a life saved is estimated using the benefits transfer approach which adjusts the latest estimate from the US Environmental Protection Agency of approximately \$7.4 Million in 2006USD assuming an income elasticity of 1.5<sup>16</sup>. The estimated VSL for India is approximately \$263,000. This yields an average annual benefit of \$3.18 million.

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<sup>12</sup> A full quantitative assessment of the benefits of the integrated water basin plan is not practical as it requires extensive data and validated models that are not yet available.

<sup>13</sup> The National Hydrology Project focused on standardizing and integrating hydrological data and models across the country for use in water resource planning and management. It covered the 11 states and several UTs. It follows two phases the Hydrology project.

<sup>14</sup> Using this approach, benefits can be measured without the need for detailed data and complex models that would be required for the conditional probability approach while retaining the still grounded on the local context.

<sup>15</sup> Historical data is sparse creating significant uncertainties around these estimates. Sensitivity analysis is used to test the robustness of the analysis results to different assumptions for deriving these annual loss estimates.

<sup>16</sup> <https://openknowledge.worldbank.org/handle/10986/4041>



The Central Water Commission (CWC) attributed much of the 2018 floods to high precipitation. Under those circumstances, the full extent of the damages is “preventable” with a reliable forecast and a sufficient lead time. Reliable 24- hour forecasts and warnings have been shown to reduce damages by 10 to 35 percent (Hallegate 2012). As a conservative estimate, the analysis assumes that only 5% of the preventable damages are avoided through the early warning.

Flood forecasting is embedded in the cost of the IWRM and is difficult to isolate from the other expenditures. Being conservative, the full cost of \$10 million for the IWRM component during the first two years are included, overstating the cost of the program. The equipment and modeling and software for the program is expected to be replaced every 10 years and an annual O&M costs of 10% is also added. The economic analysis is carried over a 10-year period in line with the life of the equipment. The added benefits are assumed to accrue starting in year 3.

Productivity from the reallocation of water resources are not considered in this analysis as it requires complex hydrologic models that are not currently available. The NHP-II project assumed productivity resulting from an increase the availability of water supply by 0.5 percent. The program did not consider added benefits through the reallocation of water supply.

The analysis indicates that the flood forecasting and warning part of the IWRM component investments deliver a return of 4 to 34 percent and an NPV of 10 million using a discount rate of 12%. While there is large uncertainty in these estimates, they are not indicative of the economic viability of this component which is being carried out in the context of a broader program in IWRM.

## **G. RISKS: PROGRAM DESIGN, INSTITUTIONAL CAPACITY FOR IMPLEMENTATION AND SUSTAINABILITY AND STAKEHOLDER RISK**

**Moderate technical program design risk.** Over last two years, GoK has invested on reforms and improvement in state capabilities with support of World Bank Resilient Kerala Development Policy Operations (DPO). The World Bank engagement included technical assistance to strengthen sectors strategies through knowledge-sharing of international best practices, macro-analytics and institutional assessments. In short, the risk is limited because the ground for implementation has already been laid out with supportive policy actions adopted through DPO. In addition, as the PforR operations continues to focus on same DPO sectors, except for addition of health sector, the risk of uncharted is less.

A key design risk remains complexity involved in integration across sectors especially at the last mile for a strengthened disaster management plan or for Urban Master Plans. The relative strength of Kerala’s local self-governance system, entrusted to undertake integration at last mile, is primary reason for the ambitious attempt to weave and inter-link multiple elements of resilience into a single program. Yet, the task is enormous and will require high levels of co-ordination for the parts to add up. The program seeks to address this by (i) incorporating incentives for local bodies for taking up the activity, (ii) training officials and (iii) facilitating linkages of local bodies with institutions / agencies with technical expertise.

