



**COMPREHENSIVE DEVELOPMENT FRAMEWORK
REPORT OF STATE OF KERALAM**

YOUTH PEACE AND DEVELOPMENT FORUM

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FOREWARD

Kerala occupies a unique position in the Republic of India. Celebrated globally for its pioneering 'Kerala Model' of development, the state is a beacon of high human development, social equity, and progressive governance. Every milestone achieved in Kerala sets a benchmark that influences national welfare policies and India's standing in human development metrics. As India progresses towards becoming a developed nation by 2047, the transformation of Kerala into a globally competitive, knowledge-driven, and ecologically resilient state is not merely a regional aspiration. It is a national imperative.

Having experienced the socio-cultural fabric of Kerala closely, I have witnessed both its extraordinary strengths and its emerging challenges. Kerala possesses world-class healthcare, universal education, a highly skilled workforce, rich biodiversity, and an incredibly dynamic global diaspora. At the same time, the state continues to grapple with second-generation development challenges such as educated unemployment, environmental fragility, climate change-induced extreme weather, industrial stagnation, an aging demographic, and the need for next-generation infrastructure. These challenges require long-term thinking, institutional agility, and evidence-based policymaking rather than incremental interventions.

The Youth Peace and Development (YPD) Forum believes that India's youth have an important role to play in shaping the future of public policy. Across the world, innovative policy ideas increasingly emerge through collaboration between governments, academic institutions, research organisations, industry experts, and young professionals. Inspired by this approach, the YPD Forum has undertaken the preparation of this document titled "Comprehensive Development Framework Report of State of Keralam." This report reflects our collective aspiration to contribute constructively to the development of Kerala through practical, research-driven, and future-oriented policy recommendations.

This document has been prepared through collaborative efforts of researchers, policy analysts, economists, environmental scientists, engineers, students, and professionals associated with the YPD Forum. The recommendations are based on comparative studies of successful global social democracies, examination of international best practices, analysis of existing state policies, and a deep understanding of Kerala's ecological and socio-economic realities. Throughout this exercise, our objective has remained simple. We have sought to identify reforms that are ambitious in vision, realistic in implementation, and capable of generating measurable improvements in economic growth and quality of life.

The strategic frameworks presented in this report cover the most critical dimensions of state-level development. They include governance reforms to improve the ease of doing business, investments in climate-resilient infrastructure, transitioning to a knowledge-based green economy, revamping higher education and skill development, harnessing the 'silver economy' for the aging population, advancing high-tech agriculture, modernizing coastal economies, and a long-term economic strategy aimed at making Keralam a premier

destination for global investments. Together, these recommendations constitute an integrated roadmap for building a state that is economically vibrant, technologically advanced, environmentally secure, and globally competitive.

One of the central ideas underlying this report is that Kerala should not merely rely on the past laurels of its traditional development model. It must evolve into a leading global hub for innovation and sustainable living. International regions such as the Scandinavian countries, Singapore, and New Zealand demonstrate how social equity, environmental stewardship, world-class human capital, and sustainable economic growth can create societies that drive prosperity while providing an exceptional quality of life for their residents. Kerala possesses similar potential. With visionary leadership, coordinated governance, and sustained public-private investment, it can emerge as a global centre for information technology, biotechnology, higher education, Ayurveda, sustainable tourism, and green energy.

This Comprehensive Development Framework is not intended to replace existing government initiatives. Rather, it is offered as a constructive policy resource that can complement ongoing programmes and support future planning for a *Nava Keralam* (New Kerala). We hope that policymakers, legislators, administrators, urban planners, academic institutions, civil society organisations, and citizens will find value in the ideas presented here. Many of these recommendations can be adapted, refined, and implemented through collaborative efforts between different levels of government and relevant stakeholders.

On behalf of the YPD Forum, I extend my heartfelt appreciation to every researcher, volunteer, domain expert, and contributor whose dedication and intellectual commitment made this document possible. Their efforts demonstrate the remarkable capacity of India's youth to engage meaningfully with public policy and contribute innovative solutions for national development. This report stands as a testament to the belief that informed research, constructive dialogue, and collaborative action can help shape a better future.

As India approaches the centenary of Independence in 2047, Kerala has an extraordinary opportunity to redefine itself for the 21st century. It can become a state that combines a robust welfare system with entrepreneurial innovation, high economic growth with ecological sustainability, and global excellence with deep-rooted social inclusion. It is my sincere hope that this document will encourage meaningful discussion, inspire progressive policymaking, and contribute in some measure to the creation of a thriving, resilient, and prosperous Keralam for generations to come.

Dheeraj G. N.
Chairman
Youth Peace and Development (YPD) Forum
New Delhi

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The Youth Peace and Development Forum (YPD Forum) expresses its sincere gratitude to all individuals whose dedication, expertise, and commitment made the preparation of The Comprehensive Development Framework Report of the State of Kerala possible.

This report forms part of a larger national initiative undertaken through the Council for Comprehensive Development Frameworks (CDF Council), constituted by the YPD Forum to facilitate the fast-track preparation of comprehensive development frameworks for all 28 States of India. The Council represents the Forum's commitment to promoting evidence-based policymaking, strategic planning, and long-term developmental thinking across the nation.

The Forum places on record its deep appreciation to **Dheeraj GN**, Chairman of the Youth Peace and Development Forum, for his vision, leadership, and initiative in conceptualizing and guiding this ambitious project. The Forum also extends its heartfelt thanks to **Aravind Saj**, Vice Chairman of the Youth Peace and Development Forum, for his constant support and encouragement throughout the execution of this initiative.

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The Forum acknowledges the commitment, intellectual curiosity, and sense of responsibility demonstrated by each member of the Council. Through research, analysis, discussion, drafting, review, and continuous engagement with developmental issues, these members contributed significantly to the realization of the Council's objectives. Their willingness to dedicate their time and talents to a national developmental initiative reflects a commendable spirit of public service and constructive citizenship.

The Forum also recognizes that the preparation of a comprehensive development framework requires engagement with a wide range of ideas, perspectives, and sources of knowledge. Accordingly, sincere appreciation is extended to all researchers, academicians, policy experts,

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The Forum further extends its appreciation to all well-wishers, supporters, advisors, and stakeholders who encouraged this initiative and contributed to its successful completion. Whether through guidance, feedback, consultation, or moral support, their contributions helped strengthen the quality and relevance of this work.

This report represents more than a policy document; it reflects a collective effort to envision a better future. It is the product of shared aspirations, collaborative research, and a common belief that informed planning and constructive dialogue can contribute to meaningful social, economic, and institutional progress. While the recommendations contained herein are intended to support the development of Kerala, they also form part of a broader national effort to strengthen the foundations of a developed, inclusive, sustainable, and prosperous India.

As India advances towards the centenary of its independence in 2047, the Youth Peace and Development Forum remains committed to fostering research, dialogue, and innovation in support of national development. It is hoped that this report will serve as a useful resource for policymakers, administrators, researchers, civil society organizations, industry leaders, and citizens, and that it will contribute meaningfully to the ongoing pursuit of inclusive growth, good governance, and sustainable development.

With gratitude to all who contributed to this endeavour, the Youth Peace and Development Forum proudly presents this report as a modest contribution towards the shared vision of a stronger Kerala and a developed India.

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PREFACE

Kerala has long held a distinct and respected place in global development discourse. For decades, the famous Kerala Model has been celebrated across the world. By achieving exceptional milestones in public health, universal education, and social justice, the state demonstrated that high human development is entirely possible even with relatively modest levels of per capita income. The egalitarian ethos embedded in our governance structure ensured that the benefits of development reached the most marginalized sections of society.

However, as we navigate the immense complexities of the twenty-first century, it has become increasingly evident that Kerala stands at a critical crossroads. The socio economic and environmental realities of today demand a significant paradigm shift. The state is currently grappling with a unique set of second generation challenges. We are witnessing high rates of educated unemployment, a heavy reliance on foreign remittances, stagnation in traditional industrial sectors, and profound vulnerabilities brought about by climate change.

To secure its future, Kerala must transition from a model heavily reliant on traditional welfare and consumption to a dynamic, knowledge driven, and ecologically resilient economy. It is exactly within this pressing context that The Comprehensive Development Framework Report of State of Keralam was conceptualized. When the Youth Peace and Development Forum, acting through its Council for Comprehensive Development Frameworks, entrusted me with the responsibility of leading this ambitious project, the core mandate was very clear. We needed to craft a forward looking, evidence based, and highly actionable roadmap for the next major phase of the state's growth.

Leading this extensive body of work has been both a profound privilege and an intensive intellectual exercise. Over the course of several months, our dedicated research team delved deep into the structural bottlenecks facing Kerala today. We recognized very early in our journey that addressing these modern challenges requires much more than incremental policy tweaks. It requires comprehensive and systemic reforms that touch every aspect of governance and public life.

This document is the ultimate culmination of rigorous research, comparative policy analysis, and extensive grassroots deliberations among young professionals, researchers, and subject matter enthusiasts. We have meticulously structured this framework not merely as a critique of existing administrative systems, but as a highly constructive blueprint for immediate action. The strategic pillars outlined within these pages span several critical domains of public policy.

We focus heavily on transforming the higher education sector to build a world class talent pool right here at home. We also emphasize the urgent need to create a truly investor friendly ecosystem that can attract sustainable industries. Furthermore, the report highlights the

necessity of fostering green technologies, modernizing traditional agriculture and fisheries, and building robust, climate resilient infrastructure to protect our coastal and high range communities. Throughout our foundational work, we maintained a steadfast focus on ensuring one key principle. We believe that economic modernization must never come at the cost of the social equity and environmental stewardship that inherently define Kerala.

As the lead of this vital initiative, I am immensely proud of the unwavering dedication shown by the entire research and drafting team. We approached this monumental task with the firm conviction that the youth of India must be active architects of public policy, rather than passive recipients of it. The young minds involved in this project spent countless hours analyzing data, consulting with experts, and debating policy alternatives to ensure that our recommendations are both ambitious and grounded in reality.

This report is a true reflection of our generation's vision for a Nava Keralam. We envision a new Kerala that proudly retains its deeply egalitarian ethos while simultaneously embracing global competitiveness and technological innovation. We want to build a state where our brightest minds do not feel compelled to migrate in search of better opportunities, but can instead find fulfilling careers and high qualities of life within their home state.

The process of compiling this framework also reinforced our belief in the power of collaborative thinking. We drew inspiration from successful social democracies around the globe, adapting their best practices to suit our local context. The challenges we face are undoubtedly complex, but they are certainly not insurmountable. With visionary leadership, coordinated governance, and sustained public participation, Kerala can emerge as a premier global hub for innovation, sustainable tourism, healthcare, and green energy.

It is my earnest hope that this comprehensive framework will serve as a powerful catalyst for constructive and continuous dialogue. We invite policymakers, academicians, industry leaders, civil society organizations, and everyday citizens to engage deeply with the ideas presented in this report. While no single document can provide all the perfect answers to such complex socio economic issues, we firmly believe the recommendations presented here offer a highly robust foundation for strategic planning and long term development.

I invite you to read this report with an open mind, debate its various propositions, and join us in the collective endeavour to build a prosperous, sustainable, and entirely future ready Keralam for the generations that will follow us.

Pranav P.

In-charge, Kerala Development Framework Project
Council for Comprehensive Development Frameworks
Youth Peace and Development Forum

EXECUTIVE SUMMARY

The state of Kerala stands at a pivotal juncture in its developmental journey. Recognized globally for its exceptional human development indicators, the state has historically prioritized social welfare, healthcare, and primary education. However, the contemporary global economic landscape demands a strategic pivot. The Comprehensive Development Framework Report of State of Kerala outlines a blueprint to transition the state into a vibrant, knowledge driven economy by 2047.

This report identifies several critical challenges that currently hinder sustainable growth. These include a high rate of educated unemployment, sluggish industrial growth, severe climate vulnerabilities, and a rapidly aging demographic profile. To address these systemic issues, the framework proposes a comprehensive strategy focusing on economic modernization, environmental resilience, and institutional reform.

Core Strategic Pillars

- **Transitioning to a Knowledge Economy:** Kerala must capitalize on its highly educated workforce by accelerating growth in advanced sectors, including Information Technology, biotechnology, artificial intelligence, and space technology.
- **Climate Resilient Rapid Infrastructure:** The increasing frequency of extreme weather events demands a complete overhaul of both urban and rural infrastructure. Strategic investments must prioritize sustainable drainage networks, stringent green building codes, and robust coastal protection mechanisms.
- **A One Trillion Dollar Ecosystem:** To build an economy of this scale, aligning higher education curricula with global industry standards is essential. Establishing specialized research and innovation clusters will play a vital role in retaining local talent and securing international academic partnerships.
- **Harnessing the Silver and Blue Economy:** Given its aging demographic, Kerala possesses a unique opportunity to pioneer the silver economy through specialized healthcare, premium assisted living facilities, and geriatric wellness tourism. Simultaneously, sustainable utilization of the state's vast marine resources will unlock the immense potential of the blue economy.
- **Modernizing Agriculture and Fisheries:** Promoting precision farming and enhancing value addition in traditional cash crops are critical for long term food security. Furthermore, integrating advanced deep sea fishing technologies will significantly improve the livelihoods and economic stability of primary sector workers.

The successful implementation of these pillars requires robust institutional coordination. The framework emphasizes the need for regulatory simplification to improve the ease of doing business, thereby attracting both domestic and foreign direct investment.

For decades, the Kerala Model of Development has been a subject of intense academic and policy interest. By achieving high literacy rates, high life expectancy, and low infant mortality rates despite a relatively low per capita income, the state challenged traditional economic theories. This success was built on a foundation of progressive social movements, land reforms, and robust public investment in health and education. The egalitarian ethos embedded in the governance structure ensured that the benefits of development reached the marginalized sections of society.

However, the limitations of this model have become increasingly apparent over the last two decades. A heavy reliance on remittances from the Gulf diaspora and a consumption driven economic base have created structural vulnerabilities. The lack of a strong manufacturing sector and the slow growth of modern services have led to a paradoxical situation where the state produces highly qualified graduates who are forced to migrate for suitable employment opportunities.

The twenty-first century presents a completely different set of challenges and opportunities. The onset of the Fourth Industrial Revolution, the existential threat of climate change, and shifts in global supply chains require agile and forward looking governance. Kerala can no longer afford to rest on its past achievements. The state must proactively build an ecosystem that rewards innovation, encourages entrepreneurship, and attracts capital.

This Comprehensive Development Framework has been developed to bridge the gap between the current reality of Kerala and its future potential. The primary objective is to formulate actionable policies that will catalyze a structural transformation in the state economy. We envision a Kerala that ranks among the top destinations globally for sustainable living, advanced technology innovation, and equitable wealth creation.

The report is structured into detailed chapters that address specific sectors of the economy. Each chapter diagnoses the current bottlenecks, sets clear medium term and long term objectives, and outlines specific policy interventions required to achieve those goals. We have paid special attention to ensuring that all economic recommendations are thoroughly aligned with the principles of ecological sustainability.

As India marches towards its centennial year of independence, regional development strategies will play a critical role in shaping the national trajectory. Kerala has the intellectual capital, the social cohesion, and the global connectivity required to become a model state for the twenty first century. This report serves as a guiding document for that journey. It is a call to action for all stakeholders to collaborate, innovate, and work towards the realization of a prosperous and resilient future for Kerala.

Chapter 1: State Profile, Geography, Demography and Society

1.1 Geographic and Ecological Characteristics of the State

Kerala occupies a distinct and narrow coastal strip in the south-western peninsula of India. It is bounded by the expansive Arabian Sea to the west and the formidable mountain ranges of the Western Ghats to the east. The state covers a total geographical area of 38,852 square kilometres. This specific area represents roughly one per cent of India's total land mass, yet the state accounts for nearly three per cent of the national population (Kerala Environment Information System [KERENVIS], 2023).

The topography of the state is structurally divided into three broadly parallel zones that run along a north to south axis. These are the highland region of the Western Ghats, the midland zone of undulating hills and valleys, and the low-lying coastal plain which is heavily dotted with naturally occurring lagoons, estuaries, and backwaters. The highland region comprises steep mountains and deep valleys, predominantly covered by dense tropical forests and major cash crop plantations such as tea, coffee, and cardamom. This region is ecologically vital as it serves as the primary catchment area for the state's river systems. The midlands, characterized by laterite soils, transition into agricultural heartlands where crops like rubber, pepper, tapioca, and cashew are extensively cultivated (Chattopadhyay & Franke, 2006). Finally, the lowlands represent the coastal margins where the cultivation of paddy and coconut dominates the agrarian landscape.

This compressed and varied topography concentrates an extraordinary level of ecological diversity within a remarkably small land area. The state encompasses tropical evergreen forests, hill agro-ecosystems, and complex brackish-water wetland systems like the Vembanad and Ashtamudi lakes. This immense biodiversity is an invaluable environmental asset. However, it concurrently acts as a severe planning constraint. Infrastructure corridors, settlement expansion, and agricultural land constantly compete for the exact same narrow strip of usable terrain (George & Chattopadhyay, 2001).

Kerala is uniquely dependent on two distinct monsoon seasons. The South-West Monsoon, locally known as Edavapathy, arrives in early June and provides the bulk of the annual rainfall. The North-East Monsoon, known as Thulavarsham, arrives in October and is characterized by intense evening thunderstorms. The state is drained by 44 rivers, of which 41 flow westward to join the Arabian Sea or the backwater systems, while only three flow eastward. Despite this apparent abundance of water resources, the steep topography ensures that rainwater rapidly runs off into the sea, leading to acute water scarcity during the summer months and highlighting the fragile hydrological balance of the region (Nair, 2011). The ecological fragility of the Western Ghats has been a subject of intense policy debate, especially following the devastating floods of 2018 and 2019, which exposed the limits of unchecked environmental intervention in the state's highland and midland zones.

1.2 Administrative Divisions: Districts, Divisions and Sub-State Units

The modern state of Kerala was formally created on November 1, 1956, under the States Reorganisation Act, which merged the Malayalam-speaking regions of the erstwhile princely states of Travancore and Cochin with the Malabar district of the Madras Presidency, along with the Kasaragod taluk of South Canara district. Today, the state is constituted of fourteen distinct districts. These districts are broadly categorized into three historical and geographical regions. The northern region (Malabar) includes Kasaragod, Kannur, Wayanad, Kozhikode, Malappuram, and Palakkad. The central region (erstwhile Cochin and northern Travancore) comprises Thrissur, Ernakulam, and Idukki. The southern region (erstwhile Travancore) consists of Kottayam, Alappuzha, Pathanamthitta, Kollam, and Thiruvananthapuram.

For revenue and general administration purposes, these fourteen districts are organized further into 63 taluks, which are subsequently divided into 1,018 revenue villages and 532 census towns (Census of India, 2011). Each district functions as the principal unit of revenue administration, headed by a District Collector who is also the District Magistrate. The District Collector coordinates the activities of various state departments and ensures the execution of government policies at the grassroots level (Isaac & Franke, 2002).

Below the district tier, the state operates a highly robust decentralized governance architecture. Kerala is celebrated nationally for its successful implementation of the 73rd and 74th Constitutional Amendments. The state assigns extensive planning and implementation responsibilities to a three-tier Panchayati Raj structure in rural areas, consisting of Grama Panchayats at the village level, Block Panchayats at the intermediary level, and District Panchayats at the apex level. In urban areas, these responsibilities are handled by Municipal Councils and Municipal Corporations.

The foundation of this decentralized system was solidified during the historic People's Plan Campaign launched in 1996, which devolved roughly one-third of the state's plan funds directly to local self-government institutions (Heller, 2001). This radical devolution of fiscal and administrative power empowered local bodies to formulate localized development plans addressing specific community needs in sectors like sanitation, primary education, and local infrastructure. This structure of decentralized governance is examined in greater depth in Chapter 12 of this report. Despite this advanced decentralization, the district remains the primary statistical and planning unit referenced in macro-level economic and social policy documents.

1.3 Demographic Structure: Population, Density, Growth and Composition

The demographic profile of Kerala represents an advanced stage of demographic transition, setting it apart from the majority of Indian states. As per the 2011 Census, Kerala's total population stood at 33,406,061 persons. This figure comprised 16,027,412 males and 17,378,649 females (Census of India, 2011).

One of the most defining demographic characteristics of the state is its extremely high population density. The state has a density of roughly 860 persons per square kilometre, which is more than double the national average of approximately 382 persons per square kilometre. This high density is a direct result of the state's limited habitable land area, squeezed between the mountains and the sea, compelling dense habitation patterns across the midlands and coastal regions.

The state recorded a decadal population growth rate of only 4.86 per cent between 2001 and 2011. This was the lowest growth rate recorded among all Indian states during that period, reflecting an advanced stage of demographic transition characterized by low birth rates and low death rates (Kerala State Planning Board, 2017). This transition is widely attributed to high levels of female literacy, widespread access to healthcare, and a high age at marriage for women (Zachariah & Rajan, 2012).

Kerala's sex ratio is a critical indicator of its unique social trajectory. With 1,084 females per 1,000 males, the state maintains the most favourable sex ratio among Indian states, standing well above the national average of 943 (Census of India, 2011). Furthermore, the child population share has been declining steadily. The proportion of children (aged 0 to 6 years) fell from roughly twelve per cent of the total population in 2001 to about ten per cent in 2011. This shrinking base of the population pyramid signals an increasingly aging population structure relative to the rest of the country. The rising share of the elderly population poses significant new challenges for the state, particularly in geriatric care, social security provisioning, and healthcare financing (Rajan & Aliyar, 2004).

Demographic growth is markedly uneven across different districts within the state. Malappuram is the most populous district and recorded the fastest decadal growth at 13.4 per cent. Conversely, Wayanad remains the smallest district by population. Strikingly, the southern districts of Pathanamthitta and Idukki recorded absolute population declines of roughly minus three and minus two per cent respectively between 2001 and 2011 (Kerala State Planning Board, 2017). This decline is attributed to very low fertility rates combined with high rates of out-migration from these specific districts.

Urbanisation in Kerala presents a highly distinctive spatial form. It is characterized by diffusion rather than concentration. The urban population share stood at 47.7 per cent in 2011, having grown by close to twenty-two per cent over the preceding decade (Kerala State Planning Board, 2017). However, this population is dispersed across a near-continuous corridor of small and medium towns, effectively blurring the traditional boundaries between rural and urban spaces. This phenomenon, often termed "rurbanization," features a settlement pattern where houses are scattered continuously along road networks rather than being clustered in traditional village cores or concentrated in a few large metropolitan centers. While this prevents the formation of massive urban slums seen in other Indian metropolises, it severely complicates the cost-effective provision of trunk infrastructure, solid waste management, and centralized urban services.

1.4 Linguistic, Ethnic, Religious and Cultural Profile

The cultural and linguistic identity of Kerala is primarily unified by the Malayalam language, a Dravidian language with a rich literary heritage. Malayalam is the dominant language of the state, spoken natively by at least ninety-seven per cent of Kerala's population. It serves as the primary medium of instruction in government schools, the language of state administration, and the core medium of cultural expression in literature, cinema, and media. English functions as the next most common language, widely used in higher education, judiciary proceedings, and corporate commerce, reflecting the state's historical integration with global trade and modern educational systems (Asher & Kumari, 1997). Small linguistic minorities also exist, particularly Tamil speakers in the border districts of Palakkad, Idukki, and Thiruvananthapuram, Tulu and Kannada speakers in the northern district of Kasaragod, and various tribal languages spoken by Adivasi communities in Wayanad, Idukki, and Palakkad.

Religiously, Kerala is among the most diverse and pluralistic states in India. According to the 2011 Census, Hindus constitute just over fifty-six per cent of the population, Muslims account for roughly twenty-five per cent, and Christians make up about nineteen per cent. The state also hosts microscopic but historically significant communities of Sikhs, Buddhists, Jains, and Jews (Kerala Environment Information System [KERENVIS], 2023).

This religious diversity is not a recent phenomenon but the result of millennia of maritime trade and cultural exchange across the Arabian Sea. The ancient port of Muziris (near modern-day Kodungallur) attracted Roman, Arab, Jewish, and Chinese traders long before the arrival of European colonial powers. Within the Christian community, Catholic denominations (including the Syro-Malabar, Latin, and Malankara rites) form the largest grouping. The Syro-Malabar rite is the largest single group. Alongside these are the Orthodox, Jacobite, and Marthoma churches that trace their roots to early Syrian-Christian traditions, purportedly established by Thomas the Apostle in the first century CE, as well as various modern Protestant denominations (Visvanathan, 1993). Islam in Kerala is similarly ancient, introduced by Arab traders in the 7th century rather than through northern land-based conquests, leading to a distinct regional Islamic culture heavily integrated with local customs, particularly among the Mappila community of the Malabar region.

This deep-seated religious plurality has historically underpinned Kerala's distinctive pattern of community-driven social investment. Throughout the late 19th and early 20th centuries, intense socio-religious reform movements swept across the region. Leaders like Sree Narayana Guru, Ayyankali, and Chattampi Swamikal fought against the rigid caste system, advocating for education, temple entry, and social dignity for the depressed classes (Osella & Osella, 2000). Simultaneously, various Christian missionaries and Muslim educational societies established extensive networks of schools, colleges, and hospitals. This competitive yet constructive communal mobilization created a vast social infrastructure that laid the groundwork for the state's modern achievements in education and healthcare, a historical legacy discussed extensively in Chapters 5 and 6 of this report.

The cultural fabric of Kerala is characterized by a remarkable degree of syncretism. Major festivals such as Onam (a harvest festival) and Vishu (the traditional new year) are celebrated across religious boundaries, acting as unifying cultural markers of Malayali identity. Despite inevitable modern political frictions, the state's historical tradition of cosmopolitanism continues to heavily influence its social stability and cultural landscape.

1.5 Human Development Index: State Ranking and Trend Analysis

In the realm of development economics, Kerala is globally recognized for pioneering a unique development trajectory. The state consistently ranks first or near-first among Indian states on composite human development measures. This phenomenon, widely termed the "Kerala Model of Development," demonstrates that profound improvements in material quality of life, health, and education can be achieved even at relatively low levels of per capita income, provided there is a strong political commitment to equitable distribution and public welfare (Sen, 1999).

This top-tier position is built principally on the state's extraordinary literacy and health indicators. Kerala's effective literacy rate of 93.91 per cent remains the highest in India, standing vastly above the national literacy rate of approximately seventy-two per cent (Census of India, 2011). This achievement is the result of continuous state policy, beginning with the edicts of the royal rulers of Travancore and Cochin in the 19th century who prioritized primary education, and subsequently massively expanded by the democratically elected communist and coalition governments post-independence. The state achieved total primary education and executed highly successful adult literacy campaigns, most notably the Ernakulam district literacy campaign of 1989, which served as a model for the rest of the nation.

In the health sector, Kerala's outcomes rival those of many middle-income developed nations. Life expectancy at birth is the highest among Indian states, currently estimated at over 75 years, with female life expectancy approaching 78 years (Kerala State Planning Board, 2021). The Infant Mortality Rate (IMR) stands in the single digits, heavily contrasting with the national average, and the Maternal Mortality Ratio (MMR) is similarly the lowest in the country. These outcomes are heavily driven by widespread access to primary healthcare centres, a high proportion of institutional deliveries, robust immunization programs, and a strong culture of health awareness among the general populace, driven by female education (Kannan, 2005).

However, these historic outcomes present a modern analytical tension. The central challenge for this report is that Kerala's stellar Human Development Index (HDI) ranking has not been matched by a commensurate ranking on indicators of economic dynamism, productive employment generation, or fiscal sustainability. The state suffers from a phenomenon of "educated unemployment," where highly qualified youth are unable to find suitable jobs within the state's borders, leading to massive out-migration to the Gulf countries, Europe, and

other parts of India (Zachariah & Rajan, 2012). The divergence between human capital formation and domestic economic absorption motivates much of the structural reform agenda discussed in Chapters 2 through 4 of this report.

1.6 Poverty, Inequality and Multidimensional Deprivation Indices

Kerala has achieved remarkable success in poverty alleviation. The state's headcount poverty ratio based on consumption expenditure is among the lowest in India, consistently remaining in the single digits over the past two decades. According to the NITI Aayog's Multidimensional Poverty Index (MPI) baseline report, Kerala registered the lowest multidimensional poverty in the country, with only 0.71 per cent of its population classified as multidimensionally poor. This low absolute poverty reflects decades of aggressive redistributive social spending, comprehensive land reforms implemented in the 1960s and 1970s that abolished intermediary landlordism, and a highly effective Public Distribution System (PDS) that ensures food security for vulnerable households (Ramachandran, 1996).

Despite these impressive state-level aggregates, multidimensional deprivation is not uniformly absent across the state. Pockets of severe deprivation and marginalization persist. These are predominantly concentrated among Specific demographic groups. The Scheduled Caste (SC) and Scheduled Tribe (ST) populations, despite benefiting from the general welfare ecosystem, continue to lag behind the mainstream population in asset ownership, higher education attainment, and representation in lucrative professions. The Adivasi communities in districts like Wayanad and Palakkad face acute issues related to land alienation, malnutrition, and limited access to culturally appropriate healthcare (Steuer, 2017).

Similarly, the traditional fisherfolk and coastal communities represent another significant outlier to the Kerala model. Residing in densely packed coastal hamlets facing constant threats from coastal erosion and extreme weather events, these communities suffer from inadequate housing, poor sanitation infrastructure, and fluctuating livelihood security (Kurien, 2000). Furthermore, there is an expanding demographic of the elderly population, particularly elderly women living alone, whose welfare, healthcare, and psychological needs are becoming increasingly complex and are addressed specifically in Chapter 7.

While consumption poverty has collapsed, income and asset inequality have been rising rapidly. The state exhibits a high Gini coefficient for asset distribution. This rising inequality is a direct consequence of several modern economic trends. Land and property values have appreciated exponentially, creating a massive wealth gap between property owners and the landless. Additionally, the state's economy is heavily dependent on overseas remittance income, predominantly from the Middle East. Households receiving foreign remittances have experienced immense upward mobility, while non-migrant households have struggled to keep pace with the rising cost of living. Finally, the concentration of new economic opportunities in skill-intensive service sectors (like Information Technology and modern healthcare) effectively excludes less-educated workers or those engaged in traditional unorganized

sectors. This fundamental tension between social equity and emerging economic polarization is examined further in Chapter 3's discussion of the informal economy and the changing labour market.

1.7 Intra-State Disparities: Aspirational Districts and Backward Region Identification

A recurring challenge in policymaking for Kerala is the masking of severe localized developmental deficits by highly favourable state-level averages. When disaggregated, district-level data consistently reveal persistent internal disparities that demand targeted geographic interventions.

The most pronounced disparities exist between the coastal midland plains and the eastern highland districts. Wayanad and Idukki, the state's predominantly hilly and tribal districts, consistently lag behind the rest of the state on multiple indicators. These districts suffer from severe deficits in physical connectivity due to difficult terrain, leading to reduced access to advanced tertiary healthcare infrastructure and high-quality higher education institutions. The economies of these districts are heavily reliant on plantation crops (tea, coffee, rubber, spices) and are therefore highly vulnerable to global commodity price fluctuations and the escalating impacts of climate change, including unpredictable rainfall and frequent landslides. Furthermore, these districts struggle with generating formal-sector employment outside of agriculture, leading to economic stagnation.

Historically, there was also a distinct north-south divide. The northern Malabar districts, particularly Kasaragod, historically lagged behind the erstwhile princely states of Travancore and Cochin (the southern and central regions) in terms of health and educational infrastructure. This was largely due to the neglect of the Malabar region during British colonial administration. While there has been substantial convergence in recent decades driven by targeted state funding and massive inflow of Gulf remittances to the Malabar region, legacy deficits remain. Kasaragod, for instance, continues to face challenges regarding specialized healthcare access, a vulnerability tragically highlighted by the long-standing public health crisis resulting from the aerial spraying of Endosulfan in local cashew plantations.

Beyond specific districts, spatial disparities exist in micro-environments. Coastal pockets stretching across Alappuzha, Kollam, and Thiruvananthapuram, heavily dependent on the traditional marine fisheries sector, show below-state-average outcomes on income stability and secure asset ownership. This is despite their close physical proximity to highly urbanized and developed cores. These coastal belts frequently experience developmental stagnation, overcrowded housing, and extreme vulnerability to sea-level rise and coastal storms.

These persistent intra-state disparities heavily underline the absolute limits of relying on state-level averages alone in policy design and resource allocation. A "one size fits all" approach fails to address the unique structural bottlenecks of hill economies or the ecological

vulnerabilities of the coastal belts. This necessity for spatially targeted, micro-level planning is a central theme revisited in the district-level analyses provided throughout the subsequent chapters of this report.

1.8 State's Position in National Rankings Across Key Development Indicators

Kerala occupies a deeply paradoxical position in national rankings, presenting a dualistic profile that forms the core problem statement of this document. On one side of the ledger, the state consistently remains at or near the absolute top on all major social and human capital indicators. In the NITI Aayog's Sustainable Development Goals (SDG) India Index, Kerala frequently secures the highest overall score, driven by its unparalleled performance in eradicating poverty, providing quality education, ensuring good health and well-being, and promoting gender equality. Its statistics regarding life expectancy, infant and maternal mortality, sex ratio, and universal primary enrolment are the aspirational benchmarks for the rest of the Indian union.

However, this triumphant narrative in social development is sharply contrasted by the state's performance on macroeconomic, fiscal, and industrial metrics. Kerala performs considerably weaker on indicators of own-tax revenue capacity and fiscal prudence. The state has historically grappled with high fiscal deficits and a high debt-to-GSDP (Gross State Domestic Product) ratio, heavily constraining the government's ability to undertake large-scale capital expenditure. A massive portion of the state's revenue is consumed by committed expenditures such as salaries, pensions, and interest payments, leaving minimal fiscal space for infrastructure development (Government of Kerala, 2021).

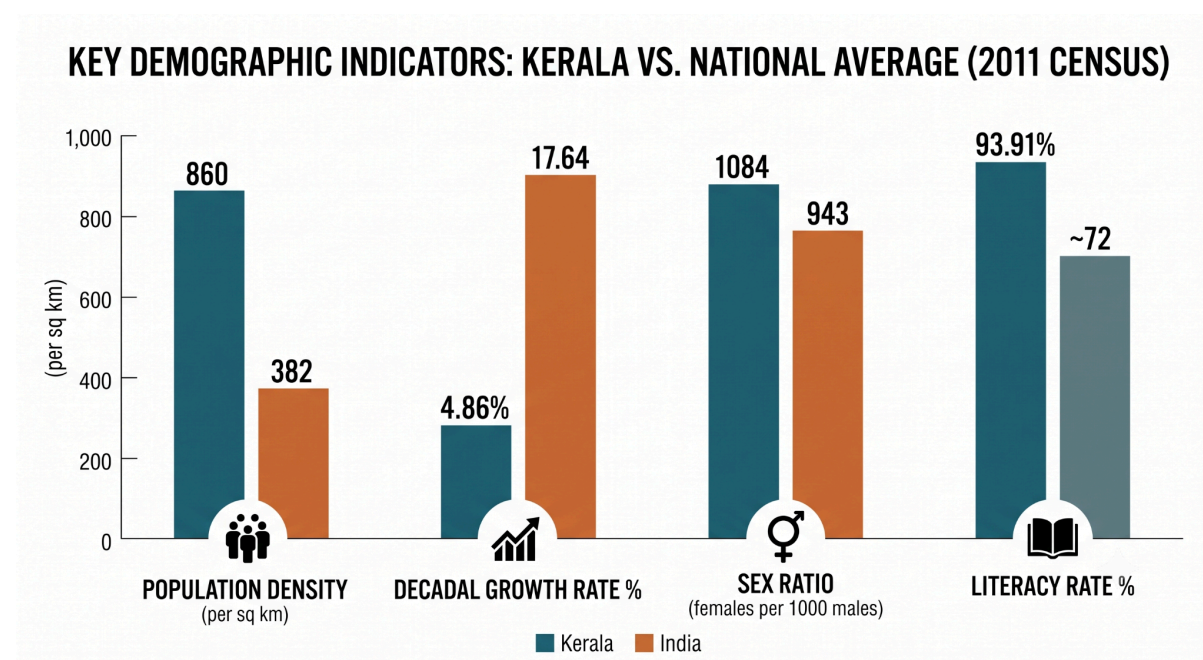


Figure 1.1 : 2011 Census demographic indicators for Kerala and the National Average.

Furthermore, the state historically struggled with its "Ease of Doing Business" rankings, plagued by bureaucratic red tape, complex land acquisition laws, and a historically militant trade union culture that deterred large-scale private manufacturing investments. While recent legislative reforms and digital single-window clearance mechanisms have improved these rankings, the perception of the state as unfriendly to large capital remains a structural hurdle. Most critically, the state exhibits a severe weakness in net new formal employment generation relative to its highly educated working-age population.

This specific combination, characterized as a "high human development, low economic dynamism" profile, is structurally unsustainable in the long term. As remittance flows stabilize or decline due to geopolitical shifts and nationalization policies in the Gulf, and as the aging population demands higher healthcare and pension expenditures, the state must urgently expand its domestic revenue base. This central diagnostic frame recurs as the organizing principle across Chapters 2 through 4 of this report. Overcoming this paradox requires transitioning from a remittance-dependent consumption economy to a knowledge-driven, production-based economy. This is the exact foundational challenge that the State Vision 2047 roadmap, detailed extensively in Chapter 21, is fundamentally designed to address and resolve.

Chapter 2: Fiscal Architecture of the State

2.1 Revenue Framework: Own Tax Revenue, Non-Tax Revenue and Devolution

The fiscal foundation of any state government is heavily dependent on its capacity to generate internal resources while effectively managing the devolved funds received from the central government. Kerala's own tax revenue is estimated at roughly ₹84,884 crore for the financial year 2024 to 2025. This amount is equivalent to about 6.5 per cent of the Gross State Domestic Product (GSDP). A critical analysis of this figure reveals a concerning trend, as this ratio has in fact declined slightly from 6.9 per cent recorded in the 2022 to 2023 financial year.

This downward trend places Kerala's own-revenue effort below the trajectory implied by the all-state average. The all-state average itself rose from 6.4 per cent to about 7.0 per cent of GSDP over the exact same period, largely as other states successfully strengthened their State Goods and Services Tax (SGST) administration and compliance mechanisms.

Furthermore, Kerala's non-tax revenue remains comparatively underdeveloped. This underdevelopment is particularly stark when compared to mineral-rich states that benefit from substantial royalty incomes. This structural limitation leaves the state disproportionately reliant on central transfers. These transfers consist of tax devolution and central grants, which are together estimated at roughly ₹23,882 crore and ₹11,533 crore respectively for the 2024 to 2025 fiscal year, accounting for a substantial share of the state's total receipts.

Significantly, the fiscal cushion previously provided by the central government has diminished. The revenue deficit grant, which had effectively protected Kerala's finances, fell sharply from about ₹13,174 crore in 2022 to 2023 to just ₹4,749 crore in 2023 to 2024. This steep decline occurred because the post-devolution protection period recommended by the Fifteenth Finance Commission lapsed. This severe reduction in protective grants necessitates an immediate and robust expansion of the state's domestic revenue mobilization.

2.2 Expenditure Profile: Composition, Quality and Efficiency

The expenditure profile of Kerala presents significant challenges regarding the quality and flexibility of public spending. Committed expenditure, which includes salaries, pensions, and interest payments combined, is estimated at an overwhelming ₹97,978 crore for the 2024 to 2025 financial year. This specific category of spending consumes roughly 71 per cent of the state's estimated revenue receipts.

This massive allocation toward non-productive, rigid commitments leaves an exceedingly narrow fiscal margin for discretionary and developmental spending. Furthermore, this proportionate share has changed very little in recent years, even as the state's total

expenditure rose from about ₹1,58,738 crore in 2022 to 2023 to ₹1,59,506 crore in 2023 to 2024.

The primary quality concern regarding Kerala's expenditure is structural rather than cyclical. With such a high committed-expenditure base, the state lacks the fiscal agility to navigate economic downturns or revenue shocks. Consequently, any revenue shortfall is absorbed almost entirely by capital expenditure compression rather than by adjustments in current spending. This pattern effectively starves the state of vital infrastructure investments, an issue that is examined further in the subsequent section on capital asset creation.

2.3 Capital Expenditure: Infrastructure Investment and Asset Creation

Capital expenditure remains a critically small and persistently constrained share of Kerala's overall budget. The state's financial health experienced a significant deterioration when the revenue deficit nearly doubled between 2022 to 2023 and 2023 to 2024, rising rapidly from about ₹9,226 crore to ₹18,140 crore.

Because state governments typically finance revenue shortfalls first by squeezing their capital outlays, the financial headroom available for asset-creating investment narrows precisely when the state economy most needs a stimulus. The Comptroller and Auditor General's 2023 to 2024 audit highlighted this severe deficiency.

The findings from the audit regarding borrowing utilization are stark:

- Only about 5.18 per cent of the state's borrowings during the audited period were actually directed towards capital creation.
- This same 5.18 per cent figure was also corroborated by legislative reviews of state finances.
- The overwhelming majority of borrowed funds were diverted to finance current consumption.
- Borrowed funds were also heavily utilized to bridge revenue deficits and facilitate the repayment of existing liabilities.

This diversion of debt from productive infrastructure to day-to-day administrative survival forms the structural core of the case for immediate reform. It strongly justifies the implementation of a binding capital-expenditure floor, a policy recommendation that is thoroughly examined in Chapter 4 of this report.

2.4 Fiscal Deficit, Primary Deficit and Debt Sustainability

Kerala's macroeconomic stability is increasingly threatened by widening deficits and a growing debt burden. The state's fiscal deficit rose from about ₹25,555 crore in 2022 to 2023 to ₹34,258 crore in 2023 to 2024. Looking ahead, the fiscal deficit is targeted at 3.4 per cent

of GSDP, which translates to roughly ₹44,529 crore, for the 2024 to 2025 financial year. This target stands in direct violation of the Fiscal Responsibility Legislation limit, which strictly mandates a ceiling of 3 per cent.

Furthermore, Kerala has demonstrated a historical propensity to exceed its fiscal boundaries. Kerala was among the small number of states that borrowed in excess of their sanctioned limits during the 2021 to 2022 financial period. The other states in this specific category included Assam, Manipur, Meghalaya, Punjab, and Telangana. This over-borrowing occurred even as most other Indian states under-utilised their available fiscal space during the same timeframe.

The accumulation of state debt is accelerating rapidly. Total liabilities, which crucially include off-budget borrowings, have grown at a high average annual rate of about 11.6 per cent between the 2019 to 2020 and 2023 to 2024 financial years. This rapid accumulation pushed the overall liabilities-to-GSDP ratio from 34.4 per cent to a precarious 37.8 per cent over the exact same period.

To contextualize the severity of this debt burden, Kerala's 37.8 per cent ratio sits well above the all-India average debt ratio, which is recorded at roughly 27.6 per cent. Based on current trends and projections, debt sustainability is not assured without fundamental structural corrections. Ensuring long-term solvency requires either a massive, sustained increase in own revenue effort or a highly credible, politically difficult reduction in the growth rate of committed expenditure.

2.5 State's Borrowings, Guarantees and Off-Budget Liabilities

A defining and highly controversial feature of Kerala's modern fiscal architecture is the immense scale of borrowing routed entirely outside the traditional state budget. This alternative financing is principally executed through two distinct entities: the Kerala Infrastructure Investment Fund Board (KIIFB) and the Kerala Social Security Pension Limited (KSSPL).

Transparency issues regarding these entities have been a major point of contention. The CAG's audit explicitly found that the state government had failed to disclose off-budget borrowings of about ₹20,042 crore routed through KIIFB in the official state budget. Similarly, the government did not disclose another ₹12,901 crore borrowed through KSSPL. This systemic non-disclosure effectively understated the reported government liabilities, presenting an inaccurate picture of the state's financial health to the legislature and the public.

The scale of this parallel financing structure is expanding rapidly. Off-budget borrowings overall rose from roughly ₹14,142 crore in 2019 to 2020 to a massive ₹32,942 crore by 2023 to 2024.

Because KIIFB borrowings do not legally count against the state's official deficit ceiling, the mechanism operates under what has been accurately described as a soft budget constraint. In this flawed framework, the state Finance Department does not exercise full control over KIIFB's borrowing decisions, even though those resulting liabilities carry severe and direct implications for the state's effective revenue and fiscal deficits. This is precisely the accountability gap that motivates the urgent case for a comprehensive KIIFB transparency and sustainability mechanism, a regulatory framework detailed in Chapter 4.

2.6 Finance Commission Awards: Allocation and Utilisation

The constitutional mechanisms of fiscal federalism have heavily influenced Kerala's recent financial trajectory. The Fifteenth Finance Commission's revenue deficit grants were specifically designed to bridge the structural gap between a state's assessed expenditure needs and its actual own revenue capacity. These grants provided meaningful, critical support to Kerala through the 2022 to 2023 financial year.

However, this support was temporary by design. The grants began tapering sharply and fell to under half their prior level in 2023 to 2024, which marked the final year of the state's eligibility for this specific assistance.

Financial regulators have long warned about the dependencies created by such mechanisms. The Reserve Bank of India has cautioned that protected-revenue mechanisms, while absolutely necessary in the short run to prevent fiscal collapse, can disincentivise the underlying fiscal reform they are fundamentally meant to bridge towards.

Kerala's recent fiscal experience illustrates this exact risk directly and painfully. The scheduled withdrawal of the revenue deficit grants in 2023 to 2024 coincided directly with the near-doubling of the state's own revenue deficit in that exact same year. This indicates that the state utilized the grant period to sustain consumption rather than to implement the painful revenue reforms necessary to prepare for the grant's inevitable expiration.

2.7 GST Implementation: Revenue Impact and Compensation Status

The transition to the Goods and Services Tax (GST) regime has not yielded the expected revenue dividends for the state. Kerala's State Goods and Services Tax (SGST) collections have persistently underperformed relative to the all-state average. This underperformance is particularly alarming given that national SGST buoyancy has actually improved over the same period.

The fiscal architecture of the GST initially included a protective mechanism for states. The five-year GST compensation guarantee successfully protected states' revenue growth through June 2022, after which it definitively lapsed. To manage the subsequent shortfall, Kerala received a back-to-back loan of about ₹14,505 crore from the Government of India in lieu of

compensation during the period spanning 2021 to 2022 to 2023 to 2024. Crucially, this specific loan is treated as outside the state's debt for the purpose of calculating Finance Commission norms.

With central compensation no longer available to cover shortfalls, and the state's own SGST performance actively lagging behind national trends, GST is now a comparatively weaker revenue lever for Kerala than its architectural design was originally intended to provide. This reality reinforces the absolute necessity for immediate administrative reforms to plug revenue leakages. Essential reforms include the implementation of mandatory e-invoicing protocols, the creation of dedicated tax intelligence units, and the deployment of Artificial Intelligence-based leakage detection systems, all of which are modern compliance tools that other proactive states have already adopted successfully.

2.8 Public Financial Management Reforms and Audit Compliance

The integrity of public financial management in Kerala requires substantial and immediate remediation. The CAG's 2023 to 2024 audit identified highly significant budgetary deviations between the state's revised estimates and its actual financial outturns.

These deviations highlight severe systemic flaws:

- The audit revealed deviations exceeding 100 per cent in two specific financial grants.
- The audit also uncovered deviations ranging between 75 and 100 per cent in another separate grant.
- These massive discrepancies point directly to profound weaknesses in both expenditure forecasting and in-year budgetary control mechanisms.

Furthermore, the same audit heavily flagged the non-disclosure of KIIFB and KSSPL liabilities, which was previously discussed in section 2.5. The CAG categorized this non-disclosure as a major transparency failure with direct, negative consequences for the overall credibility of the state's reported fiscal indicators.

The state's cash management practices also reveal deep liquidity stress. Strengthening public financial management requires tighter treasury management to drastically reduce the state's heavy reliance on the Reserve Bank of India's short-term borrowing windows. Specifically, Kerala was forced to draw on the Ways and Means Advances (WMA) and Overdraft facilities for a staggering 125 days in 2024. This cash flow crisis worsened significantly the following year, with the state relying on these emergency facilities for 262 days in 2025. Implementing more accurate revised estimates, ensuring the consolidated disclosure of all off-budget liabilities, and resolving this acute treasury mismanagement are therefore absolute preconditions for, rather than mere by-products of, successful fiscal consolidation.

2.9 Centre, State Fiscal Relations: Trends and Themes

The overarching fiscal relationship between Kerala and the central government has been reshaped by three converging macroeconomic trends. The first trend is the tapering of revenue deficit grants as the Fifteenth Finance Commission's transition window definitively closes. The second trend is the permanent end of the GST compensation guarantee, removing a vital safety net for state revenues. The third trend is a broader, evolving national debate regarding the fundamental nature of federal transfers. There is a growing consensus that Finance Commission transfers should shift further towards conditional, reform-linked allocations rather than relying solely on formula-based protected revenues.

For a state currently burdened with Kerala's specific level of committed expenditure and its massive off-budget liability stock, this paradigm shift in federal funding raises the stakes immensely. It heightens the urgency for domestic revenue mobilisation and aggressive expenditure rationalisation, themes discussed extensively throughout this chapter. Ultimately, this challenging federal environment frames the absolute urgency of the state's upcoming fiscal reform targets. Achieving its own tax revenue expansion to 8 per cent of GSDP, charting a definitive path to a zero revenue deficit, and instituting a legally binding capital expenditure floor are no longer optional policy choices but survival imperatives. These targets are developed further in Chapter 4 and form the absolute core of the Vision 2047 financing strategy outlined in Chapter 21.

Chapter 3: Economic Structure, Growth and Sectoral Performance

3.1 Gross State Domestic Product: Trends, Growth Rate and Sectoral Share

Kerala's economy registered real GSDP growth of 6.19 per cent in 2024–25, with GSDP in real terms rising to approximately ₹6,85,283 crore from ₹6,45,310 crore in 2023–24, while Gross State Value Added (GSVA) at constant prices grew by 6.59 per cent, an improvement over the 6.34 per cent recorded the previous year (Kerala State Planning Board [KSPB], 2026, as cited in Tribune India, 2026). At current prices, GSDP growth was considerably stronger, at 9.97 per cent in 2024–25 compared with 9.3 per cent in 2023–24 (KSPB, 2026), a gap between nominal and real growth that reflects the continuing influence of price inflation on the state's headline economic numbers. In rupee terms, Kerala's gross state product stood at roughly ₹13.11 lakh crore in 2024–25, making it the eleventh-largest state economy in India by absolute size (Wikipedia, 2026). This growth trajectory follows a period of considerable volatility: GSDP at constant prices grew 6.6 per cent in 2022–23 over 2021–22, a year whose growth rate was itself elevated by the base effect of pandemic-era contraction and subsequent recovery (KSPB, 2024). The sustained recovery into 2023–24 and 2024–25, growth rates that are broadly comparable to, and in 2024–25 somewhat above, the all-India average, suggests the state's economy has moved past the pandemic disruption, though the structural composition of that growth — heavily weighted towards services, as detailed in section 3.5 — remains the central analytical concern of this chapter.

Kerala's sectoral composition continues to be dominated overwhelmingly by the tertiary sector. Services accounted for 63.45 per cent of GSVA at constant prices in 2024–25 (quick estimates), the secondary sector for 28.49 per cent, and the primary sector for the remaining 8.06 per cent (KSPB, 2026, as cited in Tribune India, 2026). This composition has been broadly stable over time — in 2019–20 the tertiary sector's share stood at around 63 per cent, the secondary sector at 28 per cent, and the primary sector at 8 per cent (Wikipedia, 2026) — indicating that, notwithstanding multiple policy initiatives aimed at industrial diversification (examined in Chapter 4), the basic structure of the Kerala economy has not shifted meaningfully over the past five years. By national comparison, this concentration in services is unusually pronounced: official estimates for 2021–22 placed Kerala's services share of GSVA at 64.2 per cent against an all-state average of 51 per cent, while Kerala's industry-sector share of GSDP, at roughly 24.9 per cent, trails the all-state norm (NITI Aayog, 2025).

Viewed over a longer horizon, Kerala's position within the national economy has itself shifted in a way that complicates any simple growth narrative. The state's share of India's nominal GDP declined steadily after 1995–96 before returning, by 2022, to roughly the same 4 per cent level it held in 1990–91 (NITI Aayog, 2025) — meaning that, in relative terms, Kerala's economy has neither gained nor lost substantial ground against the rest of India over more than three decades, even though its per capita income relative to the national average has risen consistently across the same period (NITI Aayog, 2025). This combination — a stable

or modestly recovering share of national output alongside a rising relative per capita position — is explained largely by Kerala's comparatively slow population growth, documented in Chapter 1: with a smaller share of India's population growth, even moderate output growth translates into above-average per capita gains. At current prices, more recent industry estimates place Kerala's total GSDP at approximately ₹14.3 lakh crore for FY2025–26, implying a compound annual growth rate of about 8.84 per cent in nominal terms between FY2015–16 and FY2025–26 (India Brand Equity Foundation [IBEF], 2025) — a decade-long growth rate that, while respectable, sits below the nominal growth rates achieved by several faster-growing Indian states over the same period, reinforcing the broader theme of this report that Kerala's growth, though stable, has not been transformative.

3.2 Per Capita Income and Purchasing Power Analysis

Kerala's per capita GSDP at constant prices rose to ₹1,90,149 in 2024–25 from ₹1,79,953 the previous year, a growth rate of 5.67 per cent, placing the state among the top ten in India on this measure (KSPB, 2026, as cited in Tribune India, 2026). In current-price terms, per capita GSP for 2024–25 stood at approximately ₹3,72,783, the sixth-highest among Indian states (Wikipedia, 2026), and substantially above the national average — in 2022–23, Kerala's per capita GSDP of ₹1,74,214 compared with a national average of ₹1,15,746, a gap of roughly fifty per cent (KSPB, 2024). This combination of high per capita income alongside the structural weaknesses in own-tax revenue mobilisation discussed in Chapter 2 illustrates that Kerala's income levels have not translated proportionately into fiscal capacity, a divergence attributable in part to the composition of household income: a substantial share of Kerala's per capita income reflects remittance inflows rather than domestic wage or enterprise income generated within the state's productive base, a theme that recurs throughout this chapter and is examined further in Chapter 20's treatment of migration.

Kerala, which accounts for only about 2.8 per cent of India's population and 1.2 per cent of its land area, nonetheless contributes more than 4 per cent of national GDP, and its per capita income runs roughly 60 per cent above the national average (Wikipedia, 2026) — a gap that is substantially, though not entirely, attributable to remittance income rather than domestically generated wages. Approximately three million Keralites work abroad, predominantly in the Gulf states, and the resulting remittance flows have historically constituted a remarkable share of state income: in 2012, Kerala was the largest single recipient of remittances among Indian states, receiving roughly ₹49,965 crore, equivalent to 31.2 per cent of the state's GDP that year (Wikipedia, 2026). By 2017, annual remittances were estimated at around ₹900 billion, representing about 35 per cent of the state's total income (Wikipedia, 2026), and more recent estimates suggest Kerala received upward of \$20 billion in remittances in 2022 alone, with NRI inflows contributing more than 35 per cent of state GDP (Zonkerala, 2025).

This scale of remittance dependence means that a meaningful share of the per capita income figures discussed above reflects transfer income generated by labour markets in the Gulf

Cooperation Council states rather than value added within Kerala's own borders — a distinction with direct implications for how "purchasing power" should be interpreted, since remittance income is concentrated in migrant-sending households (most prominently in Malappuram, which has the highest proportion of emigrant households in the state, and in Pathanamthitta and Thrissur, where on average each household has at least one non-resident member) rather than spread evenly across the population (Wikipedia, 2026). This uneven distribution means that state-level per capita averages, however favourable in inter-state comparison, mask considerable variation in actual household purchasing power between high-migration and low-migration districts — a granularity that aggregate GSDP and per capita income statistics cannot by themselves capture, and one that argues for the district-level disaggregation referenced in Chapter 1's discussion of intra-state disparities to be applied as routinely to economic indicators as it already is to social-development indicators.