**Moderate risk pertaining to institutional capacity for implementation and sustainability.** The Rebuild Kerala Initiative (RKI) has largely demonstrated its institutional capacity to coordinate the work of multiple sectors/Line Departments through achievement of DPO2 prior actions and regular monitoring of results of DPO1. RKI’s capacity



has been significantly strengthened with support of hired external expertise of Project Management Support Services (PMSS). The key risk lies in terms of possibility of change in project leadership at RKI and Line Departments with state elections due in few months. The same could impact implementation speed for few months during the transition phase. Yet, the deep levels of ownership on the need for Kerala to build back better and the sharedness in understanding of resilience-building approaches will over long-run mitigate any temporary delays.

In terms of capacities, multiple institutions part of PforR, such as Kerala State Disaster Management Authority (KSDMA), Department of Local Self-Government (LSGD), Department of Water Resources continues to be supported through varied World Bank investment projects (national and Kerala-specific) that complements the PforR and mitigates capacity risks. The National Dam Rehabilitation and Improvement Project's Phase-1 & 2, aims to improve the safety and operational performance of selected dams in the country, including in Kerala. The National Hydrology Project aims to improve the extent, quality, and accessibility of water resources information and the capacity of WRM institutions in India, including Kerala. The National Cyclone Risk Mitigation Project Phase II aims to reduce vulnerability to cyclone and other hydrometeorological hazards of coastal communities, including in Kerala, and increase the capacity of State entities to effectively plan for and respond to disasters. The National Dam Safety Program, currently under preparation, aims to enhance dam safety by supporting the establishment of a robust institutional structure for dam safety at the Central and State levels, including Kerala. The Kerala Solid Waste Management Project, currently in the final stages of preparation, aims to integrate resilience principles into it and undertake investments in critical urban infrastructure. The health actions supported by the Program complement the India COVID-19 Emergency Response and Health Systems Preparedness Project.

**Risks to Program Expenditure Framework are considered low.** Extraneous factors affecting overall government expenditure are unlikely to affect budget allocations to the Program. The Program will, among other things, address the priority need for strengthening public financial management systems, improving financial preparedness for impacts of disasters and climate change, enhancing social protection and disaster insurance systems for vulnerable groups. All of these would contribute to building financial resilience in Kerala. There is a high level of commitment and ownership within GoK. The transversal reform and institutional capacity building agenda also reflect the priorities the government at the national level.

**Stakeholder risks are rated Substantial.** Planned actions in some sectors, such as transport, WRM, water supply, agriculture and urban planning, may have direct implications to local communities and Civil Society Organizations (CSOs). While the outcome of the operations will be beneficial to the State as a whole, it would be critical for RKI and Departments to ensure that a consultative process as defined in the RKDP are followed in both preparation and implementation stages. The Bank will ensure through the Environment and Social Systems Assessment (ESSA) and broader engagement process that the GOK has put in place robust consultative and grievance redress mechanisms.



## H. PROGRAM ACTION PLAN (PAP)

S. no	Sector	Description	By	Timeline	Indicator for completion
1	Program Management	Notify Program, geographical coverage, institutional and fiduciary arrangements for implementation	RKI	Within one month of the Effective Date	Government Order/ Gazette notification issued
2		Continue Program Management Support Services (PMSS) support to Rebuild Kerala Development Programme (RKDP)	RKI	Duration of the Program	Progress reports/M&E reports from RKI with PMSS support
3		Operationalize the implementation of the Anti-corruption Guidelines by performing actions agreed as per the Program Operations Manual	RKI and Implementing Agencies	Duration of the Program	Reports on ACG implementation to be shared with the Bank as part of the regular implementation support reviews
4	Finance	Finalize the ToR and team composition (from Implementing Agencies) of Program Internal Auditors for conducting the Program internal audit covering all Program participating departments.	RKI	Within six months from the Effective Date Biannual	Program Internal Audit team in place for submission of semi-annual internal audit reports for the Program to RKI
5		Include 'Financial Audit' review clause in the comprehensive guidelines for eligibility of incremental performance incentive grants for promoting local capital investments to tackle climate change. under the Program. The clause will detail the requirement and procedure for review of annual audited Financial Accounts and audit opinion for continuity and material misstatement.	LSGD	Within six months from the Effective Date	Guidelines for incremental performance grants issued to LGs
6	Procurement	Develop and implement guidance to address issues of transparency and accountability in procurement, including streamlining complaint handling and debarment processes	GoK	Within six months from the Effective Date	Notification issued to Implementing Agencies, providing guidance on transparency and accountability in procurement
7	Environment & Social safeguards	Mainstream environmental and social management through plans and bid documents in civil works, and integration of environmental and social safeguards and social inclusion content in capacity building programs	RKI and Implementing Agencies	Continuous. To commence within three months of the Effective Date	Incorporation of environment and social safeguards compliance in plans, bid documents for