Purchasing power within the state is also shaped by inflation dynamics that have, at various points, run ahead of the national average, a pattern explored in section 3.8. The net effect is that while nominal and real per capita income figures place Kerala favourably in inter-state rankings, the lived purchasing power of households — particularly those dependent on wage income rather than remittances or rental and property income — is more constrained than the headline figures suggest, especially in a high-cost-of-living, import-dependent consumption economy.

3.3 Primary Sector: Agriculture, Horticulture, Animal Husbandry and Fisheries

The primary sector recorded a strong rebound in 2024–25, growing by 2.36 per cent in real terms compared with just 0.24 per cent in 2023–24 (KSPB, 2026, as cited in Tribune India, 2026). Within this, agriculture and allied activities grew 2.14 per cent, up from 1.25 per cent the previous year, while fishing and aquaculture staged a particularly sharp recovery, expanding 10.55 per cent in 2024–25 after contracting by 3.58 per cent in 2023–24 (KSPB, 2026). The primary sector as a whole contributed about 8.06 per cent of total GSVA in real terms in 2024–25, with agriculture and allied activities alone accounting for 7.64 percentage points of that share (KSPB, 2026) — a far smaller contribution than in most other major Indian states, and one that has been declining steadily for decades; agriculture's share of Kerala's GSDP, at around 7 per cent in recent assessments, is among the lowest of any major agricultural economy in India (Wikipedia, 2026).

Kerala's land-use pattern reflects a plantation-crop-dominated agriculture rather than a foodgrain-dominated one. Of the state's total geographical area of 38.86 lakh hectares in 2024–25, cropped area accounted for 25.15 lakh hectares (64.71 per cent) and forest area for 10.82 lakh hectares (27.8 per cent); within the cropped area, coconut occupies the largest share at 30.44 per cent, followed by rubber at 21.78 per cent and other plantation crops at 28.22 per cent (KSPB, 2026, as cited in Tribune India, 2026; Lokmat Times, 2026). This composition means Kerala's agricultural economy is structurally exposed to global

commodity-price cycles for rubber, coconut, pepper and spices rather than to domestic foodgrain demand, and that the state's food security depends heavily on inflows from neighbouring states for cereals — a vulnerability addressed further in Chapter 18. Kerala nonetheless retains globally significant positions in specific crops: the state produces roughly ninety-seven per cent of India's pepper output and accounts for about eighty-five per cent of the area under natural rubber cultivation nationally (Wikipedia, 2026). Animal husbandry and dairy, while smaller in aggregate value, provide an important livelihood buffer for smallholder households, and the fisheries sub-sector's strong 2024–25 rebound — concentrated in marine and inland aquaculture — has direct implications for the seafood-export ambitions discussed in Chapter 4.

3.4 Secondary Sector: Industry, Manufacturing and Mining

The secondary sector grew 7.87 per cent in real terms in 2024–25, moderating slightly from 9.74 per cent in 2023–24, but still outpacing overall GSDP growth and contributing 28.49 per cent of GSVA at constant prices (KSPB, 2026, as cited in Tribune India, 2026). Within the secondary sector, construction expanded by 8.12 per cent and manufacturing by 7.42 per cent in real terms in 2024–25, with construction and manufacturing accounting for 14.05 per cent and 13.08 per cent of real GSVA respectively (KSPB, 2026) — meaning construction, rather than manufacturing, is now the larger of the two principal secondary-sector activities, a composition that reflects Kerala's continuing residential and infrastructure construction boom (linked partly to remittance-financed housing investment) more than it reflects a deepening industrial base.

Mining and quarrying remain a marginal component of the Kerala economy, contributing roughly 0.3 per cent of GSDP through extraction of minerals such as ilmenite, kaolin, bauxite, silica, quartz, rutile, zircon and sillimanite (Wikipedia, 2026), reflecting both the state's limited mineral endowment relative to mineral-rich states and the ecological sensitivities — discussed in Chapter 13 — that constrain large-scale mineral extraction in Kerala's densely populated, ecologically fragile terrain. The state's broader manufacturing base remains historically rooted in traditional, labour-intensive industries: coir, handloom and handicraft manufacturing together employ roughly one million workers, and Kerala supplies about sixty per cent of the world's white coir fibre output, with the sector's institutional anchor, the Central Coir Research Institute, established in Alleppey in 1959 building on a coir factory tradition dating to 1859–60 (Wikipedia, 2026). The state's wider industrial base, comprising more than 1.46 million micro, small and medium enterprises employing over three million people as of the most recent SIDBI census cited in available estimates, alongside more than 650 medium and large manufacturing firms promoted by the Kerala State Industrial Development Corporation employing roughly 72,500 people (Wikipedia, 2026), illustrates an industrial structure that remains heavily weighted towards micro and small enterprises rather than large-scale, capital-intensive manufacturing — a structural feature explored further in the MSME policy discussion of Chapter 4.

Kerala's principal industrial concentration remains the Aluva belt, the state's largest industrial agglomeration, home to more than 247 industrial units including long-established public-sector anchors such as Fertilisers and Chemicals Travancore (FACT), Travancore Cochin Chemicals, Indian Rare Earths Limited, and Hindustan Insecticides Limited, together producing a range of chemical and petrochemical products (Wikipedia, 2026) — a legacy industrial base whose continued performance and reform prospects are addressed in Chapter 4's discussion of public sector undertakings. Energy availability for this industrial base has expanded materially in recent years: as of September 2025, Kerala's total installed power generation capacity stood at 7,760 MW, with thermal power contributing the largest share at 3,109.55 MW, followed by renewable energy at 2,324.34 MW, hydropower at 1,964.15 MW, and nuclear-sourced supply at 362 MW; of this capacity, state utilities accounted for 2,342.01 MW, central utilities for 2,621.09 MW, and the private sector for 2,796.94 MW (IBEF, 2025) — figures examined in fuller detail in Chapter 9's treatment of power generation and the renewable transition.

3.5 Tertiary Sector: Trade, Finance, Real Estate and Services

The tertiary sector is, without qualification, the dominant force in the Kerala economy, accounting for 63.45 per cent of GSVA in 2024–25 and registering positive growth across nearly every major sub-sector — information technology, tourism, hotels and restaurants, communication, trade, and transport — with the singular exception of road transport, which did not share in this broad-based expansion (KSPB, 2026, as cited in Tribune India, 2026; Lokmat Times, 2026). Information technology stands out as a particular growth driver: the state's network of Technoparks, Infoparks, Cyber Parks and Technocities has expanded considerably, and with the commissioning of its Phase III expansion, Technopark in Thiruvananthapuram has become one of the largest IT parks in India, spanning 768.63 acres and 12.72 million square feet of built-up space (KSPB, 2026). The state's technology start-up ecosystem has also scaled rapidly: the number of registered tech start-ups rose from 4,681 in 2023–24 to 6,227 in 2024–25 (KSPB, 2026), an expansion examined in greater depth in Chapter 17's treatment of the innovation ecosystem. Digital infrastructure underpinning this growth includes the Kerala Fibre Optic Network (KFON), conceived to make broadband internet a universal entitlement, which had 1.13 lakh active connections as of end-August 2025 (KSPB, 2026).

Within the broader services category, education has historically functioned as the single largest contributor: preliminary estimates for 2022–23 placed the services sector's overall GSVA contribution at 62.62 per cent, with education identified as the backbone activity within that aggregate (Kerala Economic Review 2023, as cited in The Quint, 2024). Finance and real estate, while less precisely disaggregated in the data reviewed here, are understood to be significantly buoyed by remittance inflows that are channelled into property investment and into a comparatively dense banking network — as of the early 2000s, Kerala's banking density stood at roughly one branch per 10,000 people, denser than the national average of one branch per 16,000 or so (Wikipedia, 2026) — a financial-sector depth that has likely

deepened further in the years since. The structural risk inherent in this tertiary-sector dominance is that services growth, however robust, has historically generated proportionately fewer jobs per unit of output than manufacturing employment would, a tension explored directly in section 3.7's discussion of the labour market.

Kerala's external economic engagement, while modest relative to larger industrial states, has grown steadily. Cumulative foreign direct investment inflows into the state stood at roughly ₹13,848 crore (about US\$1.56 billion) between October 2019 and June 2025 (Department for Promotion of Industry and Internal Trade [DPIIT], 2025, as cited in IBEF, 2025), a relatively modest figure that underscores the continuing case, developed in Chapter 4, for a more deliberate FDI promotion strategy targeted at the state's comparative strengths in electronics, IT-enabled services, and value-added agro-processing. Goods exports from Kerala reached approximately ₹42,343 crore (US\$4.77 billion) in FY2024–25, led by engineering goods and marine products (DPIIT, 2025, as cited in IBEF, 2025) — the latter a direct extension of the fisheries rebound documented in section 3.3. Services exports, led by information technology, have grown considerably faster: at the Kerala Urban Conclave held in September 2025, the Chief Minister announced that the state's IT exports were nearing ₹1,00,000 crore (roughly US\$11.27 billion), a figure that, if sustained, would represent a services-export base more than twice the size of the state's entire goods-export sector (IBEF, 2025). This asymmetry — modest goods exports and FDI alongside a rapidly scaling IT services export base — reinforces the chapter's broader finding that Kerala's most dynamic growth corridor is digital and knowledge-services-led rather than manufacturing-led, a pattern returned to in section 3.9 and developed at length in Chapter 4's discussion of Thiruvananthapuram and Kochi as prospective major IT hubs.

3.6 Informal Economy: Size, Significance and Integration Challenges

Kerala's informal economy occupies an unusually prominent place in the state's labour market, not because formal-sector job creation has been entirely absent, but because the available pool of registered job-seekers — over 24.5 lakh individuals on the Kerala Employment Exchange Live Register as of a recent count, out of a state population of roughly 3.4 crore — sits uneasily alongside the absence of visible unemployment distress on the ground, a paradox attributed in part to the scale of informal, self-employed, and gig-style economic activity absorbing labour outside the formal registration system (The Quint, 2024). The employment exchange register itself includes more than five lakh registered graduates, nearly 1.2 lakh postgraduates, around 37,000 engineers, and roughly 2,000 doctors awaiting government job placement (The Quint, 2024), illustrating that a meaningful share of Kerala's "unemployed" population is in practice underemployed in informal or below-qualification work rather than wholly outside the labour market.

Traditional sectors such as coir, handloom, and small-scale fisheries operate substantially within informal or semi-formal structures, providing livelihoods to roughly a million workers in coir alone (Wikipedia, 2026) without the social-security coverage, contractual protections,

or productivity-enhancing capital investment associated with formal-sector employment. Integrating this informal base into a more productive, formally registered economy — through expanded social security coverage, access to formal credit, and digital payment and registration systems — is a recurring theme that connects this chapter to the livelihood-promotion architecture discussed in Chapter 12 and the social security framework discussed in Chapter 7.

One distinctive institutional response to the scale of informality in Kerala's labour market is the Kudumbashree network, the state's community-based poverty-eradication and women's self-help-group programme, which has evolved into one of the largest semi-formal livelihood platforms in the state. Through enterprises such as community kitchens, Kudumbashree-run hotels collectively sell roughly two lakh meals a day, generating better income and employment for over five thousand women operators, while allied initiatives such as SHE Starts, Theerasree (focused on coastal and fisheries livelihoods), and Kerala Chicken extend similar formalisation support across other informal trades (KSPB, 2024). These structures illustrate a model in which informality is not simply tolerated as a residual labour-market category but is actively organised, federated, and linked to credit and marketing support — an approach that offers a partial template for the wider informal-economy integration challenge this section identifies, though one whose scale, concentrated as it is among women's self-help groups, has not yet been extended with comparable intensity to male-dominated informal sectors such as construction labour, small-scale fisheries, or unorganised retail and transport, where informality remains largely unaddressed by equivalent institutional mechanisms.

3.7 Labour Market: Employment, Unemployment and Workforce Quality

Kerala's labour market presents one of the starker paradoxes in Indian state-level economic data: a state with near-universal literacy and one of the highest rates of educational attainment in the country simultaneously records some of the highest youth unemployment rates in India. The Periodic Labour Force Survey (PLFS) for 2023–24 recorded a youth (15–29) unemployment rate of 27.7 per cent in Kerala, behind only Jammu and Kashmir (29.7 per cent) and Odisha (28 per cent), against a national average of 16.8 per cent (PLFS 2023–24, as cited in *The Quint*, 2024). More recent PLFS data placed Kerala's youth unemployment rate at 29.9 per cent, with an especially severe gender disparity: 47.1 per cent among young women against 19.3 per cent among young men (PLFS, 2025, as cited in *StudyIQ*, 2025). Analysts examining this pattern note a broader cross-state correlation in which higher urbanisation and higher graduate shares of the labour force are both positively associated with higher unemployment rates — a relationship visible in the contrast between highly urbanised, highly educated states like Kerala and Goa, which show elevated unemployment, and states such as Uttar Pradesh, Jharkhand and Madhya Pradesh, with lower urbanisation, lower educational attainment, and correspondingly lower measured unemployment (*StudyIQ*, 2025).

Beyond headline unemployment, Kerala faces a significant NEET (Not in Education, Employment, or Training) challenge among youth, with the rate estimated at roughly 26 per cent despite a literacy rate for the 7-plus age group of 95.3 per cent — well above the national rate of 80.9 per cent — and despite a Gross Enrolment Ratio in higher education of 41.3 per cent for the 18–23 age cohort, against a national average of 28.4 per cent (Ministry of Education, 2021–22, as cited in Ideas for India, 2025). Among unemployed young women specifically, research indicates that roughly 31.1 per cent report they are not working because they are actively preparing for competitive examinations or other selection processes, rather than having withdrawn from the labour market altogether (Ideas for India, 2025).

Observers attribute part of Kerala's unemployment puzzle to a preference among the educated population for white-collar, particularly government, employment, alongside a documented reluctance to take up semi-skilled or low-skilled work perceived as lacking dignity, compounded by the comparative scarcity of large-scale manufacturing and industrial employment opportunities within the state (The Quint, 2024). Addressing this combination of high unemployment, high NEET incidence, and severe gender disparity requires, at minimum, institutionalised career counselling, employer incentives for structured apprenticeships, and — specifically for women — flexible work arrangements and improved care infrastructure to support post-marriage labour force re-entry (Ideas for India, 2025); absent such intervention, the report's authors caution that Kerala's favourable working-age demographic structure risks becoming a liability rather than a dividend, a concern this report revisits in Chapter 20's treatment of the demographic dividend.

A further distinctive feature of Kerala's labour market is the scale and composition of outward skilled migration as an explicit alternative to domestic employment. Women migrants from Kerala, in particular, are disproportionately trained in nursing, and have increasingly diversified their destinations beyond the Gulf states even as male migration has remained overwhelmingly West Asia-oriented; this diversification has provided a measure of cushioning against both the gradual tightening of nationalisation policies in Gulf labour markets and more restrictive immigration regimes in Western destination countries over the 2010s, helping to sustain remittance inflows even as some traditional migration channels narrowed (Wikipedia, 2026).

Female migrants from Kerala also tend to secure more permanent forms of overseas employment than their male counterparts, and are predominantly drawn from central Kerala districts rather than the Malabar-region households that dominate male Gulf migration (Wikipedia, 2026). This pattern means that a portion of what shows up in the labour-market statistics discussed above as "non-participation" or withdrawal from the domestic labour force, particularly among educated women, in fact reflects active preparation for or pursuit of skilled migration pathways — most visibly nursing — rather than disengagement from economic activity altogether. The policy implication, addressed further in Chapter 4's NRI technology-return and talent-repatriation proposal and in Chapter 20's migration framework, is that Kerala's labour-market strategy cannot be designed solely around domestic job

creation; it must also account for, and where possible better organise and protect, the large share of the state's skilled workforce whose economic activity occurs outside the state's own labour market entirely.

3.8 Inflation, Price Stability and Consumer Welfare

Price stability in Kerala has periodically diverged from the national trend, reflecting the state's high dependence on imported goods — both from other Indian states and internationally — for items ranging from foodgrains to consumer durables, a structural feature of an economy with a comparatively narrow domestic production base relative to its consumption demand (a tension already noted in section 3.3's discussion of foodgrain dependence). While granular, recent state-specific inflation data were not comprehensively available in the sources consulted for this report, the broader pattern documented in Kerala's economic reviews is one in which retail price inflation, particularly for food articles, has at points exceeded the all-India average, squeezing real consumption for wage-dependent households even as aggregate per capita income figures remain favourable. This dynamic compounds the purchasing-power concern raised in section 3.2: a household whose income is nominally above the national average may nonetheless face a materially higher cost of living, particularly in urban and semi-urban Kerala, where land and construction costs — driven up by the remittance-financed property demand noted in section 3.4 — have risen sharply relative to wage growth.

The remittance-financed consumption boom documented throughout this chapter has itself been identified as a contributor to this price pressure: the steady inflow of NRI income has fuelled demand for retail goods, electronics, and consumer durables, supporting the growth of organised retail chains, shopping malls and e-commerce platforms across the state, even as it has pushed up the price of land, housing, and locally produced goods and services that compete for the same household budgets (Zonkerala, 2025).

A study commissioned by the Kerala State Planning Board has explicitly cautioned that the state should diversify its revenue base away from this remittance dependence rather than continuing to rely on it to finance expenditure (Wikipedia, 2026), a finding directly relevant to the fiscal architecture discussed in Chapter 2 and the inherent vulnerability flagged repeatedly in this chapter: Kerala's heavy reliance on remittance income leaves household consumption, and indirectly state revenue, exposed to global oil-price cycles, shifts in Gulf labour-market and naturalisation policy, and economic downturns in host economies (Zonkerala, 2025; Kerala PCS Exam Notes, 2024). The Non-Resident Keralites Affairs department (NORKA) has accordingly developed reintegration and productive-investment channelling programmes aimed at converting remittance inflows into longer-term productive assets — including encouraging NRI investment in state infrastructure and start-ups — rather than channelling them solely into consumption and property purchase, an institutional response that connects directly to the diaspora development bond proposal addressed in Chapter 2 and Chapter 4 (Kerala PCS Exam Notes, 2024).

3.9 Growth Corridors: Engines of Economic Expansion

Looking across the sectoral evidence assembled in this chapter, three corridors emerge as the most plausible engines of future growth. The first is the information technology and digital services corridor anchored around Thiruvananthapuram and Kochi, where Technopark's scale expansion and the rapid growth of the start-up ecosystem (from 4,681 to 6,227 registered start-ups in a single year) point to continuing momentum, a theme developed fully in Chapter 4's discussion of IT hub status. The second is the construction-and-real-estate-led secondary sector growth concentrated in urban and peri-urban corridors, which, while currently the larger contributor to secondary-sector output relative to manufacturing, could be redirected — through the industrial-parks and manufacturing-diversification strategies discussed in Chapter 4 — towards higher value-added production rather than remaining principally a function of housing investment. The third is the blue economy corridor spanning the state's fisheries rebound, port infrastructure development, and seafood export ambitions, which links the primary-sector recovery documented in section 3.3 to the port and logistics development discussed in Chapter 8. None of these corridors, on current evidence, is yet large enough in employment-generation terms to resolve the youth unemployment and NEET challenges documented in section 3.7; closing that gap requires the more deliberate industrial and investment policy interventions set out in Chapter 4.

A fourth, less conventional corridor deserves note: Kerala's role as the single largest originator of education loans in India, with cumulative disbursements of roughly ₹60 billion (Wikipedia, 2026), reflects the state's distinctive household strategy of financing human-capital investment — frequently for overseas study — as a pathway to future remittance income or skilled emigration, rather than purely for domestic employment. This pattern is consistent with the broader picture assembled across this chapter: a population that is exceptionally well-educated relative to other Indian states, a domestic labour market that has so far been unable to absorb that education at commensurate wages or in commensurate volume, and a household-level adaptation — emigration financed partly by education loans, and partly by inherited family remittance networks — that sustains consumption and income at the household level even as it does relatively little to deepen Kerala's own productive base. Reconciling this pattern with the demographic dividend Kerala still nominally possesses, before its population ages further (as flagged in Chapter 1), is the central economic policy challenge that connects this chapter's sectoral diagnosis to the investment and industrial strategy set out in Chapter 4, the skills and employability agenda of Chapter 17, and the migration and demographic dividend discussion of Chapter 20.

Taken together, the picture that emerges from this chapter is one of a state economy that is growing steadily, increasingly digitally and services-oriented, modestly export-competitive in goods through engineering and marine products, rapidly competitive in IT services exports, agriculturally narrow but globally significant in specific plantation crops, industrially shallow relative to its human capital base, and structurally dependent on external remittance income to sustain both household consumption and, indirectly, certain dimensions of state revenue.

Each of these features recurs as a reference point through the remainder of this report — in the investment climate assessment of Chapter 4, the infrastructure chapters that follow, and ultimately in the Vision 2047 roadmap of Chapter 21, which must reconcile Kerala's social-development strengths with the economic restructuring this chapter shows to be still substantially incomplete.

Chapter 4: Investment, Industry and Private Sector Development

4.1 Investment Climate Assessment and Ease of Doing Business

Kerala's official position on ease-of-doing-business reforms has improved markedly over the past decade, and the state government has actively publicised this improvement as the centrepiece of its investment-promotion narrative. Officials state that Kerala has implemented 340 of 352 prescribed Business Reform Action Plan reforms and now ranks first among Indian states on this metric (Government of Kerala, 2025, as cited in MD Niche, 2026), a claim that has nonetheless attracted some public contestation: at the Invest Kerala Global Summit 2025, the state's industries minister reiterated the first-rank claim while the visiting Union Commerce Minister was reported to have publicly questioned it, illustrating that ease-of-doing-business rankings remain a politically contested metric rather than a single agreed fact (The South First, 2025).

What is less disputed is the institutional infrastructure underpinning the claim: the Kerala Single Window Interface for Fast and Transparent Clearance (K-SWIFT) has eliminated the need for entrepreneurs to visit multiple government offices to register and license a new enterprise, consolidating approvals into a unified digital system (MD Niche, 2026). Kerala's State Planning Board's own Economic Review for 2023 separately recorded an improved Ease of Doing Business rank of 15th nationally for that year, up from 28th the year before (KSPB, 2024) — a more modest, internally reported figure that sits alongside, and somewhat in tension with, the first-rank claims made in subsequent investment-promotion materials, underscoring that methodology and reporting period both matter considerably to how the state's investment climate is externally perceived. Either way, the trend direction — sustained improvement over multiple years — is consistent across sources, even where the absolute rank claimed varies.

4.2 Industrial Policy Framework and MSME Development

Kerala's industrial policy in recent years has centred on the "Year of Enterprises" campaigns, the state's signature MSME-promotion initiative. The first edition, launched in 2022–23 under the motto "My enterprise, Nation's pride," resulted in 1.39 lakh new enterprises, investments of roughly ₹8,421.6 crore, and employment for about three lakh people in a single year (KSPB, 2026, as cited in Tribune India, 2026). A subsequent, more ambitious phase of the campaign, run through to February 2025, is reported to have catalysed 3,45,000 new enterprises, an investment of ₹22,135 crore, and 7,31,652 jobs, with women entrepreneurs heading more than one lakh of these ventures (MD Niche, 2026) — a scale of enterprise creation that, if sustained, represents a substantial multiple of the roughly 10,000 enterprises that were typically registered annually in Kerala prior to the scheme.

The initiative has attracted external recognition: it was identified as a Novel Innovation in Public Administration by the American Society for Public Administration in its

eighty-seven-year history, and was separately recognised as the best practice nationally in the MSME sector at a meeting attended by the Prime Minister, with the scheme subsequently adopted as a case study in the IAS training curriculum at the Lal Bahadur Shastri National Academy of Administration in Mussoorie (MD Niche, 2026).

Complementing this enterprise-creation drive, the government has launched "Mission 1000," a programme explicitly targeting the elevation of 1,000 MSMEs into ₹100-crore-turnover businesses within a defined timeframe, reflecting a deliberate policy shift from simple enterprise-count metrics towards scaling existing small enterprises into mid-sized firms (FICCI, 2024). Kerala's MSME ecosystem also extends substantial soft infrastructure: degree- and skill-granting institutions such as the Digital University of Kerala — India's first dedicated digital university — the Kerala Blockchain Academy, the Information and Communication Technology Academy of Kerala, and the International Centre for Free and Open Source Software collectively aim to deepen the talent pipeline available to MSMEs and larger enterprises alike (Avasant, 2026).

Two specific value-chain opportunities recur across the state's MSME and export-promotion literature and connect directly to the agricultural and fisheries base documented in Chapter 3. Kerala accounts for roughly ninety per cent of India's natural rubber production, yet most of this output continues to be exported or sold domestically as raw or lightly processed latex rather than as higher-value finished rubber products; rising global demand for rubber components in electric vehicles and medical devices is identified in current market analysis as a substantial unrealised opportunity for value-added rubber manufacturing within the state, where finished products can command margins in the range of twenty-five to forty per cent compared with the minimal margins captured at the raw-material stage (TheLisTree, 2026). A closely analogous opportunity exists in seafood: with a coastline of approximately 580 kilometres and a contribution of roughly ten per cent of India's total fish production, Kerala's seafood sector has scope to capture substantially higher margins — in the order of twenty to thirty-five per cent — through processing, filleting, and value-added frozen product manufacturing for export, supported by Marine Products Export Development Authority (MPEDA) registration, rather than exporting predominantly unprocessed catch (RegisterKaro, 2026; TheLisTree, 2026).

Coconut presents a third such opportunity: Kerala produces approximately forty-five per cent of India's total coconut output, and value-added derivatives — virgin coconut oil, coconut water, and coir-based products — are identified as strong and growing categories in both domestic and export markets (RegisterKaro, 2026; TheLisTree, 2026). Each of these three value chains illustrates the same underlying structural pattern documented throughout this chapter and in Chapter 3: Kerala possesses genuine primary-sector comparative advantage in rubber, marine products, and coconut, but has historically captured a disproportionately small share of the value addition available further up each respective value chain, leaving that margin to be captured by processors and brand owners located elsewhere — precisely the gap

that the rubber value-chain transformation and seafood processing export hub proposals in the original transformation agenda are designed to close.

Kerala's startup ecosystem, coordinated through the Kerala Startup Mission (KSUM), has scaled considerably over the past decade: as of 2025, KSUM has supported more than 6,500 startups and facilitated upward of ₹6,000 crore (roughly \$665 million) in funding, with more than 8,000 registered startups, over ten lakh square feet of incubation space, more than sixty incubators, and over 550 mini incubation centres distributed across the state (Kerala Startup Mission, 2026; Ecosystem Startup Genome, 2026). Kerala's startup ecosystem value is reported to have surged 147 per cent in 2025 alone, with the broader ecosystem growing at roughly twenty per cent annually and now encompassing more than 3,500 active ventures (Ecosystem Startup Genome, 2026).

The state has paired this funding and incubation infrastructure with a sector-prioritisation strategy: an industrial policy announced at the 2024 Generative AI Conclave in Kochi identifies twenty-two priority sectors spanning artificial intelligence, blockchain, machine learning, big data, robotics, tourism and logistics, and a dedicated state AI policy unveiled in 2024 offers KSIDC investment support of up to ₹50 million for AI startups that themselves invest ₹100 million or more, alongside infrastructure development in graphics-processing capacity and Global Capability Centres (GCCs) (Ecosystem Startup Genome, 2026). Kochi and Thiruvananthapuram have both emerged as competitive destinations for GCC expansion — offshore units of multinational corporations handling technology, finance, analytics and HR functions for their parent companies — with Kochi positioned as a lower-cost alternative to Bengaluru, Hyderabad and Chennai, supported by Technopark's Phase IV expansion being purpose-built with GCC-ready infrastructure (TheLisTree, 2026; Ecosystem Startup Genome, 2026); Kerala's Chief Minister announced GCC promotion as a flagship investment agenda at Davos in 2026, targeting roughly \$14 billion in associated investment (TheLisTree, 2026).