					the civil works / investments, Inclusion of environment and social safeguard modules in training and capacity building programs
8		Strengthen existing grievance redress mechanism at state, department and local levels to enhance transparency and responsiveness by enabling creation of an open log of grievances and redressal actions.	GoK	Within one year from the Effective Date	Data detailing grievances received and resolved maintained by the Implementing Agencies/RKI

## I. IMPLEMENTATION SUPPORT PLAN

The objectives of the Implementation Support Plan (ISP) are: (i) to monitor implementation progress of the Program (including its PAP) and the implementation of the risk mitigation measures defined in the technical, fiduciary, environmental and social assessments, and (ii) to provide the counterpart with the technical advice necessary to facilitate the achievement of the PDO and contribute to the quality of the capacity building of stakeholders by providing best practices, benchmarks and training. The Bank will provide regular implementation support to the Program as appropriate, including for the implementation of the PAP. Formal implementation support missions and field visits will be carried out semi-annually. The focus of the implementation support, task team skill mix requirements and the role of partners are summarized at the below table.

### Focus of Implementation Support

Time	Focus	Skills Needed	Resources Estimate (US\$)	Partner Role
0–12 months	Technical support and capacity building for RKI and all implementing agencies	International experts to provide technical assistance on global best practices on all sector specific and crosscutting areas including public finance and debt management, social protection, disaster risk financing, urban development, disaster and climate risk management, health, water resources management, agriculture, transport and roads.  Support for RKI and implementing agencies on the technical topics summarizes above.	850,000	AIIB and AFD will provide overall support  KfW will provide recipient executed TA support in selected areas
	Capacity Building in environmental and social management, of the technical staff of IAs and other stakeholders involved in the Program implementation	Social and environmental experts		
	Fiduciary support and monitoring	Procurement and Financial		



Time	Focus	Skills Needed	Resources Estimate (US\$)	Partner Role
		Management experts		
12–48 months	Technical Support and capacity building	Technical experts in program areas and operational experts	1,500,000	AIIB and AFD will provide overall support. KfW will provide recipient executed TA support in selected areas
	Fiduciary Support and capacity building	Procurement and Financial management experts		
	Environmental and Social management support and capacity building	Environmental and Social development experts		
	Overall M&E	M&E experts		
Other	Potential temporary local hands on support	Institutional development or operations expert	300,000	

**Task Team Skills Mix Requirements for Implementation Support (Annual)**

Skills Needed	Number of Staff Weeks	Number of Trips	Comments
Task team leaders	8	3	2 TTLs based in headquarters, 1 TTL based in India
Disaster risk management specialist	10	3	Based in India
Disaster risk financing specialist	6	2	Based in headquarters
Financial management specialist	6	2	Based in India
Social protection specialist	6	2	Based in India
Urban development specialist	6	2	Based in India
Health specialist	6	2	Based in India
Water resource management specialist	6	2	Based in India
Agriculture specialist	6	2	Based in India
Transport specialist	6	2	Based in India
Environment specialist	4	2	Based in India
Social specialist	4	2	Based in India
Procurement specialist	3	2	Based in India
Financial management	3	2	Based in India
Local STCs for environment, social, operations, and M&E	12	10	Based in India

**Role of Partners in Program Implementation**

Name	Institution/Country	Role
KfW	Germany	Joint financing for DPL 2, TA grant to GoK for PforR
AIIB	China	Joint financing the PforR
AFD	France	Joint financing the PforR
Infrastructure Development Finance Company	India	Provide sector experts, capacity support, and change management expertise to the GoK in priority sectors and areas of resilient development over a two-year period.