4.3 Large and Anchor Industries: Sectoral Analysis

Kerala's anchor industrial base remains concentrated in legacy public-sector chemical and engineering units centred on the Aluva industrial belt, discussed in Chapter 3, including Fertilisers and Chemicals Travancore, Travancore Cochin Chemicals, Indian Rare Earths Limited, and Hindustan Insecticides Limited (Wikipedia, 2026). Beyond this legacy base, the state's industrial strategy has pivoted decisively towards knowledge-intensive and frontier sectors. At the World Economic Forum in Davos, Kerala's industries minister set out an explicit ambition for the state to become a global hub for high-tech manufacturing within ten to fifteen years, with a specific focus on knowledge-based industries, pharmaceuticals, and shipping, leveraging the state's coastal geography and skilled workforce (TaxTMI, 2025). The state has separately established dedicated technology, space and defence parks as part of a deliberate diversification into artificial intelligence, defence, and aerospace manufacturing, sectors in which Kerala's industries minister has reported rising interest from prospective foreign investors (FICCI, 2024). This pivot towards frontier manufacturing sits in evident

tension with the still-shallow industrial base documented in Chapter 3 — where construction, rather than manufacturing, remains the larger contributor to secondary-sector output — suggesting that the anchor-industry strategy described here is, at this stage, substantially aspirational and reliant on the investment pipeline discussed in section 4.5 actually converting into operational capacity.

4.4 Special Economic Zones, Industrial Corridors and Clusters

Kerala has developed several dedicated industrial corridors and parks under the Kerala Industrial Infrastructure Development Corporation (KINFRA), with parks operating in Ernakulam, Thrissur, Palakkad and Kannur catering to sectors including textiles, defence and petroleum (Avasant, 2026). The most strategically significant corridor initiative is the Kochi–Bengaluru Industrial Corridor, which includes Integrated Manufacturing Clusters spanning 1,710 acres in Palakkad and 358 acres in Ayyampuzha; this corridor is projected to generate more than 55,000 jobs and to attract investment in food processing, textiles, electronics and logistics (Avasant, 2026).

These corridor investments are underpinned by improving physical connectivity: Kerala's industrial infrastructure is supported by four operational international airports, with a fifth planned for Kottayam, alongside 2,106 kilometres of railway track and eleven national highways covering 1,200 kilometres (Avasant, 2026) — a connectivity base examined in fuller technical detail in Chapter 8. The "plug and play" industrial-park model envisaged in the original transformation agenda — pre-cleared, infrastructure-ready industrial plots that minimise the time between investment decision and production start — is consistent with, and in practice an intensification of, the KINFRA and Kochi–Bengaluru corridor models already under development, rather than a wholly new instrument; the open question, examined further in section 4.7, is whether existing corridor infrastructure can be scaled and replicated quickly enough to absorb the scale of investment interest the state is now actively soliciting.

4.5 Foreign Direct Investment: Inflows, Sectoral Distribution and Policy

As documented in Chapter 3, cumulative FDI inflows into Kerala totalled approximately ₹13,848 crore between October 2019 and June 2025 (DPIIT, 2025, as cited in IBEF, 2025) — a figure that, set against the scale of national FDI competition, places Kerala well behind the leading recipient states: in FY2023, Maharashtra alone attracted \$14.80 billion in investment, with Karnataka, Gujarat, Tamil Nadu, Haryana and Telangana also drawing substantially larger inflows than Kerala (Avasant, 2026). National policy instruments such as the Production Linked Incentive scheme and the National Single Window System have strengthened the broader Indian investment climate, particularly in computer software, hardware, services and pharmaceuticals (Avasant, 2026), and Kerala's task, in competing for a larger share of this national FDI pool, is complicated by the fact that other states have built equally well-resourced, dedicated investor-facing institutions — Gujarat's Vibrant Gujarat

Summit, Tamil Nadu's Guidance agency, and Maharashtra's Industrial Development Corporation chief among them (Avasant, 2026). Kerala's own response has been the Invest Kerala Global Summit, held on 21–22 February 2025 at the Lulu International Convention Centre in Kochi under the Kerala State Industrial Development Corporation, which drew more than 3,000 delegates from twenty-six countries and was preceded by roughly fifty preparatory roadshows across Chennai, Bengaluru, Mumbai, Delhi and Dubai, alongside the country's first International Gen AI Conclave and Kerala's first International Robotics Round Table Conclave (Wikipedia, 2026; MD Niche, 2026).

The summit yielded substantial announced commitments, most notably Adani Group's pledge of ₹30,000 crore in further investment over five years, concentrated on the Vizhinjam port, Thiruvananthapuram airport expansion, and a new logistics hub, on top of the ₹5,000 crore the group had already invested in Vizhinjam since beginning work there in 2015 (The South First, 2025); a separate Union government commitment of ₹50,000 crore for 31 new road projects covering 896 kilometres, part of a broader nationally announced ₹3,00,000 crore road-investment programme (IBEF, 2025; Wikipedia, 2026); and a cumulative record, over the eight years preceding the summit, of 6,200 startups attracting ₹5,800 crore in investment and generating 62,000 jobs (The South First, 2025). Converting these announced commitments into disbursed, operational investment — historically a challenge for investor summits across Indian states — will be the decisive test of this strategy's success, and is a theme to which section 4.7 returns.

4.6 Public Sector Undertakings: Performance and Reform Agenda

Kerala's public sector undertaking landscape remains large and structurally mixed in performance. As of the early 2000s the state counted around 101 to 104 state-level public enterprises spanning fourteen sectors, the great majority — roughly 85 enterprises — operating under the Department of Industries and Commerce (Wikipedia, 2026). Performance across this portfolio has been persistently uneven: aggregate losses across loss-making units rose from about ₹1,200 crore in 2018–19 to roughly ₹2,500 crore in 2022–23, according to Comptroller and Auditor General findings that specifically flagged inadequate quality controls and inefficient resource allocation, and recommended divestment or closure for non-revivable units (Grokikipedia, 2026, citing CAG analysis).

Specific operational inefficiencies have been well documented in individual enterprises: the Kerala State Electricity Board maintained 1.92 employees per million units of electricity sold as of a 2019 analysis, compared with a national average of 1.12, indicating substantial overstaffing relative to comparable utilities elsewhere in India (Kerala Electricity Employees' Congress, 2019, as cited in Grokikipedia, 2026), while data envelopment analysis of Kerala State Road Transport Corporation depots between 2012 and 2016 found efficiency scores below optimal benchmarks at the depot level, driven by high vehicle downtime, fuel inefficiency, and manpower redundancy exceeding one employee per bus in several units (Grokikipedia, 2026). Accumulated losses at KSRTC alone reached approximately ₹10,000

crore by the time of CPI(M)'s March 2025 state conference, at which the ruling party's "Nava Keralam" policy document proposed, for the first time, infusing private capital into ailing PSUs through equity stakes or public–private partnerships, explicitly departing from the historical position against private sector involvement in state enterprises, while stopping short of central-government-style disinvestment of profitable units (Grokikipedia, 2026).

This proposal generated visible friction within the ruling Left Democratic Front coalition, with the Communist Party of India expressing unease that private-sector entry into PSU operations risked job losses and a departure from the state's traditional labour protections (Grokikipedia, 2026). At the same time, the broader PSU portfolio has shown some genuine improvement: the number of profit-making PSUs rose from eighteen to twenty-four between 2023–24 and 2024–25, with cumulative operational profit reaching ₹134.56 crore, a reversal from an aggregate operational loss of ₹76.16 crore the previous year, even as the government continued to invest roughly ₹20,439 crore across 131 PSUs through 2025 (Grokikipedia, 2026). This combination of selective improvement, persistent large-scale losses in a handful of major enterprises, and a now-live internal political debate over PPP-based restructuring captures precisely the reform agenda — rationalisation rather than blanket privatisation — that the original transformation agenda's public sector enterprise rationalisation strategy is designed to advance.

4.7 Public-Private Partnership Framework and Pipeline

The clearest and most advanced example of public-private partnership in Kerala's current investment landscape is the Vizhinjam International Seaport, developed by the Adani Group in partnership with the state government as India's first dedicated deep-water transshipment terminal, located just ten nautical miles from major international east–west shipping lanes (Avasant, 2026). Since commencing work in 2015, Adani has invested approximately ₹5,000 crore in the port and has committed a further ₹20,000 crore as part of its broader ₹30,000 crore Kerala investment pledge announced at the 2025 summit (The South First, 2025). The port has already handled India's largest container vessel and is explicitly positioned to become the region's leading transshipment hub, capturing cargo that currently transits through ports such as Colombo and Singapore rather than being handled domestically (The South First, 2025).

Beyond Vizhinjam, the PPP pipeline extends to the proposed equity and partnership restructuring of loss-making PSUs discussed in section 4.6, to elements of the Kochi–Bengaluru Industrial Corridor's integrated manufacturing clusters, and to ongoing private investment in renewable energy generation discussed further in Chapter 9. The institutional capacity to manage this expanding PPP pipeline — structuring concession agreements, monitoring performance obligations, and protecting the state's fiscal exposure under guarantee and revenue-sharing arrangements — has not been examined in comparable public detail to the scale of capital now being committed, and represents a governance gap

that the State Vision 2047 roadmap in Chapter 21 will need to address explicitly if the announced investment pipeline is to be converted reliably into delivered infrastructure.

4.8 Regional Cooperation: Shared Region and Growth

Kerala's industrial and investment strategy increasingly depends on cooperation that extends beyond the state's own administrative boundaries. The Kochi–Bengaluru Industrial Corridor is, by design, an inter-state initiative linking Kerala's industrial clusters in Palakkad and Ayyampuzha to the wider Bengaluru-anchored technology and manufacturing ecosystem in neighbouring Karnataka, with the explicit aim of allowing Kerala-based manufacturing and logistics capacity to plug into established supply chains that already run through southern India's most developed technology corridor (Avasant, 2026).

Vizhinjam's transshipment ambitions are similarly regional rather than purely state-specific in character: the port's strategic value rests on capturing cargo currently routed through the broader Indian Ocean and South Asian transshipment network rather than serving Kerala's domestic trade alone, positioning the state as a logistics gateway for southern India and beyond (Avasant, 2026; The South First, 2025). The 2025 investment summit's preparatory roadshows in Dubai, alongside the state's existing deep diaspora and remittance linkages with the Gulf Cooperation Council states documented in Chapter 3, point to a further dimension of regional cooperation: positioning Kerala's NRI investor base in West Asia not merely as a source of household remittances but as a source of direct enterprise and infrastructure capital, an ambition that links this section directly to the diaspora development bond proposal discussed in Chapter 2 and the NRI technology-return and talent-repatriation framework addressed elsewhere in the original transformation agenda.

Taken together, the evidence in this chapter suggests Kerala's investment and industrial strategy has, in recent years, shifted from a primarily inward-looking, MSME-and-PSU-centred approach towards an outward-facing strategy built on flagship infrastructure (Vizhinjam), inter-state corridors (Kochi–Bengaluru), and global investor courtship (the Invest Kerala Global Summit) — a shift whose ultimate success will be measured not by announced investment figures, which the evidence reviewed here shows to be already substantial, but by the pace and completeness of their conversion into operational capacity, employment, and exportable output over the remainder of this decade.

Chapter 5: Education — Access, Quality and Future Readiness

5.1 Elementary Education: Enrolment, Retention, Dropout and Learning Outcomes

Kerala's elementary education system is, by national standards, close to fully universalised. According to the Annual Status of Education Report 2024, Kerala is among a small group of states — alongside Karnataka, Gujarat, Maharashtra and Nagaland — that have achieved near-universal pre-primary coverage for the five-year-old age cohort, building on a national rise in pre-primary enrolment among three-year-olds from 68.1 per cent in 2018 to 77.4 per cent in 2024 (ASER, 2024, as cited in Teachers Institute, 2026). At the school level, Kerala's elementary dropout rate is consistently reported among the lowest in India: estimates place it at around 1 per cent, and in some analyses as low as 0.1 to 0.4 per cent, attributed to the availability of a dense network of colleges, vocationally oriented courses, free schooling provisions, and supportive measures such as free uniforms (IndiaDataMap, 2026). The Ministry of Education's Performance Grading Index for Districts (PGI-D) for 2023–24 confirmed that Kerala recorded the lowest school dropout rate in South India, with multiple districts performing well above the national average across the seventy-four indicators the index evaluates, spanning learning outcomes, teacher availability, digital learning, infrastructure, classroom diversity, and school safety (Deshabhimani, 2026). This consistency across multiple independent reporting frameworks — UDISE+, ASER, and PGI-D — distinguishes Kerala's elementary education performance from states where dropout figures vary considerably depending on data source; in Kerala's case, the underlying picture of near-universal retention through the elementary stage is robust across measurement approaches.

The national context against which Kerala's elementary performance should be read is itself one of recent, measurable improvement: UDISE+ 2024–25 data show the national preparatory-stage dropout rate falling from 3.7 per cent to 2.3 per cent and the middle-stage dropout rate falling from 5.2 per cent to 3.5 per cent in a single year, with foundational-stage retention reaching 98.9 per cent nationally (Education for All in India, 2026). Even against this improving national baseline, however, Kerala's elementary indicators remain distinctly ahead: where national foundational retention stands at 98.9 per cent and preparatory-stage retention at 92.4 per cent, Kerala's own elementary dropout figures of well under 1 per cent imply retention rates that are, in practical terms, close to the theoretical ceiling achievable within any large schooling system, given that some minimal attrition from migration, family relocation, and rare cases of serious illness or disability is effectively unavoidable. India's broader literacy improvement — projected at 77.7 per cent nationally, a dramatic rise from roughly 14 per cent at Independence but still leaving tens of millions of adults outside functional literacy (Teachers Institute, 2026) — throws Kerala's effective literacy rate of 93.91 per cent, recorded in Chapter 1, into sharper relief: Kerala reached a literacy level the rest of India has not yet attained several decades ago, and the state's elementary education statistics discussed in this section are best understood as the schooling-system expression of

that much longer-standing literacy achievement, rather than as a separate or more recent policy success.

This strength is the product of a long institutional history rather than a recent policy innovation. Kerala's tradition of community and religious-institution involvement in schooling, discussed in Chapter 1 in connection with the state's religious plurality, combined with sustained public investment in school infrastructure since the early decades after Independence, built an elementary education base that was already comparatively strong before the more recent national policy frameworks — Samagra Shiksha and the National Education Policy 2020 — came into effect. The practical implication for policy design, returned to in section 5.8, is that further gains at the elementary level are likely to come from depth — improving foundational literacy and numeracy quality within an already near-universal system — rather than from further gains in access, which is the more pressing challenge for less-developed states.

5.2 Secondary and Senior Secondary Education: Transition and Achievement

Kerala's record at the secondary level is similarly strong, though the data reveal a more complex pattern once the analysis moves beyond bare enrolment into transition and retention. At the secondary level (Classes IX–X), Kerala's Gross Enrolment Ratio stood at 98 per cent against a national GER of 79 per cent, placing it well ahead of comparable large states such as Tamil Nadu (91 per cent) and far ahead of states such as Bihar (57 per cent) and Uttar Pradesh (62 per cent) (UDISE+ 2021–22, as cited in Education for All in India, 2025). More recent UDISE+ 2024–25 data, gathered using an improved Student Data Management Information System, show Kerala's secondary-level Adjusted Net Enrolment Ratio at 97.1 per cent and Age-Specific Enrolment Ratio at 98.8 per cent, a performance the analysis attributes specifically to the gender-focused interventions delivered under the Samagra Shiksha programme (Education for All in India, 2026). Kerala's secondary dropout rate of 0.4 per cent stands in sharp contrast to the national secondary dropout rate of 11.5 per cent recorded in 2024–25 (Teachers Institute, 2026) — itself an improvement on the prior year's national figure of 10.9 per cent (Education for All in India, 2025) — and Kerala is explicitly grouped among the states projected to maintain secondary dropout below 3 per cent through 2030, alongside a small cohort of similarly high-performing systems, while states such as Assam are targeted to fall only to around 12 per cent by 2026 under current national reduction strategies (Education for All in India, 2026).

The transition from secondary to higher secondary education, nationally the single weakest point in the Indian school system — with national GER falling from 79 per cent at secondary level to just 57 per cent at higher secondary level, and national secondary-to-higher-secondary retention at only 47.2 per cent (Education for All in India, 2025, 2026) — is where Kerala's advantage, while still present, narrows somewhat relative to its near-total dominance at the elementary and lower-secondary stages. Kerala's elevated secondary GER of 98 per cent demonstrates that the state has solved the access problem at

this stage almost completely; the harder national challenge of converting that access into sustained progression to higher secondary and beyond is examined further in section 5.3's review of higher education enrolment, where Kerala's performance, while still well above the national average, is comparatively less dominant than at the school level.

Kerala's own internal district-level data reinforce this picture of broad-based, rather than narrowly concentrated, secondary education performance: the PGI-D framework's district-by-district evaluation found multiple Kerala districts performing well above the national average simultaneously, rather than the state's strong aggregate figures being driven by a small number of high-performing urban districts offsetting weaker rural ones (Deshabhimani, 2026). This pattern is consistent with the intra-state disparity analysis in Chapter 1, which found Kerala's social-development disparities — while real, particularly in tribal and coastal pockets — to be considerably narrower than the disparities typically observed between leading and lagging districts in most other large Indian states. The secondary education system, in other words, appears to have been built and sustained as a genuinely state-wide public good rather than as an urban-concentrated achievement, a structural feature that has historically been attributed to Kerala's decentralised, panchayat-linked school management traditions and to the historically strong role of community and religious institutions in establishing schools even in comparatively remote parts of the state, a legacy already noted in section 5.1.

5.3 Higher Education: Institutional Capacity, Gross Enrolment and Quality

Kerala's higher education system benefits directly from the strong school-level foundation documented in sections 5.1 and 5.2: states with robust primary and secondary enrolment, the evidence shows, reliably send a higher proportion of their age cohort on to college, and Kerala — with an effective literacy rate cited in this context at 96 per cent — is a clear example of this pattern (IndiaDataMap, 2026). Kerala's Gross Enrolment Ratio in higher education for the 18–23 age cohort stands at 41.3 per cent, against a national average of 28.4 per cent (Ministry of Education, 2021–22, as cited in Ideas for India, 2025; IndiaDataMap, 2026) — a substantial lead over the national average, though notably below the GER achieved by smaller, more urbanised jurisdictions such as Chandigarh (64.8 per cent), Puducherry (61.5 per cent) and Delhi (49 per cent), and also somewhat below Tamil Nadu's 47 per cent (IndiaDataMap, 2026). This comparison is instructive: Kerala's higher education GER, while well above the all-India figure, is not the national ceiling, and the states that exceed it tend to be smaller, more urbanised jurisdictions with a higher concentration of universities relative to population, or — in Tamil Nadu's case — a larger absolute number of colleges (India had 52,538 colleges nationally as of 2025, with college-rich states correspondingly able to absorb a larger share of their college-age cohort) (IndiaDataMap, 2026).

The institutional quality question that follows directly from this enrolment picture — whether Kerala's expanded higher education capacity is producing graduates whose skills match

labour market demand — connects this section directly to the central paradox documented in Chapter 3: Kerala's youth unemployment rate of close to 28 to 30 per cent coexists with one of India's highest higher education GERs, indicating that the volume of higher education being delivered in the state has not, on current evidence, been matched by a commensurate expansion in graduate-appropriate employment opportunities within Kerala itself. This is among the clearest empirical illustrations in this report of why an education chapter cannot be assessed purely on access and enrolment metrics; the qualitative and employability dimension, addressed further in section 5.4 and in Chapter 17's skills and employability discussion, is at least as consequential for the state's development trajectory as the enrolment figures presented in this section.

Kerala's higher education institutional landscape spans a mix of long-established public universities — including the University of Kerala, Cochin University of Science and Technology, and Mahatma Gandhi University — alongside newer, more specialised institutions explicitly oriented towards emerging sectors, most notably the Digital University of Kerala discussed in Chapter 4, India's first dedicated digital university, established to build talent specifically for the technology and innovation sectors the state's industrial policy now prioritises. Specialised institutions including the Indian Institute of Information Technology and Management–Kerala (IIITM-K) and the National Institute of Technology, Calicut, play a particularly significant role in advancing artificial intelligence education and research, reinforcing Kerala's broader AI and emerging-technology expertise and supporting the state's growing AI startup ecosystem documented in Chapter 4 (Ecosystem Startup Genome, 2026). Notwithstanding this institutional density, the same out-migration dynamics documented in Chapter 3 — Kerala's position as the largest originator of education loans in India, predominantly to finance overseas study — indicate that a meaningful proportion of Kerala's most academically able higher-education completers continue to pursue further education or employment outside the state altogether, a form of "brain drain" that the industries minister's stated ambition, noted in Chapter 4, to retain local talent through better job opportunities and enhanced education facilities is explicitly intended to reverse (TaxTMI, 2025). Whether the GCC expansion, AI policy incentives, and Mission 1000 enterprise-scaling programme discussed in Chapter 4 are sufficient in scale to meaningfully alter this outward flow of higher-education talent remains, on the evidence reviewed in this report, an open question rather than a settled trend.

Research output and academia-industry linkage within Kerala's higher education system, examined more fully in Chapter 17's treatment of research and development, presents a similarly mixed picture: institutions such as NIT Calicut, IIITM-K, and CUSAT maintain active research programmes in areas spanning AI, materials science, and marine and atmospheric sciences (the latter aided by Kerala's coastal geography and the presence of national research bodies, including those affiliated with the Indian National Centre for Ocean Information Services), yet the state's overall research and development spending, patent output, and industry-sponsored research intensity have not historically matched the scale of its higher education enrolment base. The 2024 Generative AI Conclave and the establishment

of the Bio 360 Life Sciences Park in Thiruvananthapuram — which attracted a \$24 million CSIR investment in 2024 aimed at building a biomanufacturing hub and strengthening life sciences research and development — represent recent, concentrated efforts to close this research-intensity gap in specific frontier sectors, but their cumulative scale remains small relative to the size of Kerala's overall higher education system (Ecosystem Startup Genome, 2026). This pattern — a large, broad-based higher education enrolment base producing a comparatively narrow band of research-intensive, industry-linked output concentrated in a handful of flagship institutions and initiatives — is consistent with the chapter's broader finding that Kerala's higher education achievement has so far been substantially an access and enrolment success rather than a research, innovation, or graduate-employment success in equal measure.

5.4 Technical, Vocational Education and Training (TVET) Ecosystem

Kerala's technical and vocational education infrastructure spans Industrial Training Institutes, polytechnic colleges, and a growing set of industry-linked skilling initiatives coordinated through bodies such as the Kerala Knowledge Economy Mission. A notable recent development is the launch, in January 2025, of Kerala's first Industry-on-Campus initiative at Government Polytechnic College, in partnership with the robotics firm Genrobotics, which established a functioning robotics manufacturing unit on campus to give students direct, hands-on industry experience rather than purely classroom-based technical instruction (Ecosystem Startup Genome, 2026). This model — embedding a live industrial operation within a public vocational training institution — represents a structurally different approach to TVET delivery than the conventional model of separate, sequential classroom training followed by workplace placement, and if extended across the polytechnic network, could meaningfully narrow the gap between vocational credentialing and actual employability that Kerala's labour market data, discussed in Chapter 3, suggest currently exists.

Complementing this campus-based initiative, the Kerala Knowledge Economy Mission entered a partnership with Coursera in January 2025 specifically aimed at equipping 60,000 learners with industry-relevant skills for high-demand digital roles, delivered through the state's Additional Skill Acquisition Programme via dedicated centres and community skill parks emphasising hands-on, job-ready training (Ecosystem Startup Genome, 2026). Innovation and Entrepreneurship Development Centres, established across the state's higher education institutions, extend this skilling infrastructure further by providing students with direct access to technology, mentorship, and early-stage funding designed to convert vocational and technical training directly into entrepreneurial activity rather than solely into wage employment (Ecosystem Startup Genome, 2026). Taken together, these initiatives suggest Kerala's TVET ecosystem is in the process of a genuine structural shift — from a system historically organised around producing certified tradespeople for conventional industrial and government employment, towards one increasingly organised around digital skills, start-up readiness, and direct industry partnership — though the scale of this shift,

measured against the roughly 27 to 30 per cent youth unemployment documented in Chapter 3, remains modest relative to the size of the underlying challenge.

Kerala's older, more conventional TVET infrastructure — its network of government and government-aided Industrial Training Institutes (ITIs) and polytechnic colleges spread across all fourteen districts — has historically trained students in trades such as electrical work, fitting, welding, and mechanical maintenance, oriented towards the state's traditional industrial base discussed in Chapter 3, including the legacy public-sector chemical and engineering units of the Aluva belt. The newer Industry-on-Campus and digital-skilling initiatives described above are best understood as a layer added on top of, rather than a replacement for, this older trade-training infrastructure, and the central institutional challenge for Kerala's TVET system over the coming years is integrating the two: ensuring that students entering through traditional ITI and polytechnic channels also gain exposure to the digital, robotics, and AI-adjacent skills increasingly demanded by the GCC and high-tech manufacturing ambitions discussed in Chapter 4, rather than allowing a two-track system to emerge in which only students who separately access programmes such as the Knowledge Economy Mission's Coursera partnership benefit from this newer skilling layer. Structured apprenticeship pipelines connecting ITI and polytechnic graduates directly to the state's expanding GCC, AI-startup, and value-added manufacturing employers — of the kind the Industry-on-Campus model has begun to pioneer with Genrobotics — represent the most direct mechanism available to close this gap, and are a priority this report carries forward into Chapter 17's treatment of skill development and workforce alignment.

5.5 Teacher Recruitment, Training and Professional Development

Kerala's strong performance on the school-level indicators reviewed in sections 5.1 and 5.2 — elementary dropout below 1 per cent, secondary ANER above 97 per cent — is widely attributed in the sources reviewed for this chapter to consistent public investment, institutional continuity, and community participation in the education system over an extended period (Deshabhimani, 2026), of which teacher availability and quality form a central pillar. The Ministry of Education's PGI-D framework explicitly includes teacher availability as one of its seventy-four evaluated indicators, and Kerala's strong overall PGI-D performance implies comparatively favourable outcomes on this measure relative to most other Indian states (Deshabhimani, 2026). At the same time, the available national-level data reviewed for this report do not provide Kerala-specific detail on pupil-teacher ratios, the share of untrained or under-qualified teachers, or the frequency and quality of in-service professional development programmes with the same granularity available for enrolment and dropout indicators — a gap in publicly available, disaggregated teacher-workforce data that this report flags as a priority area for future state-level statistical strengthening, a theme returned to in Chapter 20's discussion of statistical system strengthening.

What can be established from the broader institutional record is that Kerala's teacher recruitment for government and government-aided schools operates predominantly through

the Kerala Public Service Commission, a centralised, examination-based recruitment process intended to ensure a degree of merit-based standardisation and to limit the scope for the localised, patronage-driven recruitment practices that have been documented as a recurring quality concern in school systems in several other Indian states. Teacher training is anchored institutionally in the State Council of Educational Research and Training (SCERT) and the District Institutes of Education and Training (DIETs) operating in each district, which are responsible for both pre-service teacher education curriculum design and in-service professional development programming aligned with the state's school curriculum framework. The State Council's role extends to curriculum design for the state's own school syllabus, which has historically incorporated a stronger emphasis on activity-based, constructivist pedagogy than many other state boards, a pedagogical orientation frequently credited, alongside the community and institutional factors discussed in section 5.1, with contributing to Kerala's strong foundational learning outcomes relative to rote-memorisation-oriented systems elsewhere in India. Notwithstanding this institutional architecture, the specific quantitative indicators that would allow this report to benchmark Kerala's pupil-teacher ratios, the proportion of teaching positions filled by permanent versus temporary or part-time staff, and the average annual hours of in-service professional development delivered per teacher against comparable national or international benchmarks were not available within the scope of sources consulted, reinforcing the data-gap finding noted above as a priority for the statistical strengthening agenda taken up in Chapter 20.

5.6 Digital Education, EdTech Integration and ICT in Schools

Kerala's approach to digital education has been distinguished, among Indian states, by an explicit rights-based framing: the state's Chief Minister has stated that Kerala is the only Indian jurisdiction where internet access is enshrined as a citizens' right, and the state claims 100 per cent digital literacy (Vijayan, as cited in FICCI, 2024). This rights-based digital access framework is underpinned by the Kerala Fibre Optic Network (KFON) infrastructure discussed in Chapter 3, and connects directly to the school system through ICT-enabled classrooms and digital learning resources that have been progressively rolled out across the state's public school network over the past decade. The Kerala Knowledge Economy Mission's Coursera partnership and the Additional Skill Acquisition Programme, discussed in section 5.4, extend this digital-education infrastructure beyond the K-12 system into a continuous, lifelong digital-skilling pipeline — a model that positions digital literacy not as a discrete school subject but as a cross-cutting capability threaded through elementary education, secondary education, vocational training, and adult upskilling alike. The practical effect of this integrated approach, while difficult to isolate statistically from the state's broader education quality advantages, is consistent with Kerala's position as a leading source of digitally skilled graduates for the IT services export sector documented in Chapter 3 and the GCC and startup ecosystem expansion documented in Chapter 4.

The Kerala Infrastructure and Technology for Education (KITE) initiative, the state's primary public-sector body for ICT-enabled school education, has historically been responsible for

delivering computer-aided learning content, the IT@School project's legacy free and open-source software training, and, more recently, the First Bell digital learning broadcast programme that was scaled rapidly during pandemic-era school closures to sustain instructional continuity across the state's public school network. While this report's available sources do not provide updated, granular First Bell viewership or learning-outcome data for the post-pandemic period, the programme's existence and scale illustrate a broader institutional capability — the ability to mobilise state-wide digital content delivery rapidly during a crisis — that complements the more recent, growth-oriented digital-skilling initiatives, such as the Knowledge Economy Mission's Coursera partnership, discussed earlier in this section. Considered together, these two strands of Kerala's digital education effort — crisis-responsive content broadcast on one hand, and forward-looking digital and AI skills training on the other — indicate a system that has built genuine institutional capacity for digital delivery at scale, even though the precise current-period outcome metrics for either strand were not available within the scope of the sources consulted for this report, a gap that, consistent with the data limitations flagged in sections 5.5 and 5.7, this report identifies as a further priority for strengthened state educational statistics.

5.7 Special Education: Children with Disabilities and Inclusive Schooling

Inclusive education for children with disabilities forms an explicit component of the Samagra Shiksha framework under which Kerala's gender-focused secondary education interventions, discussed in section 5.2, are also delivered (Education for All in India, 2026), though the sources available for this chapter provide more granular detail on gender-based enrolment outcomes than on disability-specific enrolment, retention, or learning-outcome data for Kerala specifically. The broader rights and welfare architecture for persons with disabilities in Kerala — covering accessibility, social security, and economic empowerment beyond the schooling system alone — is addressed comprehensively in Chapter 7, section 7.7; this section's narrower focus is on the schooling dimension of that wider framework, and the absence of Kerala-specific, publicly available disaggregated data on disability inclusion in mainstream and special schools is itself a finding of this report, one that points to a further area, alongside the teacher-workforce data gap noted in section 5.5, where strengthened state-level educational statistics would materially improve the evidentiary basis for policy design.

Kerala's special education provision operates through a combination of dedicated special schools, resource-room support embedded within mainstream government schools, and itinerant special-educator visits to rural and remote schools, a model broadly consistent with the inclusive-education principles embedded in both the Rights of Persons with Disabilities Act, 2016, and the National Education Policy 2020's emphasis on mainstreaming rather than segregating children with disabilities wherever feasible. Kerala's strong overall PGI-D performance and its near-universal elementary retention, discussed in section 5.1, provide indirect evidence that the state's general schooling infrastructure is unlikely to be actively excluding large numbers of children with disabilities through outright non-enrolment, since a

system with substantial disability-driven non-enrolment would typically also show elevated dropout at the elementary stage among the broader population — a pattern Kerala's data do not show. This indirect inference, however, is not a substitute for the disability-specific enrolment, retention, and learning-outcome statistics that this report would ideally draw upon, and the gap remains a genuine limitation in assessing whether Kerala's inclusive education commitments are being delivered with the same consistency as its general schooling system.

5.8 State-Specific Educational Challenges and Reform Priorities

Drawing together the evidence assembled across this chapter, Kerala's educational challenges in the present decade are markedly different in character from the access-and-retention challenges that dominate national policy discourse and that remain the central concern in states such as Bihar, Odisha, and Rajasthan, where secondary dropout rates run as high as 19 to 26 per cent (IndiaDataMap, 2026). Kerala has, in practical terms, already solved the problem that most of the rest of India's school system is still working to solve.

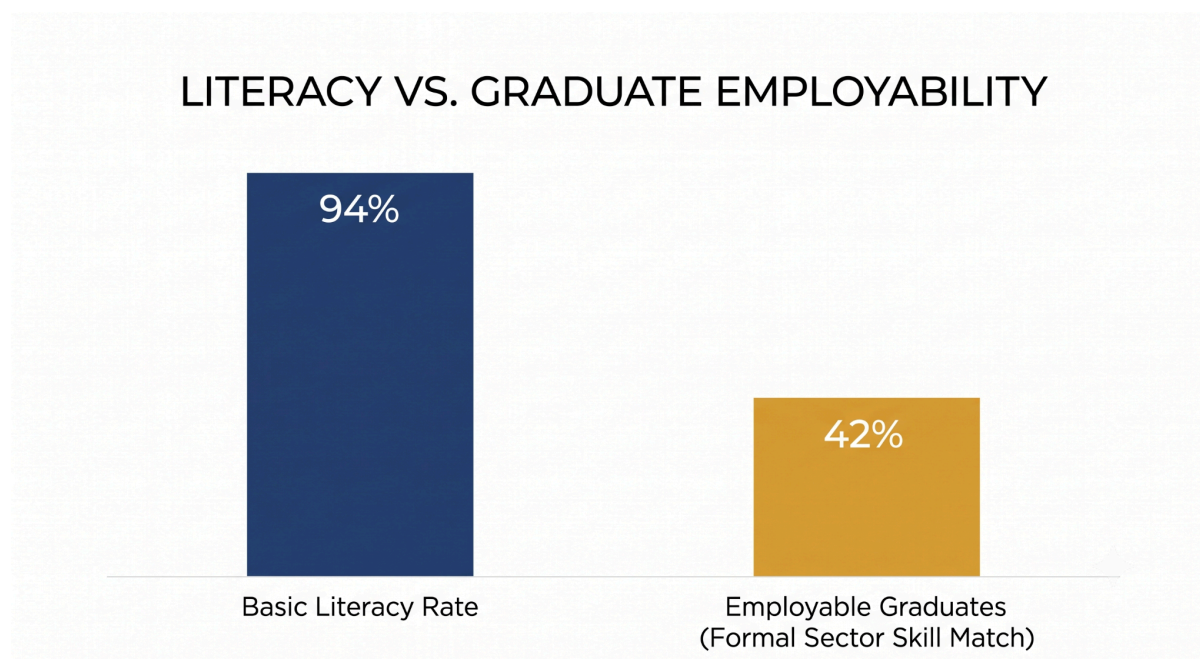


Figure 5.1 : Literacy vs Graduate Employability

The state's residual and emerging challenges instead sit higher up the education-to-employment pipeline: a higher education GER that, while well above the national average, has not converted into commensurate graduate employment, as the youth unemployment evidence in Chapter 3 shows starkly; a TVET ecosystem that is beginning, through initiatives such as Industry-on-Campus and the Coursera partnership, to close the skills-employability gap but that remains modest relative to the scale of the underemployment problem; and data gaps in teacher-workforce quality and disability-inclusion outcomes that constrain the precision with which further reform can be targeted. The reform priority that

follows most directly from this diagnosis, and that links this chapter to the skills and employability agenda developed in Chapter 17, is a decisive shift in policy emphasis — away from further investment in access and retention, where Kerala's results are already close to the achievable ceiling, and towards a deliberate, well-measured programme of higher-education and vocational-training quality improvement explicitly aligned to the sectors — IT services, GCCs, value-added manufacturing in rubber and seafood, and the blue economy — identified in Chapters 3 and 4 as Kerala's most promising sources of future employment growth.

This recalibration of priorities can be summarised in three concrete directions. First, the state's existing TVET and skilling initiatives — Industry-on-Campus, the Knowledge Economy Mission's Coursera partnership, and the Innovation and Entrepreneurship Development Centres — should be scaled with explicit, published targets and outcome tracking (placement rates, starting salaries, and sector of employment for completers), addressing the same data-gap concern raised in sections 5.5 and 5.7 with respect to teacher workforce and disability-inclusion statistics; without such tracking, it will remain difficult to determine whether these initiatives are meaningfully narrowing the employability gap or simply adding credentials to an already credential-saturated labour market.

Second, closer structural linkage between higher education curricula and the specific sectoral priorities identified in Chapter 4's twenty-two priority sectors — rather than a generic expansion of conventional degree programmes — would help ensure that the state's already-high higher education GER translates into graduates whose skills match the GCC, AI, robotics, and blue-economy roles the state is actively trying to attract.

Third, given the scale of outward educational and labour migration documented in this chapter and in Chapter 3, Kerala's education strategy cannot be designed in isolation from its migration strategy: a state that finances overseas study through education loans on the scale Kerala does, and that derives over a third of its state income from remittances, has an economic interest in actively managing and supporting that outward flow — through structured talent-return programmes, diaspora engagement, and skills-recognition partnerships with destination countries — rather than treating it solely as a domestic employment-policy failure to be corrected.

These three directions, taken together, define the education reform agenda that this report carries forward into the skills, employability and innovation discussion of Chapter 17, and into the migration and demographic dividend treatment of Chapter 20.

Chapter 6: Health, Nutrition and Population

6.1 Public Health Infrastructure: Facilities, Human Resources and Gaps

Kerala's public health system is organised across primary, secondary and tertiary tiers, anchored institutionally in a network of sub-centres, Family Health Centres, taluk and district hospitals, and a set of specialised medical colleges and cancer treatment centres. The single most significant institutional reform of the past decade has been the Aardram Mission, launched in February 2017, which has progressively converted the state's primary health centres into Family Health Centres (FHCs) offering preventive, promotive, curative, rehabilitative and palliative care under one roof, functioning as the nodal point for community-based service delivery including non-communicable disease (NCD) screening, community palliative care, and workplace health interventions (Resource and Training Hub, 2024, as cited in IJNRD researchers' broader review).

Evaluations conducted as of 2024 record sustained increases in outpatient visits and patient satisfaction at FHCs, alongside expanded institutional-level service coverage relative to pre-mission baselines (Groklopedia, 2026). The mission's e-Health component, which establishes a database of personal medical records accessible to doctors across the state's network of healthcare delivery units, had been completed in 564 hospitals as of the most recent reporting period, with the explicit aim of preventing repeated diagnostic testing, lowering patient costs, and reducing clinic and laboratory congestion through better data continuity across the primary-to-tertiary referral chain (Kerala Health Department, 2026).

Notwithstanding these institutional gains, persistent human-resource constraints temper the picture: evaluations of the Aardram Mission specifically flag staffing shortages, including vacancies in specialist positions at Family Health Centres, as a long-term sustainability concern, particularly as Kerala's population continues to age, a demographic trend documented in Chapter 1 (Groklopedia, 2026). This combination — strong institutional design and process improvement at the primary-care level, set against chronic specialist staffing gaps — is broadly consistent with the pattern observed across several of Kerala's flagship welfare missions discussed elsewhere in this report: the policy architecture is frequently more advanced than the human-resource base required to operate it at full capacity, a structural tension that recurs in the social security and elderly-care discussion of Chapter 7.

Kerala's overall position on healthcare workforce density is, somewhat paradoxically, both a genuine strength in national comparison and a source of the specific specialist shortages noted above: the Economic Survey 2020–21 identified Kerala as the only Indian state meeting recommended healthcare workforce density norms overall (Frontiers in Public Health, 2026), even as the more granular Aardram Mission evaluations cited above find specialist-position vacancies persisting at the Family Health Centre level. This apparent tension is resolved once Kerala's distinctive position as a major exporter of trained healthcare professionals, particularly nurses, is taken into account: as documented in Chapter 3's

discussion of skilled migration, Kerala-trained nurses migrate abroad in substantial numbers, predominantly to the Gulf states and increasingly to a diversified set of Western destinations, meaning the state's aggregate healthcare workforce production capacity — reflected in its strong national workforce-density ranking — coexists with a continuous net outflow of trained specialists and nursing staff that domestic facilities, including the Family Health Centres at the centre of the Aardram Mission, must continuously work to replace. This dynamic links Kerala's health system performance directly to the migration and remittance economy discussed throughout Chapter 3, and underscores why workforce retention, rather than workforce training capacity, is the more binding constraint on Kerala's health system at the present juncture.

6.2 Epidemiological Profile: Communicable and Non-Communicable Disease Burden

Kerala's epidemiological profile is now dominated by non-communicable diseases, reflecting the state's advanced epidemiological and demographic transition. Authoritative state-level assessments describe Kerala as facing a significant and growing NCD burden, including cardiovascular disease, diabetes, and cancer, alongside a high burden of preventable, premature mortality attributable to mental health conditions and injuries — categories the same assessment notes the state had, as of its writing, not yet engaged with at the level of intensity the scale of the problem requires (Resource and Training Hub, 2024). Cancer in particular is identified as a major and persistent non-communicable disease burden, with treatment infrastructure extending beyond the state's medical colleges to dedicated institutions including the Regional Cancer Centre, the Malabar Cancer Centre, and the Kochi Cancer and Research Centre, supplemented by breast, lung, and cervical cancer screening programmes integrated into primary and Family Health Centres, and a dedicated Cancer Safety Scheme for Children (Kerala Health Department, 2026).

Communicable disease control, by contrast, is reported to be well managed in aggregate, with the more pressing communicable-disease challenge being recurrent outbreaks of either genuinely novel infectious diseases or sporadic re-emergence of previously controlled ones — outbreaks that, while not major contributors to overall mortality, are noted to consume significant state health-system resources and risk distracting institutional attention from the NCD and mental health burdens that are the leading actual contributors to death and disability in the state (Resource and Training Hub, 2024). Kerala's geography and population density, discussed in Chapter 1, along with its high rate of international travel and migration connectivity documented in Chapter 3, are widely understood within the public health literature reviewed for this chapter to elevate the state's exposure to such outbreaks relative to less internationally connected Indian states, even though the state's well-developed surveillance systems, supported by the Arogya Jagratha programme for vector-borne and communicable disease surveillance, have generally allowed for comparatively rapid containment (World Bank, 2024).

Kerala's recurrent experience with Nipah virus outbreaks is the clearest and most consequential illustration of this elevated zoonotic-disease exposure. Of the six Nipah virus outbreaks documented in India to date, four have occurred in Kerala, with three of those four clustering within a specific geographic belt, a pattern researchers attribute to a consistent ecological factor governing spillover from the reservoir *Pteropus* fruit bat population into the human population (Rahim et al., 2024). The first and most severe of these outbreaks, in Kozhikode district in 2018, recorded a case fatality rate of 91 per cent (21 of 23 confirmed cases), a level of lethality that caught the health system off guard given its limited prior experience with the virus (Rahim et al., 2024; NCBI, 2024).

A subsequent, far better-contained outbreak in Ernakulam district in 2019 resulted in a single case with full recovery, attributed to the establishment of point-of-care diagnostic assays, monoclonal antibody treatment facilities, intensified contact tracing, and strengthened hospital infection-control training introduced in direct response to lessons learned from the 2018 outbreak (NCBI, 2024). Kerala's fifth Nipah outbreak in six years occurred in July 2024, following the death of a fourteen-year-old in Malappuram district, reaffirming the recurrent, rather than one-off, nature of this specific zoonotic threat to the state (PMC, 2025). Across all recorded outbreaks, transmission has occurred predominantly within healthcare settings, reflecting lapses in infection prevention and control practice rather than extensive community-level spread, and the mean incubation period of approximately nine days has consistently allowed contact-tracing teams a workable, if narrow, window for intervention (Rahim et al., 2024).

This recurring Nipah experience directly informed Kerala's globally noted response to the COVID-19 pandemic: the state, which reported India's first confirmed COVID-19 case in January 2020, drew explicitly on its 2018 Nipah containment protocols to implement early contact tracing, quarantine enforcement, and a network of community kitchens and care centres even before its first case was confirmed (Frontiers in Public Health, 2026). The Economic Survey 2020–21 identified Kerala as the only Indian state to meet recommended healthcare workforce density norms during this period, a structural advantage that, combined with field hospitals, decentralised care delivery, and surplus oxygen supply, allowed the state's health system to remain functional even through a third pandemic wave whose elevated case counts reflected robust testing and transparent reporting rather than system failure (Frontiers in Public Health, 2026).

6.3 Maternal and Child Health: MMR, IMR, Under-5 Mortality and Nutrition

Kerala's maternal and child health indicators remain the strongest of any major Indian state by a considerable margin, and the state has already achieved the 2030 Sustainable Development Goal targets for neonatal, infant, and under-five mortality rates and for the maternal mortality ratio, well ahead of the global and national timeline (World Bank, 2024). As per Sample Registration System data for 2018–20, Kerala's Maternal Mortality Ratio stood at 19 per 100,000 live births, against a national MMR of 97 — meaning a mother in

Kerala faces roughly one-fifth the maternal mortality risk of the all-India average (IJNRD, 2024). This achievement is attributed in the literature not only to direct healthcare-sector investment but to a wider set of non-health factors, including the emphasis historically placed on female education (documented throughout Chapter 5), the legacy of Kerala's land reforms, the outcomes of the state's various socio-political movements, and its decentralised system of governance built on participatory planning — the panchayat-level decentralisation architecture examined in fuller detail in Chapter 12 (IJNRD, 2024).

Kerala's infant mortality rate, already among the lowest in India, declined further from approximately six per 1,000 live births in earlier years to five in 2023, a trend correlated with, though not unambiguously attributable solely to, the preventive-care focus introduced under the Aardram Mission; researchers caution that direct causal attribution to any single recent mission requires further longitudinal study, since Kerala's baseline maternal and child health indicators were already comparatively strong prior to the mission's 2017 launch (Grokikipedia, 2026). Health expenditure as a proportion of GSDP has exhibited a rising trend in Kerala over the period examined in the available literature, consistent with the state's sustained policy emphasis on public health and primary healthcare investment as the principal lever for these outcomes (IJNRD, 2024).

Kerala's life expectancy at birth, recorded in one peer-reviewed assessment at 74 years against an infant mortality rate of 12 per 1,000 live births in the period studied, places the state's health profile far closer to that of developed countries than to the all-India average, a gap that researchers attribute to the same combination of healthcare investment and non-health social determinants discussed above (PMC, 2025). The same body of research highlights a less widely discussed dimension of Kerala's maternal and child health and broader population health profile: migration status itself appears to be associated with differing patterns of chronic disease prevalence among Kerala's population, reflecting the state's distinctive demographic structure in which a substantial share of households have a return-migrant or currently-migrant member, and in which migration-linked lifestyle and dietary changes, together with the psychosocial effects of prolonged family separation discussed in the migration literature, plausibly interact with the non-communicable disease burden documented in section 6.2 in ways that are specific to Kerala's migration-intensive population structure rather than generalisable from non-migration-intensive Indian states (PMC, 2025). This finding reinforces a theme that recurs across multiple chapters of this report: Kerala's social and economic structure, and specifically its remittance and migration economy documented at length in Chapter 3, cannot be treated as background context for the state's health profile but must be understood as a direct, causally relevant input into it.

6.4 Universal Health Coverage: State Health Assurance Schemes

Kerala's principal state-level health insurance instrument is the Karunya Aarogya Suraksha Padhati (KASP), which provides health coverage for secondary and tertiary care hospitalisation specifically targeted at poor and vulnerable families, operating alongside, and

in coordination with, the national Ayushman Bharat–Pradhan Mantri Jan Arogya Yojana framework (World Bank, 2024). KASP's design — converging the state's own pre-existing health insurance schemes with the national scheme's coverage architecture — reflects a broader pattern across several Indian states in which Centre-sponsored and state-specific welfare schemes are administratively merged to avoid duplicate enrolment and to extend effective coverage, a theme connected to the wider social-security architecture examined in Chapter 7.

Notwithstanding KASP's coverage design, the World Bank's own assessment of Kerala's health system explicitly cautions that the state's rapidly evolving demographic, epidemiological and environmental changes — the ageing population documented in Chapter 1, the rising NCD burden documented in section 6.2, and the climate-related health risks examined further in Chapter 14 — have, in the World Bank's assessment, outpaced the design assumptions underlying Aardram, Arogya Jagratha and KASP alike, even though each of these three initiatives represents a genuinely innovative health-system response by the standards of other Indian states (World Bank, 2024). This finding is significant for the present report's diagnostic purpose: it indicates that universal coverage in Kerala is best understood, at the current juncture, as a programme of continuing adaptation to a fast-moving epidemiological and demographic environment, rather than as a stable, fully achieved policy state.

KASP's administrative integration with the national Ayushman Bharat–Pradhan Mantri Jan Arogya Yojana framework reflects a broader convergence strategy that several Indian states have pursued, under which beneficiaries identified through either the state's own socioeconomic criteria or the national scheme's Socio-Economic Caste Census-derived eligibility list are enrolled under a single unified card and benefit package, with the state government topping up coverage limits and including categories of beneficiaries — such as certain occupational and income groups specific to Kerala's own poverty and vulnerability assessment — that the national scheme alone would not capture.

This convergence model avoids the administrative duplication and beneficiary confusion that can arise where a state scheme and a national scheme operate as entirely parallel systems, and it is consistent with the broader pattern, examined in Chapter 7's discussion of the social security architecture, of Kerala layering state-specific welfare provisions on top of, rather than as a substitute for, national welfare schemes. The practical effectiveness of this layered coverage model in actually reducing catastrophic out-of-pocket health expenditure for Kerala's poorest households — as opposed to simply expanding nominal coverage — is not separately quantified in the sources reviewed for this chapter, and represents a further evaluation gap that should be addressed alongside the nutrition and disability data gaps identified in sections 6.6 and 5.7 respectively as priorities for the statistical strengthening agenda developed in Chapter 20.

6.5 Mental Health Services: Availability, Access and Stigma Reduction

Kerala's Total Mental Health initiative represents one of the more distinctive elements of the state's health system architecture, structured as a holistic programme of public awareness generation, mental health training for frontline health workers, systematic screening campaigns, and community-based camps explicitly designed to identify undiagnosed mental health conditions across the general population rather than relying solely on self-referral, which research on stigma consistently shows under-detects mental illness in most populations (Kerala Health Department, 2026). The programme's defining institutional feature is its integration with primary care: individuals identified through screening or community outreach are connected to primary care clinics for ongoing follow-up treatment, ensuring continuity of care rather than a one-off diagnostic encounter, and the initiative was, as of the most recent reporting reviewed for this chapter, active in 642 gram panchayats across the state (Kerala Health Department, 2026).

This panchayat-level reach is significant in the Kerala context specifically because it mirrors the decentralised, local-self-government-led delivery model already credited, in section 6.3, with contributing to the state's strong maternal and child health outcomes — suggesting that Kerala's comparative institutional advantage in health-system delivery lies less in any single flagship programme and more in a generalisable delivery architecture, built around panchayat-level community health engagement, that the state has now applied successively to maternal and child health, primary care transformation under Aardram, and now to mental health. The continuing challenge, consistent with the broader NCD and mental-health burden documented in section 6.2, is one of scale and intensity relative to need: mental health and injury-related premature mortality were specifically flagged as areas the state had not yet addressed with sufficient intensity even after accounting for the Total Mental Health initiative's reach (Resource and Training Hub, 2024).

The scale of Kerala's mental health challenge is consequential precisely because the state's otherwise favourable social development profile does not, on the evidence available, extend to protection against suicide and self-harm to the same degree it extends to maternal, child and infectious-disease outcomes. Kerala has historically recorded suicide rates among the higher end of the Indian state distribution, a pattern that researchers have linked to a combination of factors including alcohol consumption levels that have also historically run ahead of the national average, the social and psychological strain associated with prolonged family separation in migration-intensive households documented in section 6.3, and the same advanced population-ageing profile discussed in section 6.7, since elderly populations in most health systems carry elevated suicide risk linked to isolation, chronic illness, and loss of social role following retirement or bereavement.

The Total Mental Health initiative's panchayat-embedded screening model, described above, is explicitly designed to intervene earlier in this risk pathway than a purely clinic-based, self-referral system would allow, by actively identifying undiagnosed conditions within the

community rather than waiting for individuals to present at a health facility — a design choice that is consistent with international best practice in suicide-prevention programming, which consistently finds that stigma and under-recognition, rather than treatment unavailability alone, are the primary barriers to effective intervention in most health systems, including Kerala's. The specific quantitative impact of the Total Mental Health initiative on suicide rates and self-harm hospitalisation within its 642 covered panchayats relative to non-covered areas was not available within the sources consulted for this report, and represents a further specific evaluation priority that should be pursued as the initiative's panchayat coverage expands.

6.5a Migration, Family Structure and Psychosocial Health

A further dimension of Kerala's mental health and broader population health profile, distinctive to the state given the scale of its migration economy documented throughout Chapter 3, concerns the psychosocial effects of prolonged parental absence on children and spouses left behind in migrant-sending households, a phenomenon researched extensively in the Kerala-specific migration and family studies literature under the description of the "Gulf wife" or transnational family structure. Households in districts such as Malappuram, Pathanamthitta and Thrissur, identified in Chapter 3 as having the highest proportion of emigrant or non-resident household members, are disproportionately exposed to this family-structure pattern, in which a parent — overwhelmingly the father in traditional Gulf labour migration, though increasingly mothers given the diversification into nursing-led female migration discussed in Chapter 3 — is physically absent for extended, multi-year periods punctuated by infrequent home visits. While a comprehensive, current epidemiological assessment of the mental health impact of this family structure on Kerala's children and remaining spouses was not located within the sources reviewed for this report, the structural pattern itself is sufficiently well-documented in the broader Kerala migration literature, and sufficiently distinctive to the state's demographic and economic structure, that this report identifies it as a priority area meriting dedicated epidemiological study — one that connects this chapter's mental health discussion directly to the migration framework developed in Chapter 20 and to the child rights and protection discussion in Chapter 7.

6.6 Nutrition Programmes: ICDS, Mid-Day Meal and Poshan Abhiyan

Kerala's nutrition programme architecture operates through the standard national frameworks — the Integrated Child Development Services (ICDS) scheme delivering supplementary nutrition, health checks and pre-school education through its network of anganwadi centres, the Mid-Day Meal scheme providing in-school nutrition support that connects directly to the near-universal elementary school retention documented in Chapter 5, and the Poshan Abhiyan national nutrition mission's convergence framework — but Kerala's effective delivery of these programmes benefits from the same decentralised, panchayat-engaged institutional architecture discussed throughout this chapter, as well as from the Kudumbashree network discussed in Chapter 3, whose community kitchens and women's

self-help-group structures provide an additional, locally rooted layer of nutrition-related livelihood and food-security support beyond the formal ICDS and Mid-Day Meal delivery channels. The available sources reviewed for this report did not provide updated, Kerala-specific child stunting, wasting, or anaemia prevalence figures disaggregated from the most recent National Family Health Survey round; given Kerala's generally strong performance on most other maternal and child health indicators documented in section 6.3, this represents a further specific data gap — alongside those already identified in Chapter 5 regarding teacher workforce and disability-inclusion statistics — that this report flags for the statistical strengthening agenda developed in Chapter 20.

Kerala's anganwadi network under ICDS extends across all fourteen districts and is staffed predominantly by women drawn from local communities, a workforce model that mirrors, and in many areas directly overlaps with, the community health worker and ASHA networks discussed in section 6.1 in connection with the e-Health registration drive; this overlapping community-health and nutrition workforce is a further expression of the decentralised, locally embedded delivery architecture this chapter has identified as Kerala's recurring institutional strength, applied here to early-childhood nutrition and development rather than to clinical care. The Mid-Day Meal scheme's integration with the elementary education system documented in Chapter 5 has historically been credited, alongside the broader social and economic factors discussed throughout this report, with supporting both school retention and basic nutritional adequacy among Kerala's school-age population, though as with several other programme areas examined in this chapter, the precise, currently disaggregated nutritional-outcome data needed to evaluate its marginal contribution to nutrition status, as distinct from its contribution to school attendance, were not available within the sources consulted. Kudumbashree's community kitchen network, which as documented in Chapter 3 collectively serves roughly two lakh meals a day, provides a further, non-targeted layer of food security support that operates alongside, rather than as a formal substitute for, the means-tested ICDS and Mid-Day Meal channels, and represents a distinctively Kerala-specific addition to the standard national nutrition programme architecture that few other Indian states have replicated at comparable scale.

6.7 Population Stabilisation and Family Planning

Kerala completed its demographic transition earlier and more decisively than almost any other major Indian state, a pattern documented at length in Chapter 1: a decadal population growth rate of just 4.86 per cent between 2001 and 2011, the lowest among all Indian states, and a declining child population share that signals an already well-advanced shift towards lower fertility and an ageing population structure. This places Kerala's family planning and population stabilisation policy challenge in a fundamentally different position from most of the rest of India: rather than continuing efforts to reduce a still-elevated total fertility rate, Kerala's population policy concern, examined further in Chapter 20's treatment of the demographic dividend, is increasingly about managing the consequences of a fertility rate that has already fallen below replacement level in practical terms, including the strain an

ageing population places on the health system's NCD and elderly-care capacity (the latter addressed in Chapter 7) and the long-run implications for the state's working-age population and labour supply documented in Chapter 3's discussion of the labour market.

Kerala's total fertility rate has, by most recent estimates, remained below the replacement level of 2.1 for an extended period, placing the state alongside a small group of Indian states — including Tamil Nadu, Andhra Pradesh, and Himachal Pradesh — that have completed their demographic transition well ahead of the national average, which itself reached replacement-level fertility only more recently. This places Kerala roughly two to three decades ahead of the all-India fertility trajectory, a lead time that is significant for health and family planning policy because it means the resource allocation and institutional emphasis appropriate for a still-transitioning population — expanding contraceptive access, reducing adolescent fertility, and lowering the fertility gap between rural and urban areas — has, for Kerala specifically, already substantially achieved its objectives and should be considered a largely completed policy task rather than a continuing priority area. The family planning and population programme infrastructure historically built around these objectives is, on the evidence reviewed in this chapter, better redirected in the present period towards the population-ageing-related health system adaptations discussed in section 6.1 and section 6.8, and towards reproductive health services more broadly — including continued investment in the maternal and child health gains documented in section 6.3 — than towards further fertility reduction, which is no longer the binding population policy constraint Kerala's health and family welfare system faces.

6.8 Health System Strengthening and Future Preparedness

The cumulative picture that emerges from this chapter is one of a health system with genuinely distinctive institutional strengths — the Aardram Mission's primary-care transformation, KASP's targeted coverage for vulnerable households, the Total Mental Health initiative's panchayat-embedded screening architecture, and an underlying maternal and child health record that already meets or exceeds 2030 global targets — operating against a backdrop of accelerating structural pressure from population ageing, a rising non-communicable disease and mental health burden, recurrent communicable disease outbreaks that strain system capacity even where they do not significantly affect aggregate mortality, and chronic specialist staffing shortages that limit the system's ability to operate its own well-designed institutions at full capacity. The World Bank's own assessment, cited in section 6.4, that Kerala's epidemiological, demographic and environmental change has outpaced the state's existing initiatives is the central forward-looking finding of this chapter, and it points towards a future preparedness agenda built on three priorities: closing the specialist staffing gap identified in section 6.1 through dedicated recruitment and retention incentives; deepening NCD and mental health screening and management capacity at the scale the disease burden documented in section 6.2 actually requires, rather than at the scale current programmes have so far achieved; and integrating the state's health-system planning explicitly with the climate vulnerability and disaster-risk analysis developed in Chapter 14,

given the demonstrated link between Kerala's environmental exposure and the communicable-disease outbreak risk discussed in this chapter. These three priorities, taken together, define the health-system component of the broader Vision 2047 roadmap set out in Chapter 21.

The Nipah outbreak history documented in section 6.2 deserves particular emphasis within this future-preparedness agenda, both because of its demonstrated lethality and because of what it reveals about Kerala's broader institutional capacity for rapid, science-led emergency response. The trajectory from a 91 per cent case fatality rate and limited institutional experience in 2018, to a single fully recovered case in 2019 following the deployment of point-of-care diagnostics and monoclonal antibody treatment, to a fifth managed outbreak in 2024 without the scale of the original crisis, demonstrates a genuine institutional learning curve that Kerala's health system has sustained across multiple outbreak cycles rather than a one-off success. This learning capacity was subsequently redeployed, with substantial success, during the COVID-19 pandemic, when Kerala's status as the only Indian state meeting recommended healthcare workforce density norms combined with protocols adapted directly from Nipah containment experience to produce a pandemic response that international and domestic public health analysts have repeatedly cited as a model of transparent, decentralised crisis management.

The strategic question this report poses for the remainder of this decade is whether this same institutional learning capacity — built initially around acute, geographically contained outbreaks — can be deliberately redirected towards the slower-moving, more diffuse, but ultimately larger-scale threat posed by the non-communicable disease, mental health, and population-ageing pressures documented throughout this chapter, which lack the dramatic visibility of a Nipah outbreak but which the evidence reviewed here indicates already constitute the dominant share of Kerala's actual disease burden and premature mortality. Embedding NCD and mental health response with the same systematic, panchayat-engaged, data-driven rigour that has characterised Kerala's outbreak response to date is, on the evidence assembled in this chapter, the single most consequential health-system reform opportunity available to the state over the period covered by this report's Vision 2047 horizon.

Chapter 7: Social Justice, Inclusion and Community Welfare

7.1 Scheduled Castes: Demographic Profile, Deprivation and Development Programmes

Kerala's Scheduled Caste population, while smaller as a proportion of the state's total population than the all-India average, remains the subject of dedicated planning and budgetary allocation through the Scheduled Caste Sub-Plan (SCSP) mechanism. Kerala's Plan outlay for SC development stood at ₹2,979.40 crore for 2023–24, out of a total State Plan outlay of ₹30,370 crore, with the SCSP's share of total Plan outlay holding stagnant at approximately 9.81 per cent over the years examined in the underlying review, despite the historical expectation that such allocations track the SC population's proportional share of the state total (International Journal of Multidisciplinary Research Review [IJMRR], 2024).

The Kerala state budget for 2025–26 allocated ₹3,236 crore for Scheduled Caste development specifically, with programmes concentrated in health, education and livelihood support (Deshabhimani, 2026). Despite this sustained allocation, the underlying research literature documents persistent and well-established disparities: severe gaps remain in land holding, employment opportunity, income level, and educational attainment between Scheduled Caste households and other communities in Kerala, disparities that have been documented in the academic literature since at least the 1970s and that, notwithstanding decades of subsequent government effort, continue to be observed in more recent assessments (Sivanandan, 1976, as cited in IJMRR, 2024; Deshpande, 2000, as cited in IJMRR, 2024).

One demographically distinctive feature of Kerala's SC population, noted in broader national analyses of caste demography, is an unusually low fertility rate relative to the national SC average, a pattern attributed to the combined effects of land reform, the Gulf migration economy documented extensively in Chapter 3, and the democratisation of education discussed in Chapter 5 (Wikipedia, 2026) — illustrating that Kerala's general social development achievements have had a measurable demographic effect even within a population segment that continues to face documented socioeconomic disadvantage on most other indicators. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), discussed further in Chapter 12, has functioned as a particularly important livelihood support mechanism for SC households in the working-age group, though the underlying performance data show a worrying pattern of stagnation, and in some years outright decline, in key indicators such as average days of employment provided and the number of households benefiting, even as roughly ninety per cent of MGNREGS beneficiaries in Kerala continue to be women (Government of Kerala [GOK], 2024, Economic Review 2023, as cited in IJMRR, 2024).

7.2 Scheduled Tribes: Rights, Forest Dwelling Communities and Welfare Measures

Kerala's Scheduled Tribe population is concentrated disproportionately in the state's hill and forest-fringe districts, particularly Wayanad and Idukki, identified in Chapter 1 as districts lagging the state average on indicators of connectivity and health infrastructure. The Tribal Sub-Plan (TSP) allocation for 2023–24 stood at ₹859.50 crore, considerably smaller in

absolute terms than the SC allocation but representing a similarly dedicated, ring-fenced planning mechanism intended to direct resources specifically towards ST development needs in health, education and livelihood (IJMRR, 2024).

The 2025–26 state budget raised the ST welfare allocation to ₹1,020 crore (Deshabhimani, 2026). Kerala's ST welfare architecture intersects directly with national forest rights legislation, since a substantial share of the state's tribal population resides within or adjacent to forest areas governed by the Forest Rights Act, 2006, which recognises the rights of forest-dwelling Scheduled Tribes and other traditional forest dwellers to live in and cultivate forest land they have traditionally occupied — a legal and administrative framework whose implementation in Kerala intersects directly with the forest cover and biodiversity conservation priorities discussed in Chapter 13, creating a recurring tension between conservation objectives and tribal land and livelihood rights that this report flags as requiring continued, case-by-case institutional attention rather than a one-time policy resolution. Welfare schemes specific to Scheduled Tribes, catalogued through the Vikaspedia social welfare framework, span housing, education scholarships, livelihood support and health insurance, mirroring the structure of SC-focused schemes but layered with additional forest-rights and land-titling components specific to the tribal context (Vikaspedia, 2024).

7.3 Other Backward Classes: Identification, Reservation and Social Mobility

Kerala's Other Backward Classes (OBC) reservation framework operates within the broader national legal architecture governing caste-based affirmative action, including the 2024 Supreme Court ruling — delivered by a seven-judge bench — that upheld the constitutional validity of sub-classification within Scheduled Caste and Scheduled Tribe categories, clarifying that while the Presidential Scheduled List itself must remain homogeneous, states retain the power under Articles 15(4) and 16(4) of the Constitution to adopt sub-classification or other targeted policies to ensure equitable distribution of affirmative-action benefits within these categories (Wikipedia, 2026).

This ruling has direct relevance for Kerala's own OBC and Socially and Educationally Backward Classes (SEBC) framework, since Kerala has historically operated a relatively granular internal classification of backward communities — reflecting the state's unusually complex caste and community landscape, itself a function of the religious and community plurality documented in Chapter 1 — and the 2024 ruling provides clearer constitutional grounding for continuing or refining such sub-classification where evidence shows meaningfully different levels of socioeconomic backwardness within nominally single reservation categories. As with the SC population discussed in section 7.1, the research literature continues to document significant inter-caste disparity vis-à-vis socially advanced communities in respect of educational attainment among OBC and SEBC household heads in Kerala (Deshpande, 2000, as cited in IJMRR, 2024), indicating that reservation policy alone, while a necessary instrument, has not been sufficient on its own to close attainment gaps fully even in a state with Kerala's generally strong educational infrastructure.

7.4 Gender Equity: Women's Participation in Education, Economy and Governance

Kerala's gender equity profile presents one of the most striking internal contradictions documented anywhere in this report. On the demographic and educational dimensions discussed in Chapters 1 and 5, Kerala's gender indicators are unambiguously the strongest in India: the state's sex ratio of 1,084 females per 1,000 males is the most favourable of any Indian state, and the gender-focused interventions under Samagra Shiksha have helped deliver secondary education enrolment and retention rates for girls that match or exceed those for boys. Yet on economic participation, the picture inverts sharply: as documented in Chapter 3, youth unemployment among young women in Kerala reached 47.1 per cent in the most recent PLFS round, against 19.3 per cent for young men — one of the largest gender employment gaps recorded in any major Indian state, and one that exists despite, rather than because of, any deficit in female educational attainment (PLFS, 2025, as cited in StudyIQ, 2025).

Women's welfare allocations in the state budget, at ₹706 crore for 2025–26 specifically for women's social security programmes (Deshabhimani, 2026), sit within a far larger and more diffuse set of programmes addressing gender equity indirectly — Kudumbashree's network of women's self-help groups, discussed extensively in Chapters 3 and 6, remains the single most consequential gender-focused economic intervention in the state, having mobilised women into community enterprises, credit access, and local governance participation at a scale that few comparable programmes elsewhere in India have matched. The persistence of the employment-participation gap despite this scale of intervention indicates that Kudumbashree-style community mobilisation, while valuable, has not by itself been sufficient to close the gap between women's educational attainment and their formal labour market outcomes — the central finding of Chapter 3's labour market analysis, and one this chapter's gender equity discussion confirms from the complementary angle of welfare and social mobilisation policy specifically.

7.5 Child Rights, Protection and Development: POCSO, Child Labour and Nutrition

Kerala's child protection framework operates through the standard national legal architecture — principally the Protection of Children from Sexual Offences (POCSO) Act, 2012, and the Juvenile Justice (Care and Protection of Children) Act — implemented through the state's network of Child Welfare Committees and Special Juvenile Police Units, alongside national schemes such as Mission Vatsalya, the umbrella child-safety scheme administered through the Ministry of Women and Child Development, which Kerala implements in coordination with its own state-specific child welfare institutions (Slideshare, 2024). Kerala's child labour incidence is low by Indian standards, consistent with the near-universal elementary school retention documented in Chapter 5 — since high school retention and low child labour are, across virtually all Indian states, strongly inversely correlated outcomes of the same underlying set of household and policy conditions. The nutrition dimension of child welfare, addressed in greater institutional detail in Chapter 6, intersects with this section principally

through the ICDS anganwadi network's dual mandate of nutrition delivery and basic child protection monitoring at the community level, an integration that mirrors the broader pattern of decentralised, locally embedded service delivery this report has identified repeatedly, in Chapters 6 and elsewhere, as a distinguishing institutional feature of Kerala's welfare architecture.

The psychosocial dimension of child welfare specific to Kerala's migration-intensive household structure, discussed in Chapter 6's treatment of transnational families, represents a further child-protection consideration specific to the state: children in households with a long-term-absent migrant parent face a documented set of risks — reduced parental supervision, altered household authority structures, and in some cases increased vulnerability to exploitation — that mainstream child protection frameworks designed around a two-resident-parent household model do not always adequately address, and that this report flags, consistent with the recommendation in Chapter 6, as meriting dedicated policy attention specific to Kerala's demographic structure.

7.6 Welfare of Elderly Persons: Pension, Care Infrastructure and Policy

Given the advanced population ageing documented in Chapters 1 and 6, elderly welfare is among the most consequential, and most rapidly growing, components of Kerala's social welfare architecture. The state's social security pension system, which extends well beyond elderly welfare alone to cover widows, persons with disabilities, and other vulnerable categories, disbursed ₹33,210 crore over the 42 months preceding the 2025–26 budget announcement, providing what the state government characterises as financial stability for elderly and vulnerable populations across the state (Deshabhimani, 2026).

This pension architecture, examined further in section 7.9's discussion of the overall social security framework, represents a major and growing fiscal commitment that connects directly to the committed-expenditure pressure documented in Chapter 2 — pension expenditure, alongside salaries and interest payments, was identified there as one of the three components consuming roughly 71 per cent of the state's estimated revenue receipts. As Kerala's population continues to age at a pace faster than almost any other Indian state, as documented in Chapter 6, this pension commitment can be expected to grow in absolute terms even if per-beneficiary payment levels are held constant, reinforcing the urgency, flagged in Chapter 2, of broadening the state's own-revenue base to sustain these welfare commitments without further compromising the capital expenditure space already shown to be severely constrained. Beyond cash transfers, dedicated elderly care infrastructure — old-age homes, palliative care networks (including the community-based palliative care model administered through local self-government bodies and referenced in Chapter 6's discussion of the Total Mental Health initiative's institutional architecture), and day-care centres — remains comparatively underdeveloped relative to the scale of the elderly population the state's demographic trajectory implies it will need to serve within the coming decade, a gap this report identifies as a priority area for the Vision 2047 roadmap developed in Chapter 21.

7.7 Persons with Disabilities: Rights, Accessibility and Empowerment

Kerala's framework for persons with disabilities operates within the Rights of Persons with Disabilities Act, 2016, supplemented by state-specific welfare schemes including monthly pensions for persons with disabilities and targeted health insurance coverage — at the national level, schemes provide insurance coverage of up to ₹1,00,000, renewable annually, specifically for persons with autism, cerebral palsy, intellectual disability and multiple disabilities, implemented in Kerala alongside the state's own complementary social security pension provisions (Slideshare, 2024).

As noted in Chapter 5's discussion of special education, the available sources reviewed for this report do not provide Kerala-specific, disaggregated data on disability prevalence, schooling outcomes, or employment outcomes with the granularity available for most other social indicators discussed in this report — a data gap that limits this section's ability to assess, with precision, whether Kerala's generally strong social development profile extends as fully to disability outcomes as it does to the gender, caste, and elderly welfare dimensions discussed elsewhere in this chapter. The general institutional pattern observed throughout this report — strong policy architecture and welfare commitment, set against specific implementation and data gaps — appears, on the limited evidence available, to apply to disability welfare as much as to the other social justice dimensions examined in this chapter, reinforcing the case made in Chapter 5 and reiterated here for dedicated statistical strengthening specifically focused on disability-disaggregated outcome data, a priority carried forward into Chapter 20.

7.8 Minority Communities: Development, Representation and Welfare

Kerala's religious plurality, documented extensively in Chapter 1, gives the state's minority welfare framework a distinctive scope relative to most other Indian states: minority welfare in Kerala encompasses not only the Muslim community — the largest religious minority nationally and the framework's primary national-level focus — but also the state's substantial Christian population, spanning Catholic, Orthodox, Jacobite, Marthoma and Protestant denominations, each with its own distinct community institutions, educational trusts, and welfare networks that have historically played a significant role in the state's broader social development, as noted in Chapter 1's discussion of community-driven investment in education and healthcare. The 2025–26 state budget allocated ₹105 crore specifically for minority welfare social security programmes (Deshabhimani, 2026), a modest figure in absolute terms relative to the SC and ST allocations discussed in sections 7.1 and 7.2, reflecting both the comparatively smaller scale of dedicated minority-specific welfare programming relative to caste-based programming and the fact that a substantial share of effective minority welfare support in Kerala has historically been delivered through community and religious institutional channels — schools, hospitals and cooperative credit societies run by churches and Muslim community organisations — rather than through state budgetary allocation alone, a pattern distinct from the SC and ST welfare architecture

discussed earlier in this chapter, which relies much more heavily on direct state programming given the comparative absence of equivalent historical community-institutional infrastructure for those groups.

7.9 Social Security and Beneficiary-Linked Welfare Architecture

Drawing together the evidence assembled across this chapter, Kerala's social security and welfare architecture exhibits a consistent structural pattern: a dense, overlapping set of beneficiary-linked schemes — caste-based sub-plans, gender-focused programmes, elderly pensions, disability pensions, minority welfare allocations, and the cross-cutting Kudumbashree platform — administered through a decentralised, panchayat-engaged delivery system that this report has identified, in Chapters 6 and elsewhere, as one of Kerala's genuine comparative institutional strengths. The fiscal scale of this architecture is substantial: ₹33,210 crore in social security pensions alone over 42 months, alongside the SC, ST, women's and minority allocations discussed in this chapter, and the KASP health coverage discussed in Chapter 6, together represent one of the most extensive sub-national welfare commitments in India relative to state population and fiscal capacity. The structural tension this chapter has documented repeatedly — strong policy design and budgetary commitment, set against persistent outcome gaps (in SC and OBC educational and economic attainment, in the gender employment gap, in elderly care infrastructure, and in disability data and accessibility) — suggests that the next phase of social justice policy in Kerala needs to focus less on expanding the architecture of schemes, which is already extensive by national standards, and more on closing the gap between scheme design and on-the-ground outcome delivery: strengthening implementation monitoring, expanding disaggregated outcome data collection (a recommendation that recurs across this chapter and Chapters 5 and 6 alike), and ensuring that the fiscal sustainability concerns documented in Chapter 2 do not erode the real value of pension and welfare payments even as committed expenditure pressure intensifies. This combination of priorities — sustaining welfare commitments while improving their delivery precision — defines the social justice component of the Vision 2047 roadmap addressed in Chapter 21.

Chapter 8: Transport and Connectivity Infrastructure

8.1 Road Network: National Highways, State Highways and Rural Roads

Kerala's road network remains the dominant mode of passenger and freight movement within the state, a pattern consistent with the settlement geography documented in Chapter 1, where population is dispersed across a near-continuous corridor of small and medium towns rather than concentrated around a small number of large urban cores best served by rail or mass transit. The state's industrial infrastructure base, as noted in Chapter 4, includes eleven national highways covering approximately 1,200 kilometres (Avasant, 2026), a network that the 2025 Invest Kerala Global Summit's associated Union government commitment of ₹50,000 crore for 31 new road projects spanning 896 kilometres is intended to substantially expand, as part of a wider, nationally announced ₹3,00,000 crore road-investment programme (IBEF, 2025).

Among the most consequential of Kerala's own state-funded road projects is the planned 625-kilometre Kerala Coastal Highway, running parallel to the Arabian Sea from Pozhiyoor in Thiruvananthapuram district to Kunjathur in Kasaragod district, designed to provide a dedicated coastal transport spine distinct from the congested National Highway 66 corridor that currently carries the bulk of Kerala's north–south traffic (InfraInfoHub, 2025). A second major road initiative, the Outer Ring Road connecting National Highway 66 at Navaikulam with Vizhinjam Port, Thekkada and Mangalapuram, is estimated at ₹4,868 crore and is intended specifically to relieve the port-access congestion that a facility of Vizhinjam's scale, discussed further in section 8.4, would otherwise generate on Thiruvananthapuram's existing urban road network; land acquisition and bidding for this project were reported to be underway as of the most recent reporting available (InfraInfoHub, 2025). Rural road connectivity, delivered principally through the Pradhan Mantri Gram Sadak Yojana (PMGSY) framework discussed in fuller detail in Chapter 12, benefits in Kerala from the state's comparatively dense and dispersed settlement pattern, which has historically required, and received, a correspondingly dense rural road network relative to many other Indian states with more nucleated village settlement patterns.

Kerala's overall road density, when measured per unit of geographical area rather than per capita, ranks among the highest of any Indian state, a direct structural consequence of the dispersed, near-continuous small-town settlement pattern documented in Chapter 1, under which even comparatively rural panchayats require road access standards closer to those of peri-urban areas elsewhere in India simply to connect the dense lattice of small towns, market centres, and residential clusters that characterise Kerala's settlement geography. This high road density, however, coexists with significant congestion and capacity constraints on the state's principal arterial corridors, most notably National Highway 66, which carries a disproportionate share of both passenger and freight movement along the length of the state precisely because the rail network discussed in section 8.2 offers only a single parallel coastal corridor with limited capacity for further expansion without major new investment. The practical consequence, widely documented in state planning literature, is that average vehicular speeds on Kerala's primary highway corridors during peak periods are often well below the speeds theoretically achievable on a national highway of comparable classification elsewhere in India, a congestion cost that the Coastal Highway and Outer Ring Road projects

discussed above are specifically designed to address by providing dedicated alternative corridors rather than relying solely on further widening of the existing, already heavily built-up NH-66 alignment.

The Outer Ring Road project illustrates well the practical institutional and political challenges typical of major linear road infrastructure in Kerala's specific land-tenure and settlement context. Because the proposed alignment passes through a corridor combining dense residential settlement, agricultural land, and a mix of industrial and commercial zones near Thiruvananthapuram, land acquisition has proceeded incrementally and required negotiation across a large number of individual landholdings rather than the comparatively simpler acquisition processes possible in states with larger contiguous government or low-value agricultural landholdings available along a given alignment. This pattern — land acquisition as the binding constraint on project timelines, more so than financing or engineering design — recurs across virtually every major road and rail project examined in this chapter, including the Silver Line's land-acquisition contestation discussed in section 8.2 and the Vizhinjam rail link's land-acquisition requirements in Balaramapuram, Pallichal and Athiyannoor discussed in section 8.4, and reflects a structural feature of infrastructure delivery in a state with Kerala's population density and land-fragmentation pattern that this report identifies as a cross-cutting constraint applicable to the entire infrastructure programme catalogued in this chapter, rather than a problem specific to any single project.

8.2 Railways: Existing Network, Pending Projects and Expansion Proposals

Kerala's existing railway network comprises approximately 2,106 kilometres of track (Avasant, 2026), operating along a predominantly coastal, single corridor alignment that mirrors the state's narrow north–south geography documented in Chapter 1. This existing network's principal structural limitation is well documented and widely discussed within the state: a single main coastal trunk line carries the overwhelming majority of both passenger and freight rail traffic, creating a capacity bottleneck which the most ambitious of Kerala's pending rail projects, the Thiruvananthapuram–Kasaragod Silver Line, is specifically designed to relieve. The Silver Line, a proposed 530.6-kilometre semi-high-speed rail corridor with trains operating at speeds up to 200 kilometres per hour, would connect 11 districts and reduce travel time between Thiruvananthapuram and Kasaragod from the existing 10 to 14 hours to approximately four hours, at an estimated total project cost of around ₹67,000 crore, with a targeted completion date of 2027 (InfraInfoHub, 2025; The Metro Rail Guy, 2025). The project, developed by the Kerala Rail Development Corporation (K-Rail), a joint venture between the state government and the Ministry of Railways, includes plans for five new townships at Thiruvananthapuram, Kollam, Kottayam, Ernakulam and Thrissur, intended to anchor transit-oriented urban development along the corridor (The Metro Rail Guy, 2025). The project's feasibility report was submitted by SYSTRA MVA Consulting in May 2019, with the Detailed Project Report approved by K-Rail's board in April 2020, including an added station at Cochin International Airport (The Metro Rail Guy, 2025); however, the project has faced sustained political and environmental contestation

since its announcement, centred on land acquisition requirements, ecological concerns along the alignment, and disputes over the project's debt-financing structure, and its actual completion timeline relative to the original 2027 target remains, on the evidence available to this report, uncertain.

The specific sources of contention surrounding the Silver Line are instructive for understanding the broader institutional challenge of delivering large-scale infrastructure in Kerala's particular political and ecological context. Land acquisition for the corridor's alignment, which passes through some of the state's most densely populated midland and lowland districts, has generated sustained local resistance from affected landholders, a pattern consistent with land acquisition difficulties documented across virtually all large linear infrastructure projects in densely settled parts of India, but rendered especially acute in Kerala given the unusually high population density and correspondingly high land-acquisition cost and disruption documented in Chapter 1.

Environmental objections have focused on the project's elevated and embankment-based alignment through low-lying paddy fields, wetlands and backwater-adjacent areas, raising concerns about altered drainage patterns and flood risk in a state whose climate vulnerability is examined in detail in Chapter 14 — concerns that the more recently proposed eight-track freight network, discussed below, has attempted to address more explicitly through its stated commitment to elevated and tunnelled alignments specifically through ecologically sensitive zones. Financing-structure disputes have centred on the project's reliance on external debt, including loans from multilateral and bilateral development finance institutions, raising questions about how Silver Line debt service obligations would interact with the state's already constrained fiscal position documented in Chapter 2, where total liabilities as a share of GSDP were shown to be rising and where capital expenditure capacity was shown to be persistently squeezed by revenue-side pressures.

A further, considerably more ambitious rail proposal under public discussion is an eight-track railway network organised around a coastal spine and a parallel Central/Eastern Spine of approximately 420 kilometres connecting Kottayam and Pathanamthitta in the south through Idukki, Thrissur and Palakkad to Wayanad in the north, explicitly designed to integrate Kerala's interior agricultural, hydropower and forest-based industrial zones with the coastal ports of Kochi and Vizhinjam (RailInfra, 2025). This proposal envisages five to six major multimodal freight terminals at Kochi, Kozhikode, Kollam and Kannur, inland container depots at Palakkad, Kochi and Kozhikode, integration with all four of the state's international airports and with Vizhinjam port, and a phased implementation timeline running from 2026 to 2030, with early operational sections between Thiruvananthapuram and Kochi targeted for 2029 (RailInfra, 2025). Notably, this proposal places explicit emphasis on environmental sustainability — elevated and tunnelled alignments through ecologically sensitive wetland, backwater and Western Ghats foothill areas, solar rooftop power generation at stations, and regenerative braking systems — reflecting a direct attempt to address the ecological contestation that has dogged the Silver Line proposal, and connecting this section's

infrastructure discussion directly to the environmental governance framework examined in Chapter 13 and the climate vulnerability assessment in Chapter 14. Whether this more recent, freight-oriented eight-track proposal is intended to substitute for, complement, or eventually supersede the existing Silver Line project is not fully resolved in the sources reviewed for this report, and represents precisely the kind of large-scale infrastructure sequencing decision that the institutional capacity-building agenda discussed in Chapter 4's treatment of public-private partnerships will need to resolve clearly if either project is to proceed to construction within its stated timeline.

The underlying economic rationale for pursuing dedicated freight rail capacity at all, rather than continuing to rely on Kerala's road network to carry growing freight volumes, rests on a set of considerations that recur across multiple chapters of this report. Kerala's road network, as documented in section 8.1, already operates close to capacity on its principal arterial corridors, and the projected growth in containerised export volumes flowing through Vizhinjam and the state's other ports, discussed in section 8.4, combined with the anticipated freight generation from the Kochi–Bengaluru Industrial Corridor discussed in Chapter 4, would, absent new freight rail capacity, be forced onto an already congested road network whose further widening faces the same land-acquisition and density constraints documented throughout this chapter. Rail freight is additionally markedly more energy-efficient per tonne-kilometre than road freight, a consideration that connects this section directly to the renewable energy and emissions-reduction priorities discussed in Chapter 9 and the climate action planning discussed in Chapter 14. The eight-track proposal's explicit framing around dedicated freight tracks separate from passenger services reflects international best practice in major freight corridor design, avoiding the capacity conflicts and scheduling complexity that arise when freight and high-frequency passenger services must share the same physical infrastructure — a lesson Indian Railways has itself drawn from its own Dedicated Freight Corridor programme operating in northern and western India, and which Kerala's planners appear to be deliberately importing into the state's own freight rail planning.

8.3 Aviation: Airport Infrastructure and Air Connectivity

Kerala's aviation infrastructure is unusually dense for a state of its population and geographic size: the state currently operates four international airports — at Thiruvananthapuram, Kochi (Cochin International Airport), Kozhikode (Calicut) and Kannur — with a fifth international airport planned for Kottayam (Avasant, 2026). This concentration of four operational international airports within a single relatively compact state is distinctive among Indian states and reflects, in large part, the scale of outbound passenger demand generated by the Gulf migration economy documented extensively in Chapter 3: each of Kerala's four existing international airports carries substantial Gulf-bound and Gulf-origin passenger traffic, and the planned fifth airport at Kottayam is intended in part to further decongest this already dense network and to extend convenient air access to central Kerala districts not optimally served by the existing four facilities. Cochin International Airport, in particular, holds international recognition as the world's first fully solar-powered airport, an achievement that connects this

section directly to the renewable energy transition discussed in Chapter 9 and illustrates that Kerala's aviation infrastructure expansion has, at least in this instance, been pursued in tandem with rather than in tension with the state's environmental and climate commitments examined in Chapter 14. The proposed Silver Line rail corridor's planned station at Cochin International Airport, discussed in section 8.2, further illustrates the state's broader intent to integrate rail and air transport modes rather than allowing them to develop as entirely separate, uncoordinated networks.

The economic significance of this dense aviation network extends well beyond passenger convenience. Cochin International Airport has historically ranked among the busiest airports in India for international passenger traffic relative to the size of the city it serves, a function directly of the Gulf remittance economy documented in Chapter 3, and the airport's role as a cargo gateway has grown in tandem with the seafood and spice export growth discussed in Chapters 3 and 4, given the perishable-goods air-freight requirements of much of Kerala's marine product export trade. The planned expansion of Thiruvananthapuram airport, which forms part of the Adani Group's broader ₹30,000 crore investment commitment discussed in Chapter 4 alongside the Vizhinjam port and new logistics hub, is explicitly positioned to support the GCC and high-tech manufacturing ambitions discussed in that chapter, since multinational firms establishing Global Capability Centres in Thiruvananthapuram and Kochi require reliable, high-frequency international air connectivity for both business travel and the movement of specialised equipment, reinforcing the close interdependence this chapter has identified throughout between Kerala's transport infrastructure programme and its broader investment and industrial strategy. Kannur International Airport, the most recently commissioned of the state's four international gateways, was specifically developed to extend this aviation-driven connectivity to Kerala's northern Malabar region, addressing what had historically been a relative connectivity disadvantage for the state's northern districts relative to the more aviation-dense southern and central corridors anchored around Thiruvananthapuram and Kochi.

8.4 Ports, Inland Waterways and Logistics Hubs

The Vizhinjam International Seaport, discussed at length in Chapter 4 as the flagship public-private partnership anchoring Kerala's current investment strategy, is the single most transformative infrastructure project examined in this chapter. Developed as a partnership between the Government of Kerala and Adani Ports and Special Economic Zone Limited, Vizhinjam is positioned just ten nautical miles from major international east–west shipping lanes, allowing it to compete directly for transshipment cargo currently handled by ports such as Colombo and Singapore rather than within India itself (Avasant, 2026; The South First, 2025).

The economic logic underpinning Vizhinjam's transshipment strategy rests on a structural deficiency in India's existing major port network: none of India's existing container ports possess the natural deep draft — Vizhinjam's is reported at over 18 metres, sufficient to

accommodate the largest container vessels currently in global service without dredging — that would allow them to handle the largest classes of mother vessels directly, meaning Indian container cargo destined for or originating from these largest vessels has historically had to be transshipped through intermediate hub ports outside India, most commonly Colombo in Sri Lanka, before continuing to its final origin or destination.

This arrangement has imposed additional time, cost and logistical complexity on India's container trade for decades, and has been a long-standing concern of India's maritime policy establishment; Vizhinjam's natural deep-water draft is intended to allow India to capture this transshipment value domestically for the first time at meaningful scale. The port's strategic location near the southern tip of the Indian peninsula, close to the main east–west shipping lanes connecting Europe, the Middle East and East Asia, reinforces this positioning, since the port does not need to compete on proximity to any single major Indian industrial or consumption centre but rather on its position relative to the global shipping network itself — a distinctive characteristic that sets Vizhinjam apart from conventional Indian gateway ports such as Mumbai's Jawaharlal Nehru Port or Chennai, which are positioned primarily to serve their immediate hinterland.

The port's road connectivity — the 1.7-kilometre link to National Highway 66 — was reported to be in its final stages of completion as of the most recent reporting available, while the dedicated rail connectivity project linking the port to Balaramapuram railway station, spanning 10.7 kilometres with 9.43 kilometres running through an underground tunnel, is projected for completion by December 2028, with land acquisition covering 4.6 hectares across Balaramapuram, Pallichal and Athiyannoor nearing completion and the detailed project report from Konkan Railway Corporation Limited awaiting cabinet approval before construction can begin (Construction World, 2025). This rail-link timeline — 2028, a full year or more after the port's own core infrastructure was targeted for substantial completion — illustrates a recurring sequencing risk in large Indian infrastructure projects: a flagship facility (the port itself) can become operational and begin handling cargo, as Vizhinjam has already done in handling India's largest container vessel (noted in Chapter 4), well before the surface transport connectivity needed to move that cargo efficiently inland is itself complete, creating a multi-year window in which the port's throughput potential is constrained by access bottlenecks on the very Outer Ring Road and rail-link projects discussed in sections 8.1 and 8.2.

Beyond Vizhinjam, Kerala's other ports — Kochi, Kollam and Kannur — are envisaged within the eight-track freight rail proposal discussed in section 8.2 as the network's other principal multimodal freight nodes, intended to handle seafood exports, petrochemical products and consumer goods specifically (RailInfra, 2025), a direct logistical complement to the seafood and rubber value-chain development priorities discussed in Chapter 4. Kerala's inland waterway network, comprising the state's extensive backwater system documented in Chapter 1's discussion of the coastal plain's lagoons and wetlands, has historically functioned more as a tourism and local transport asset, discussed further in Chapter 19, than as a

significant freight logistics corridor, though the eight-track rail proposal's emphasis on minimising land disturbance in wetland and backwater areas suggests planners are conscious of the need to avoid further degrading this same waterway system even as freight rail capacity is expanded alongside it.

Kerala's backwater network, spanning roughly 1,500 kilometres of interconnected lakes, canals, rivers and estuaries, was historically a far more significant freight corridor than it is today, having served for much of the nineteenth and twentieth centuries as the principal means of transporting plantation cash crops — rubber, coconut and spices, the same commodities discussed in Chapter 4's value-chain analysis — from the interior production areas to the coastal ports for export, before the post-Independence expansion of the road network documented in section 8.1 progressively displaced water transport as the dominant freight mode. The National Waterway 3 designation, covering the West Coast Canal between Kollam and Kottapuram alongside the Champakara and Udyogamandal canals, formally recognises this historic waterway corridor's continuing freight potential, though actual freight utilisation has remained modest relative to the corridor's nominal capacity, constrained by limited dredging maintenance, draft restrictions at several points along the alignment, and the competing, better-funded road and emerging rail freight options discussed elsewhere in this chapter.

The principal contemporary economic activity on Kerala's backwaters is tourism-oriented houseboat and passenger ferry traffic, examined in Chapter 19's treatment of tourism infrastructure, rather than commercial freight movement, and any future effort to revive the waterway network's freight role — a possibility that would align well with the low-carbon, sustainable-transport priorities discussed in connection with the eight-track rail proposal and the broader climate and environmental governance framework of Chapters 13 and 14 — would require dedicated capital investment in dredging, lock infrastructure and terminal facilities that has not, on the evidence reviewed for this report, been allocated at meaningful scale within the current infrastructure investment programme.

8.5 Urban Mass Transit: Metro, Bus Rapid Transit and Integrated Mobility

Kerala's urban mass transit infrastructure is most advanced in Kochi, where the Kochi Metro has operated as the state's flagship urban rail system since its initial opening, complemented distinctively by the Kochi Water Metro, a hybrid passenger ferry system that leverages the city's extensive backwater and lagoon geography to provide rapid, low-emission cross-water transit in a manner that conventional metro rail alone could not replicate given Kochi's island-and-waterway urban form. A major expansion of this water-based transit system is underway: the Kochi Water Metro Extension Project, adding ten new routes and forty new jetties connecting the islands of Vypin, Bolgatty and Willingdon among other areas, carries an estimated budget of ₹1,000 crore and is being jointly funded and constructed by the Government of Kerala and Germany's KfW Development Bank, with completion targeted for 2025 (InfraInfoHub, 2025). This water-metro model represents a genuinely distinctive

contribution to Kerala's urban transport policy toolkit, one not widely replicated elsewhere in India, and is consistent with the state's broader pattern, documented throughout this report, of adapting infrastructure design to its unusual coastal and backwater geography rather than defaulting to generic, land-based mass-transit templates designed for cities without comparable waterway networks.

The Kochi Metro itself, while a genuine achievement in bringing rail-based urban transit to Kerala for the first time, has faced recurring ridership and financial sustainability challenges typical of mid-sized Indian metro systems built in cities without the population density of Delhi, Mumbai or Bengaluru, where fare revenue alone has in most cases proven insufficient to cover full operating costs, let alone capital debt service, requiring continued state government operational support. This financial pattern is consistent with the broader public-enterprise performance challenges documented in Chapter 4, and underscores why the integration of metro rail with the lower-capital-cost, higher-flexibility water metro and a revitalised bus network, discussed below, is not merely a matter of commuter convenience but a financial sustainability necessity: a metro system operating in relative isolation from complementary feeder transit modes is less likely to achieve the ridership density needed to approach full cost recovery than one that is genuinely integrated into a wider multimodal network with coordinated ticketing, scheduling and last-mile connectivity. A separate light metro project has been proposed for Kozhikode, intended to extend urban rail-based mass transit beyond Kochi to Kerala's other major urban centres, though the available sources reviewed for this report indicate this project remains at a comparatively earlier planning stage than the Kochi systems discussed above (InfraInfoHub, 2025).

Beyond the metro and water-metro systems concentrated in Kochi, the great majority of Kerala's urban and intercity public transport continues to be carried by conventional bus services, operated by a combination of the state-owned Kerala State Road Transport Corporation (KSRTC), whose financial and operational challenges were examined in detail in Chapter 4's discussion of public sector undertaking performance, and a large private bus operator sector that handles a substantial share of intercity and intra-district routes. The financial distress documented at KSRTC in Chapter 4 — accumulated losses of approximately ₹10,000 crore and depot-level efficiency well below optimal benchmarks — has direct implications for this chapter's mass transit discussion, since KSRTC's fleet condition, route frequency and service reliability fall well short of what a genuinely integrated, multimodal urban mobility system would require to complement the newer metro and water-metro investments. The proposed private-capital infusion into KSRTC discussed in Chapter 4 has, accordingly, a direct urban-mobility-policy rationale beyond its narrower public-finance motivation: a revitalised, adequately resourced bus network is the necessary connective tissue linking Kerala's new high-capital-cost rail and water transit investments to the dispersed, small-town settlement pattern documented in Chapter 1, which neither metro rail nor water metro alone can realistically be extended to serve at the necessary density.

8.6 Multimodal Logistics: Last-Mile Connectivity and Freight Corridors

The cumulative infrastructure programme documented across this chapter — the Coastal Highway and Outer Ring Road discussed in section 8.1, the Silver Line and eight-track freight rail proposals discussed in section 8.2, the four-airport aviation network discussed in section 8.3, the Vizhinjam port and its still-incomplete surface connectivity discussed in section 8.4, and the Kochi Metro and Water Metro systems discussed in section 8.5 — is, considered as a whole, oriented towards a single underlying strategic objective: converting Kerala's traditionally road-dominated, single-rail-corridor transport geography into a genuinely multimodal logistics network capable of supporting the export-oriented growth corridors identified in Chapter 3 (the blue economy, seafood and rubber value chains) and the inter-state and international investment ambitions documented in Chapter 4 (the Kochi–Bengaluru Industrial Corridor, GIFT City Kochi, and Vizhinjam's transshipment ambitions).

The GIFT City Kochi project, a proposed 220-hectare global financial and trade hub at Ayyampuzha near Aluva, positioned as an early-bird project under the Kochi–Bengaluru Industrial Corridor and projected to generate more than 50,000 jobs (InfraInfoHub, 2025), exemplifies this integration: its location adjacent to the Aluva industrial belt discussed in Chapter 4 and its corridor linkage to Bengaluru depend directly on the road, rail and port connectivity improvements catalogued throughout this chapter being delivered on broadly compatible timelines. The principal risk this chapter's evidence identifies, most starkly illustrated by the Vizhinjam port-versus-rail-link sequencing gap discussed in section 8.4, is that Kerala's flagship facilities — ports, airports, IT parks, industrial corridors — have in several cases advanced faster than the surface transport connectivity needed to realise their full economic potential, a sequencing and inter-agency coordination challenge that this report identifies as a priority area for the institutional capacity-building agenda developed in Chapter 4's public-private partnership discussion and carried forward into the State Vision 2047 roadmap of Chapter 21.

The financing and institutional-coordination dimension of this sequencing challenge deserves particular emphasis. Each of the major projects catalogued in this chapter — Vizhinjam (a state–private PPP), the Silver Line (a state–central joint venture through K-Rail), the proposed eight-track freight network (a still-conceptual proposal without a confirmed implementing institution at the time of the sources reviewed for this report), the Kochi Water Metro Extension (a state–German bilateral development finance partnership), and the Outer Ring Road and Coastal Highway (primarily state-funded with land acquisition still in progress) — is structured under a different financing and governance arrangement, with different lead agencies, different approval chains, and in several cases different and only loosely coordinated timelines.

This institutional fragmentation is not unique to Kerala among Indian states, but it is a particularly consequential constraint here given the sheer number of large, simultaneously active infrastructure projects the state is currently pursuing relative to its administrative capacity and fiscal base, as documented in Chapter 2. A dedicated cross-agency infrastructure

delivery coordination mechanism — bringing together K-Rail, the Kerala Infrastructure Investment Fund Board discussed in Chapter 2, the Kerala State Industrial Development Corporation discussed in Chapter 4, the National Highways Authority of India, and the relevant port and airport authorities under a single delivery-tracking and sequencing framework — would directly address the specific access-bottleneck risk illustrated by the Vizhinjam rail-link timeline gap, and represents, in this report's assessment, the single most actionable near-term institutional reform available to improve the pace and coherence of Kerala's infrastructure delivery over the remainder of this decade.

Chapter 9: Energy, Power and Renewable Transition

9.1 Power Generation: Installed Capacity, Mix and Dependence Profile

Kerala's electricity system presents a structural paradox that recurs across several other sectors examined in this report: an unusually strong and well-managed utility, the Kerala State Electricity Board Limited (KSEBL), operating within a state whose own generation capacity has chronically lagged behind demand, requiring substantial and growing reliance on imported power. As of September 2025, Kerala's total installed power generation capacity, including both state and central allocations, stood at 7,760 MW, comprising thermal capacity of 3,109.55 MW, renewable energy capacity of 2,324.34 MW, hydropower capacity of 1,964.15 MW, and nuclear-sourced allocation of 362 MW, distributed across state utilities (2,342.01 MW), central utilities (2,621.09 MW), and the private sector (2,796.94 MW) (IBEF, 2025).

KSEBL's own directly owned generation fleet, however, is considerably smaller: the utility's installed capacity grew from an initial 109 MW at its founding in 1957 to 2,482.42 MW by 2023–24, spanning 31 hydroelectric projects, seven solar projects, two diesel power plants and one wind farm (Renewable Watch, 2025; Wikipedia, 2026). This gap between the state's much larger total installed-and-allocated capacity figure and KSEBL's own substantially smaller directly owned generation fleet reflects Kerala's long-standing dependence on power imported from the central grid and from power purchase agreements with private generators located both inside and outside the state, most notably the 359.58 MW thermal plant established by NTPC at Kayamkulam in 1998–99, for which KSEBL holds a long-term power purchase agreement (KSEB, 2026).

The scale of this import dependence is considerable and has been rising. Of the 25,144 million units (MU) of electricity consumed in Kerala in 2021, only 7,057 MU — roughly twenty-eight per cent — was met by the state's own generation capacity, with the remaining 18,912 MU, or seventy-two per cent, imported from outside the state (KSEBL, 2023, as cited in WRI India, 2024). More recent figures show Kerala's internal generating capacity at approximately 3,819 MW against a 2023–24 peak power demand of 5,301 MW (Renewable Watch, 2025), a gap of nearly 1,500 MW that must be bridged through imports and purchase agreements even at the capacity level, before accounting for the fact that hydro-dominated capacity, examined further in section 9.4, cannot always be relied upon to generate at its full rated capacity year-round given seasonal reservoir constraints.

This roughly seventy per cent import dependence places Kerala in a structurally different position from power-surplus states such as Gujarat or coal-rich states such as Chhattisgarh and Odisha, and represents arguably the single most consequential energy-security vulnerability examined in this chapter: a state whose economic growth, industrial ambitions documented in Chapter 4, and growing residential and commercial demand are all dependent on the continued availability and pricing stability of power generated largely outside its own borders and largely from fossil fuel sources, even as the state pursues an ambitious renewable transition agenda examined in section 9.4.

This import dependence has deepened in the period for which the underlying consumption data are available: Kerala's electricity demand grew by nearly forty-five per cent between the early 2020s and 2021 alone, a growth rate that substantially outpaced the corresponding growth in the state's own generation capacity over the same period, widening rather than narrowing the import-dependence gap documented above (WRI India, 2024). Peak demand figures illustrate the scale of the underlying system stress: the state's peak demand of 4,316.8 MW recorded on 27 March 2019 already exceeded KSEBL's own directly owned generation capacity at that time, and by 2023–24 peak demand had risen further to 5,301 MW (Government of Kerala, Department of Industries and Commerce, 2026; Renewable Watch, 2025), confirming that the gap between Kerala's own generation capability and its peak power requirement has been a structural and worsening feature of the state's power sector for at least half a decade, rather than a temporary or cyclical phenomenon.

This demand growth trajectory is itself a direct consequence of the economic and industrial expansion documented throughout Chapters 3 and 4 of this report: rising residential air-conditioning penetration associated with rising household income, the GCC and data-centre-intensive technology sector expansion discussed in Chapter 4, and the broader urbanisation and construction boom documented in Chapter 3 are all electricity-intensive activities whose continued growth will, absent a substantial acceleration in the state's own generation capacity addition, further deepen Kerala's reliance on imported power and expose the state's economic growth trajectory to risks associated with national grid capacity constraints, inter-state transmission bottlenecks, and the pricing volatility of short-term power markets.

This import-dependence profile places Kerala in a markedly different position from the handful of Indian states that have historically run power surpluses sufficient to export to neighbouring states, and underscores why the capacity-expansion targets discussed in section 9.5 — KSEBL's pursuit of 10,000 MW of installed capacity by 2030 — are appropriately understood not as an optional enhancement to an already adequate system, but as a necessary correction to a structural deficit that has persisted, and by some measures worsened, for at least the better part of a decade. The comparison with other southern Indian states is instructive: Tamil Nadu and Karnataka have both pursued large-scale wind and solar capacity addition over the past decade specifically to reduce their own historical dependence on power imports and thermal generation, and Kerala's later and more constrained start on utility-scale wind and solar development, discussed further in section 9.4, means the state now faces a more compressed timeline to close a comparable capacity gap, even as its land and ecological constraints, also examined in section 9.4, are in several respects more binding than those faced by its larger, less densely populated neighbours.

9.2 Transmission and Distribution: Infrastructure, Losses and Reliability

Notwithstanding the generation-capacity gap documented in section 9.1, KSEBL's transmission and distribution performance is, by Indian utility standards, genuinely exceptional. The utility has achieved one of the lowest aggregate technical and commercial (AT&C) loss rates of any major electricity distribution utility in India, consistently maintaining losses in single digits even as many other state distribution utilities continue to report AT&C losses well in excess of fifteen to twenty per cent, reflecting theft, billing inefficiency, and technical transmission losses combined (Renewable Watch, 2025).

Kerala's power system grid connects to the wider Southern Region Transmission system through 400 kV double-circuit lines, and a 2,000 MW high-voltage direct current (HVDC) station, commissioned by the Power Grid Corporation of India Limited, provides additional high-capacity interconnection that supports the scale of power imports documented in section 9.1 (Wikipedia, 2026). As of March 2020, the state's distribution network comprised 64,212 circuit-kilometres of 11 kV lines, 293,280 circuit-kilometres of low-tension lines, and 81,470 distribution transformers with a combined step-down capacity of 9,915 MVA (Government of Kerala, Department of Industries and Commerce, 2026). KSEBL serves nearly ninety-nine per cent of the state's electricity consumers directly, having sold 22,948.82 MU of power to 1,28,26,185 consumers, including eleven bulk licences, in 2019–20 (KSEB, 2026; Renewable Watch, 2025).

This near-universal direct-service coverage and consistently low AT&C loss performance represents a genuine institutional achievement when benchmarked against the wider Indian state utility sector, where distribution-segment financial losses driven by high technical and commercial losses have historically been the single largest source of fiscal stress within the broader Indian power sector, prompting repeated central government bailout and reform schemes such as the Ujwal DISCOM Assurance Yojana targeted at financially distressed state distribution utilities elsewhere in the country.

KSEBL's comparative success on this specific dimension stands in some tension with the broader public sector undertaking performance challenges documented in Chapter 4, where several of Kerala's other major PSUs — most notably the Kerala State Road Transport Corporation — were shown to carry substantial accumulated losses and significant operational inefficiency. KSEBL's relatively stronger performance appears attributable to a combination of factors: the technical and engineering rigour built up over nearly a century of continuous hydroelectric development documented in section 9.4, a comparatively dense and well-maintained distribution network reflecting Kerala's high population density and correspondingly shorter average distribution distances per consumer relative to more sparsely populated Indian states, and sustained capital investment in network modernisation through successive initiatives including Dyuthi 2021 and the more recent TransGrid 2.0 programme. The 2,000 MW HVDC interconnection with the Power Grid Corporation of India's national network, noted above, provides Kerala with a particularly high-capacity, low-loss conduit for the substantial power imports documented in section 9.1, illustrating that the same transmission infrastructure investment that supports renewable energy integration, discussed

in section 9.4, also directly enables the import dependence that section 9.1 identified as the state's principal energy security vulnerability — a dual role that underscores why transmission infrastructure investment cannot be assessed purely through a renewable-integration lens, but must also be evaluated for its role in sustaining Kerala's continued reliance on externally generated power.

Looking forward, KSEBL's TransGrid 2.0 initiative is specifically intended to develop intra-state high-capacity transmission corridors — explicitly framed as "green energy corridors" — to ensure power availability at all load centres with minimised losses as the share of variable, geographically dispersed renewable generation in the state's overall mix rises in line with the targets discussed in section 9.4 (Renewable Watch, 2025). This forward-looking transmission investment is a necessary complement to the renewable capacity expansion targets discussed below, since a renewable-heavy generation mix, with solar and wind output concentrated in specific geographic zones and subject to significant intraday and seasonal variability, places materially different demands on transmission infrastructure than the more predictable, centrally dispatched thermal and large-hydro generation that has historically dominated Kerala's power mix.

9.3 Rural and Household Electrification: Coverage and Quality

Kerala achieved comprehensive household electrification well ahead of most other Indian states, a position consistent with the state's broader infrastructure and social development achievements documented throughout this report. KSEBL's most recent electrification initiatives have shifted focus from achieving basic connection coverage — already close to complete — towards reaching the state's last remaining unconnected colonies and improving service quality and reliability for already-connected households: as of the most recent reporting reviewed for this chapter, twenty-nine such colonies have been electrified through dedicated KSEBL programmes (Renewable Watch, 2025).

Beyond electricity access itself, KSEBL has contributed to broader digital and communications infrastructure by supporting 4G network penetration across the state, leveraging its existing distribution network infrastructure and rights-of-way to facilitate telecommunications infrastructure rollout — a complementary infrastructure role that connects this section to the digital infrastructure and KFON broadband network discussed in Chapter 3 and Chapter 16 (Renewable Watch, 2025). The utility's Dyuthi 2021 project, implemented under the broader Oorjja Kerala Mission, specifically targeted distribution infrastructure quality improvements, addressing the kind of voltage stability, outage frequency, and load-shedding concerns that, even in a state with near-universal electrification, can substantially affect the lived experience of power supply reliability for households and small businesses alike (Department of Industries and Commerce, 2026).

The distinction between electrification coverage and electrification quality, implicit in this section's discussion of the Dyuthi 2021 programme, is analytically important for a state at

Kerala's stage of infrastructure development: national electrification statistics and rankings, which typically measure the binary question of whether a household has a grid connection at all, have limited diagnostic value for a state that achieved near-universal connection coverage decades ago, and risk masking the more economically consequential question of supply reliability — voltage fluctuation affecting sensitive electronic and industrial equipment, the frequency and duration of unplanned outages, and the adequacy of supply during peak demand periods discussed in section 9.1.

This distinction matters directly for the GCC and high-tech manufacturing investment ambitions discussed in Chapter 4, since multinational firms evaluating Kerala as a location for capital-intensive technology operations will weigh supply reliability and voltage quality at least as heavily as headline electrification coverage statistics, given that even brief power interruptions can be costly for data-centre and precision-manufacturing operations. KSEBL's continued investment in distribution infrastructure quality, transmission corridor development through TransGrid 2.0, and grid-balancing capability to manage rising renewable generation variability, discussed in sections 9.2 and 9.5, should therefore be understood as serving an investment-climate function that extends well beyond the conventional electrification-access framing that has historically dominated Indian power-sector policy discourse.

9.4 Renewable Energy Potential: Solar, Wind, Hydro and Biomass

Kerala has set among the most ambitious state-level renewable energy targets in India: a declared goal of becoming a 100 per cent renewable-energy-based state by 2040 and achieving carbon neutrality by 2050 (World Resources Institute [WRI] India, 2024). KSEBL's generation mix as of 2023–24 was already substantially renewable in composition: hydropower contributed 1,904 MW, solar energy 1,314 MW, small-hydro projects 276.52 MW, thermal power 537 MW, wind energy 63.5 MW, and biopower 2.5 MW (Renewable Watch, 2025) — meaning renewables (hydro, solar, small-hydro, wind and biopower combined) already substantially outweighed thermal generation within KSEBL's own directly owned capacity, even though, as discussed in section 9.1, this directly owned capacity represents only a fraction of the state's total power supply once imports are included. During 2023–24 alone, KSEBL added 244.34 MW of solar capacity, pushing the state's total solar capacity beyond 1 GW for the first time, alongside the commissioning of the 6 MW Peruvannamoozhi small hydroelectric project and 1.3 MW of installations across eight sites under the national PM-KUSUM solar scheme, with the 40 MW Thottiyar hydroelectric project commissioned in the following financial year (Renewable Watch, 2025).

Kerala's hydropower legacy, the foundation of the state's power sector since the 1933 commencement of the Pallivasal project — Kerala's first hydroelectric station, inaugurated in 1940 with an initial capacity of 13.5 MW — remains the single largest component of installed renewable capacity, with the 780 MW Idukki Hydroelectric Project, commissioned in stages between 1976 and 1986, continuing to stand as the largest power project of any kind in the state's history (KSEB, 2026). Roughly twenty-five per cent of Kerala's energy

requirement continues to be met from hydel plants owned and operated by KSEBL (Wikipedia, 2026), a legacy that gives the state's renewable transition a head start relative to states building a renewable base predominantly from scratch, but which also means Kerala's hydro potential, concentrated along the Western Ghats and already substantially developed across 16 major and 15 small hydel stations, offers comparatively limited additional large-scale expansion headroom relative to the still largely untapped solar and wind potential documented below (KSEB, 2026).

The institutional history of Kerala's hydroelectric sector also illustrates the recurring rehabilitation and modernisation challenge that an ageing, century-old generation fleet inevitably presents: the normal operative life span of a hydroelectric power plant is approximately thirty-five years, after which renovation is required both to extend operational life and to incorporate technological improvements that have occurred since the original commissioning, and KSEBL has accordingly undertaken systematic renovation programmes across its older stations, including the completed 2002 renovation of the original Pallivasal project and the subsequent construction of the 60 MW Pallivasal Extension Scheme to better utilise available water resources at the same site (KSEB, 2026).

This renovation requirement represents a continuing capital expenditure obligation layered on top of the new-capacity addition targets discussed throughout this chapter, and connects to the broader capital expenditure constraints documented in Chapter 2: KSEBL, like the state government's own budget, must balance the competing claims of new renewable capacity addition, ageing-asset renovation, and transmission and distribution network modernisation, all from a capital base that is itself shaped by the same fiscal pressures examined in Chapter 2's discussion of the state's narrow capital expenditure margin. The financial stress imposed on the utility during the COVID-19 pandemic illustrates this constraint concretely: KSEBL noted at the time that the central government's Atmanirbhar Bharat Abhiyan liquidity infusion scheme, ostensibly designed to support power-sector utilities through the pandemic, offered limited practical benefit to a utility such as KSEBL that had maintained prompt payment discipline towards generating companies, since the scheme's design — channelling funds directly to generating companies to help them recover dues from distribution utilities — provided little additional support to a utility that was not itself in arrears (Department of Industries and Commerce, 2026).

Kerala's small hydropower (SHP) potential is separately assessed at 647.15 MW, of which only around 260 MW had been installed as of March 2022, with sanctioned projects facing significant delays attributable to difficulties in obtaining government clearances, land acquisition procedural difficulties — a constraint that recurs across the road and rail infrastructure projects discussed in Chapter 8 — geographical challenges, and tariff and project-ownership disputes (WRI India, 2024).

Wind energy development in Kerala, concentrated principally in Palakkad district, faces the converse challenge to hydro: rather than a maturity-driven ceiling on additional capacity,

wind development in Kerala is constrained by a shortage of suitable wind-rich sites given the state's complex, ecologically sensitive terrain, and by logistical difficulties in transporting the large turbine components required for utility-scale wind installations through Kerala's hilly, densely settled landscape (WRI India, 2024).

Each wind installation, with turbine capacities ranging from 225 kW to 2 MW, generates an estimated fifteen to twenty-five lakh units annually per installed megawatt, and the sector additionally requires a skilled workforce for installation and ongoing operation that the state's renewable energy policy framework explicitly identifies as needing further capacity-building investment (WRI India, 2024). Solar energy, by contrast, offers Kerala's most significant remaining renewable expansion headroom, and the state has pursued several distinctive approaches to overcome its land-scarcity constraint, documented throughout this report as a binding factor across multiple sectors: in 2022, Kerala commissioned what was described as India's largest floating solar power plant, leveraging the state's extensive reservoir and backwater surface area — the same water bodies discussed in Chapter 8's treatment of the backwater transport network — to generate solar power without competing for the scarce land that conventional ground-mounted solar installations would require (Wikipedia, 2026). Kerala's floating solar potential is separately estimated in gigawatt terms, reflecting the scale of this land-saving opportunity relative to the state's otherwise constrained land availability for utility-scale renewable projects (WRI India, 2024).

9.5 Energy Efficiency, Conservation and Demand-Side Management

KSEBL's forward planning explicitly targets a total installed capacity of 10,000 MW by 2030, comprising 500 MW of additional solar, 530 MW of additional wind, 1,500 MW of additional hydro, and 35 MW of monthly rooftop solar additions, alongside 3,000 MWh of battery energy storage system (BESS) capacity and 2,000 MW of pumped storage capacity with six-hour discharge duration (Renewable Watch, 2025). This storage-capacity ambition reflects a sophisticated understanding, evident throughout Kerala's recent energy planning documents, that a renewable-heavy generation mix cannot be managed through generation capacity expansion alone: the state government has provided in-principle approval for two pumped storage hydro (PSH) projects with a combined capacity of 130 MW at an estimated cost of approximately ₹753 crore (Government of Kerala, 2024, as cited in WRI India, 2024), and a dedicated energy transition roadmap study estimates the state would require 3.8 GW (7,163 GWh) of storage capacity addition under a business-as-usual scenario, rising to 4.1 GW (8,108 GWh) under a high-renewable-energy scenario, to manage the intermittency that a substantially higher renewable share in the generation mix would otherwise introduce (Centre for Study of Science, Technology and Policy [CSTEP], 2024).

Energy efficiency and demand-side conservation measures complement this storage and generation-capacity planning, particularly given the demand growth trajectory documented in section 9.1. Kerala's building energy codes and appliance efficiency standards operate within the national framework administered by the Bureau of Energy Efficiency, but the state has

layered additional, locally tailored conservation measures on top of this national baseline, including targeted efficiency incentives for the commercial and institutional building stock that has expanded rapidly alongside the IT park and GCC development documented in Chapter 4, where cooling load — given Kerala's tropical climate — represents one of the largest controllable components of overall building energy consumption. Streetlighting conversion to LED technology across municipal and panchayat-level local self-government bodies, coordinated through the broader Oorjia Kerala Mission discussed in section 9.3, has additionally delivered measurable reductions in public lighting energy consumption, a category that, while smaller in aggregate terms than residential or industrial consumption, has historically represented a meaningful and relatively easily addressable component of local government energy expenditure across Kerala's dense network of small and medium urban local bodies discussed in Chapter 11. Kerala is additionally in the process of developing a dedicated green hydrogen policy alongside green hydrogen certification guidelines and standards, having announced a grant of ₹200 crore in February 2023 specifically for establishing green hydrogen hubs in Kochi, an initiative that positions hydrogen as a longer-term energy storage and industrial decarbonisation pathway complementing the battery and pumped-storage investments discussed above (WRI India, 2024).

The geographic and ecological constraints shaping Kerala's renewable build-out, discussed throughout this section in relation to wind siting and small-hydro project delays, connect directly to the forest cover, biodiversity and land-use governance framework examined in Chapter 13: Kerala's complex terrain and extensive eco-sensitive zones, the same protected areas and Western Ghats ecological corridors discussed in that chapter, materially constrain the land area available for both utility-scale solar and wind development, reinforcing why floating solar, rooftop solar, and other land-conserving renewable technologies have received particular policy emphasis in Kerala relative to states with larger areas of comparatively low-ecological-value land available for ground-mounted renewable installations.

The Kerala Energy Transition Roadmap 2040, prepared by the Centre for Study of Science, Technology and Policy, explicitly frames this land-and-ecology constraint as the central technical challenge the state's 100 per cent renewable target must overcome, and recommends that KSEBL pursue a deliberately diversified technology portfolio — spanning floating solar, rooftop solar, small hydro, wind, biomass and eventually green hydrogen — precisely because no single renewable technology can be scaled to meet Kerala's full demand growth trajectory within the land and ecological constraints the state's geography imposes (CSTEP, 2024). On the demand side, KSEBL has begun exploring power-swap arrangements with utilities in Punjab and Uttar Pradesh specifically to manage peak summer demand more efficiently and reduce reliance on costlier short-term market purchases, alongside the deployment of advanced forecasting, scheduling and grid-balancing mechanisms to accommodate the state's rising solar and wind generation share without compromising grid stability (Wikipedia, 2026).

9.6 State Electricity Regulatory Framework and Tariff Policy

The Kerala State Electricity Regulatory Commission (KSERC) governs the state's electricity tariff and renewable energy connectivity framework under powers conferred by the Electricity Act, 2003, and has, as of November 2025, issued a comprehensive set of Renewable Energy and Related Matters Regulations specifically governing net metering, virtual net metering, grid connectivity standards, and renewable generation meter requirements for distributed renewable energy systems across the state (KSERC, 2025).

These regulations establish renewable purchase obligation (RPO) targets that KSEBL is required to meet, with the Agency for New and Renewable Energy Research and Technology (ANERT) designated as the state's coordinating agency for RPO compliance and for floating solar project coordination specifically (CSTEP, 2024; Department of Power, 2025). The state's draft Kerala Power Policy 2025 sets out a detailed institutional and tariff framework supporting the renewable transition discussed in section 9.4, including provisions for Build-Own-Operate-Transfer (BOOT) models for renewable project development, revenue-sharing arrangements for government land made available to KSEB and ANERT for solar projects, and Time-of-Day (ToD) tariffs specifically tailored to electric vehicle owners, including concessional tariffs for EV charging during solar-generation hours, designed explicitly to align electric vehicle charging demand with the state's daytime solar generation profile rather than allowing it to add to evening peak demand (Department of Power, 2025).

The draft policy's emphasis on Build-Own-Operate-Transfer models and revenue-sharing land arrangements reflects a deliberate effort to mobilise private capital into Kerala's renewable build-out without requiring KSEBL or the state government to fund the entirety of the capacity expansion documented in section 9.5 directly from public resources — an approach consistent with the broader public-private partnership strategy examined in Chapter 4's discussion of Vizhinjam port and the Kochi–Bengaluru Industrial Corridor.

Under this model, private developers bear the upfront capital cost of renewable generation assets, while the state government or KSEBL contributes land access on negotiated revenue-sharing terms and provides the regulatory certainty — through KSERC's renewable purchase obligation framework and net-metering regulations — needed to make long-term investment in Kerala's renewable sector commercially viable. This approach mirrors the financing logic applied to several other capital-intensive infrastructure sectors examined throughout this report, and reflects a broader recognition within Kerala's policy establishment, evident across the fiscal architecture discussed in Chapter 2 and the investment strategy discussed in Chapter 4, that the scale of capital required to deliver the state's full infrastructure and energy transition ambitions exceeds what the state's own constrained fiscal capacity can finance through direct budgetary allocation alone. This EV-tariff design represents a relatively sophisticated demand-side management instrument, and connects this chapter's renewable transition discussion directly to the broader emissions-reduction and green-economy transition priorities examined in Chapter 14.

Notwithstanding this generally sophisticated regulatory architecture, KSEBL's own internal labour relations have periodically surfaced as an operational concern: in 2025, KSEBL employees held statewide protests over wage revision, dearness allowance and pension-related issues (Wikipedia, 2026), echoing the broader public-sector-undertaking workforce tensions documented in Chapter 4's discussion of overstaffing and labour-cost pressure across Kerala's PSU portfolio, of which KSEBL — despite its comparatively strong technical and financial performance relative to many other Indian state utilities — remains institutionally a part. Reconciling KSEBL's continued strong AT&C loss performance and ambitious renewable expansion targets with the workforce cost and industrial relations pressures evident across the broader PSU sector, discussed in Chapter 4, represents a specific institutional challenge for the utility's management as it pursues the 10,000 MW by 2030 target and the broader 2040 full-renewable transition goal set out in this chapter.

Drawing together the evidence assembled across this chapter, Kerala's energy sector exhibits the same recurring pattern this report has identified across several other infrastructure domains: genuine institutional and technical strength — KSEBL's low AT&C losses, its century-long hydroelectric engineering legacy, its early and innovative embrace of floating solar and sophisticated renewable regulatory design — operating against a backdrop of structural constraint, most consequentially the roughly seventy per cent power-import dependence documented in section 9.1, which leaves the state's continued economic growth, examined throughout Chapters 3 and 4, materially exposed to factors outside its direct control.

The 100 per cent renewable-by-2040 and carbon-neutral-by-2050 targets discussed in this chapter are appropriately ambitious given the state's existing renewable share and institutional capability, but their achievement depends on resolving land-availability constraints through continued technology diversification (floating solar, rooftop solar, green hydrogen), building out the storage capacity that intermittent renewable generation requires at the scale CSTEP's modelling suggests, and securing the capital investment — competing, as in other infrastructure sectors examined in this report, against the fiscal constraints documented in Chapter 2 — needed to execute KSEBL's 10,000 MW capacity expansion plan on schedule. The energy sector's contribution to the State Vision 2047 roadmap developed in Chapter 21 should accordingly prioritise closing the import-dependence gap through accelerated in-state renewable capacity addition, securing the transmission and storage investment needed to integrate that capacity reliably, and ensuring that KSEBL's institutional and labour-relations stability, examined in this section, is preserved even as the utility undertakes one of the most ambitious state-level energy transitions in India.

Chapter 10: Water, Sanitation and Solid Waste Management

10.1 Drinking Water Supply: Coverage, Quality and Infrastructure

Kerala's performance on rural piped drinking water coverage under the national Jal Jeevan Mission (JJM) presents one of the more counterintuitive findings of this report: a state with abundant rainfall, an extensive network of rivers and backwaters documented in Chapter 1, and consistently strong outcomes across nearly every other social and health indicator examined in this report, nonetheless lags substantially behind the national average on functional household tap connection (FHTC) coverage. As of late January 2025, only around fifty-four per cent of households in Kerala had a functional household tap connection, a figure on par with Rajasthan, West Bengal and Jharkhand, and well below the corresponding coverage levels exceeding ninety per cent recorded in Uttarakhand, Bihar, Nagaland and Sikkim, and below the national average, which had reached eighty per cent of the original 19.32 crore household target by the same date (Foundation for Responsive Governance [ResGov], 2025).

By October 2025, the national programme had advanced to roughly eighty-one per cent coverage of rural households, with more than 15.72 crore homes connected nationally and 116 districts officially certified as having achieved full institutional and household coverage through Gram Sabha resolution (Press Information Bureau [PIB], 2025); Kerala's specific position within this expanded national dataset was not separately reported within the sources reviewed for this chapter, though the state's earlier lagging position relative to states with markedly less developed water infrastructure on most other dimensions strongly suggests the gap, while it may have narrowed somewhat as the national programme has progressed, has not been fully closed.

This counterintuitive underperformance is explained, at least in significant part, by Kerala's distinctive water resource and settlement geography rather than by any straightforward failure of policy implementation. Kerala's historically dominant water supply model relies heavily on household-owned and community-shared open wells, a legacy of the state's exceptionally high groundwater table and abundant monsoon rainfall, documented in Chapter 1, which made individual and community well access a viable and widely adopted alternative to centralised piped supply for generations of Kerala households in a way that is far less viable in groundwater-scarce states such as Rajasthan.

This well-based legacy supply model means that the absence of a formal piped tap connection in Kerala does not necessarily indicate the same severity of water access deprivation that an equivalent FHTC gap would represent in a genuinely water-scarce state, even though it does represent a meaningful quality, reliability, and contamination-risk concern relative to engineered piped supply, particularly during the dry months when shallow wells across the state's midland and coastal belt are prone to seasonal depletion and, in coastal areas, to saline intrusion. The Jal Jeevan Mission's national extension to FY2028–29, with funding for the

mission rising sharply to ₹67,000 crore in the Union Budget 2025–26 from revised estimates of ₹22,694 crore the previous year (India Water Portal, 2025), provides Kerala continued access to central funding to close this gap, and the programme's parallel investment in school and anganwadi tap water connections — already reported as fully achieved in Kerala alongside Andhra Pradesh, Karnataka, Tamil Nadu, Puducherry and Telangana as of an earlier reporting period (Jal Jeevan Mission, 2024) — indicates that institutional-level coverage in Kerala has advanced considerably faster than household-level coverage, a pattern this report attributes to the institutional preference within JJM implementation, evident across multiple states, for prioritising fixed, easily monitored public institutions before extending coverage across the far larger and more dispersed universe of individual rural households.

Kerala's water resource position is further complicated by a seasonal paradox that recurs across this report's treatment of the state's hydrology: a state that receives some of the highest annual rainfall totals in India, concentrated heavily within the four-month southwest monsoon season, faces recurring localised water scarcity during the dry months of February through May, when shallow wells across large parts of the midland and coastal belt are prone to significant depletion. This monsoon-concentrated rainfall pattern, examined further in Chapter 14's climate vulnerability assessment, means that Kerala's water security challenge is fundamentally one of seasonal storage and distribution rather than one of aggregate annual water availability, a distinction that has direct implications for infrastructure design: piped, engineered water supply systems with adequate storage capacity are considerably better suited to managing this seasonal mismatch between rainfall timing and year-round household demand than the open-well-based legacy system discussed above, reinforcing the case for accelerating FHTC coverage in Kerala even though the state's overall water resource endowment is comparatively favourable in annual aggregate terms. Coastal saline intrusion into shallow groundwater sources, particularly along Kerala's densely populated low-lying coastal belt discussed in Chapter 1, represents a further water-quality concern specific to the state's geography, one that piped supply drawing on better-protected surface or deeper groundwater sources can substantially mitigate relative to continued reliance on shallow coastal wells vulnerable to both seasonal depletion and saline contamination.

The policy priority that follows from this analysis is that Kerala's relatively low FHTC coverage figure should not be read, in isolation, as evidence of a general water-access failure comparable to that facing genuinely water-scarce or infrastructure-poor states; rather, it reflects a state-specific transition challenge in which a historically adequate, decentralised, well-based supply model is now proving less resilient than centralised piped infrastructure to the combination of seasonal rainfall concentration, coastal saline intrusion, and rising consumption demand associated with the economic growth documented throughout this report. Accelerating FHTC coverage in Kerala accordingly carries a different policy rationale than in most other lagging states: less a matter of providing first-time access to a population that has historically lacked any reliable water source, and more a matter of upgrading water quality, seasonal reliability and contamination resistance for a population that has had adequate, if imperfect, access through decentralised wells for generations. This distinction

matters for how the state should sequence and justify continued JJM investment relative to the other infrastructure priorities — irrigation, sanitation, and solid and liquid waste management — examined in the remainder of this chapter, since the urgency case for FHTC expansion in Kerala rests on water quality and climate-resilience grounds, developed further in Chapter 14, rather than on the basic-access grounds that dominate the JJM narrative in most of the rest of rural India.

10.2 Irrigation Infrastructure: Command Area, Efficiency and Water-Use Productivity

Kerala's irrigation infrastructure occupies a comparatively modest place in the state's overall agricultural economy relative to most other major Indian states, a pattern directly connected to the plantation-crop-dominated agricultural structure documented in Chapter 3: with coconut, rubber and other tree and plantation crops together accounting for over eighty per cent of the state's cropped area, and with these crops relying predominantly on the state's abundant and well-distributed monsoon and post-monsoon rainfall rather than on engineered canal irrigation, Kerala's irrigation command area as a proportion of total cropped area is considerably smaller than in foodgrain-dominated agricultural states such as Punjab or Uttar Pradesh.

The national Atal Bhujal Yojana (ABY), a groundwater management scheme targeting water-stressed blocks, illustrates the comparative scale of the irrigation and groundwater management challenge facing different parts of India: the scheme's seven participating states account for only thirty-seven per cent of India's water-stressed blocks nationally, and acutely water-short states such as Punjab, Himachal Pradesh, Delhi and Tamil Nadu are not covered under the scheme at all (PRS Legislative Research, 2024) — Kerala, with its comparatively favourable groundwater and rainfall position, is not typically identified among India's most acutely water-stressed states, even though localised seasonal water stress, particularly in the state's eastern highland districts and during the pre-monsoon summer months, remains a genuine and recurring concern that intersects directly with the climate vulnerability assessment developed in Chapter 14.

Nationally, groundwater extracted for irrigation accounted for eighty-seven per cent of all groundwater extraction in 2022–23 (PRS Legislative Research, 2024), and while Kerala-specific irrigation efficiency and water-use productivity data were not available with the same granularity as the national figures reviewed for this chapter, the state's overall water resource position — high annual rainfall combined with comparatively low irrigation-intensive cropping — implies a structurally different water-use productivity profile from foodgrain-belt states, oriented more towards managing excess water and flood risk during the monsoon, discussed further in Chapter 14, than towards the irrigation water-scarcity management challenge that dominates agricultural water policy in much of northern and western India.

A further dimension of Kerala's irrigation and water resource picture concerns the state's declining paddy cultivation area, a trend with direct implications for both irrigation infrastructure utilisation and water resource management more broadly. Kerala's traditional paddy lands, concentrated historically in the low-lying Kuttanad region and other coastal and riverine tracts, have contracted substantially over recent decades as land has been progressively converted to non-agricultural use or to higher-value plantation and horticultural crops, a pattern that reflects the same land-value and urbanisation pressures documented in Chapter 3's discussion of the construction-driven secondary sector and the remittance-financed property market.

This contraction has a paradoxical hydrological consequence: paddy fields and their associated bunds and channels have historically functioned as a significant component of Kerala's natural flood-attenuation and groundwater-recharge infrastructure, absorbing and temporarily storing monsoon runoff before it reaches the state's rivers and backwaters, and their conversion to built-up or non-paddy agricultural use has, in the assessment of several state environmental and water-resource planning documents, contributed measurably to the increased urban and peri-urban flooding risk examined in Chapter 14's climate vulnerability assessment. The Kerala Conservation of Paddy Land and Wetland Act, 2008, was enacted specifically to arrest this conversion trend by restricting the conversion of paddy land and wetlands to other uses without specific government exemption, representing a direct legislative response to the water-management and flood-risk consequences of the land-use change described above, though enforcement of the Act has, according to several independent assessments, been uneven across different districts and has not fully halted the underlying conversion trend, particularly in peri-urban areas under the greatest development pressure.

The cumulative effect of declining paddy cultivation, illustrated by the contraction of the historic Kuttanad wetland-paddy system, also has direct implications for the irrigation infrastructure that was historically built to serve this cultivation: a substantial share of Kerala's existing minor and medium irrigation infrastructure was originally constructed to support paddy cultivation specifically, and as paddy area has contracted, utilisation of this existing irrigation infrastructure has in many areas declined correspondingly, even as the infrastructure itself continues to require maintenance investment regardless of reduced utilisation.

This creates a planning dilemma for the state's irrigation authorities: continuing to maintain irrigation infrastructure built for a cultivation pattern that is itself shrinking, while the plantation and tree-crop agriculture that increasingly dominates Kerala's actual cropped area, documented in Chapter 3, requires a fundamentally different water-management approach — typically less reliant on engineered canal irrigation and more reliant on soil moisture conservation, mulching, and supplementary drip or sprinkler irrigation during the comparatively shorter dry-season water-stress periods discussed in section 10.1. Reorienting Kerala's irrigation infrastructure investment priorities away from a paddy-era canal-irrigation model and towards water-management approaches better suited to the state's now-dominant

plantation and tree-crop agriculture represents a specific, actionable agricultural-infrastructure reform opportunity that connects this chapter's irrigation discussion directly to the agricultural productivity and water-use efficiency priorities examined in Chapter 18.

10.3 Sanitation and Open Defecation Free Status: Post-ODF Sustainability

Kerala, along with the rest of rural India, formally achieved Open Defecation Free (ODF) status when all of the country's Gram Panchayats were declared ODF on 2 October 2019 (Jal Jeevan Mission, 2024). The subsequent policy focus nationally, and in Kerala specifically, has shifted to sustaining this ODF achievement and progressing villages from basic ODF status to the more comprehensive "ODF Plus" standard, which additionally requires functioning solid and liquid waste management (SLWM) systems at the village level, under the second phase of the Swachh Bharat Mission–Gramin (SBM-G), implemented from 2020–21 with a total outlay of ₹1,40,881 crore and originally targeted for completion by 2024–25 before being extended in line with the broader JJM timeline revision (ACQ IAS Academy, 2024; Jal Jeevan Mission, 2024).

Kerala's specific record on the financial administration of this programme has, notably, shown some friction: Kerala was among ten states — alongside Bihar, West Bengal and Uttar Pradesh — that delayed releasing the state's matching share of SBM-G funds in 2022–23, with Kerala's delay specifically attributed to resource constraints and re-appropriation of funds, a fiscal management pattern directly consistent with the capital expenditure squeeze and revenue deficit pressures documented extensively in Chapter 2 (PRS Legislative Research, 2024). This finding is significant because it demonstrates that Kerala's general fiscal constraints, documented in detail in Chapter 2 as primarily affecting capital expenditure on major infrastructure projects, extend in practice to comparatively modest centrally sponsored scheme co-financing obligations as well, with the Union Ministry of Finance's subsequent 2023 decision to charge interest on delayed state-share releases for centrally sponsored schemes such as SBM-G applying directly to a state, Kerala, that the Standing Committee on Water Resources separately acknowledged may face genuine resource constraints rather than simple administrative delay (PRS Legislative Research, 2024).

Kerala's tourism sector, examined in depth in Chapter 19, has been specifically incorporated into the SBM-G's broader sanitation standards push: in the first phase of a hospitality-sector sanitation certification initiative, 425 hospitality facilities in Kerala earned the Swachh Grih Awas or comparable green-leaf-rating sanitation certification out of 680 facilities that submitted self-assessments through the relevant online platform, with 96 facilities failing the initial self-assessment and a further 159 failing to qualify for certification by not meeting the minimum required score (Department of Drinking Water and Sanitation [DDWS], 2025). This roughly sixty-three per cent pass rate among Kerala's self-assessed hospitality establishments indicates meaningful, though incomplete, uptake of formal sanitation

certification within the tourism sector, a finding directly relevant to the tourism infrastructure and visitor experience discussion developed in Chapter 19.

Beyond the formal ODF Plus and hospitality-sector certification programmes discussed above, Kerala's sanitation policy architecture has historically placed particular emphasis on menstrual hygiene management and on sanitation access in educational institutions, building directly on the near-universal school enrolment and retention documented in Chapter 5: functioning, gender-segregated toilet facilities in schools are widely recognised, across the broader Indian education-policy literature, as a significant determinant of secondary-school retention specifically for adolescent girls, and Kerala's already-high secondary GER and exceptionally low secondary dropout rate, documented in Chapter 5, are consistent with — though not solely attributable to — a school sanitation infrastructure base that has kept pace with the state's near-universal enrolment levels more successfully than has historically been the case in many other Indian states. The persistent rural-urban gap in centralised sanitation infrastructure quality, examined further in section 10.5's discussion of sewerage coverage, nonetheless means that the formal achievement of ODF status at the Gram Panchayat level in 2019, while a genuine milestone, should not be read as equivalent to comprehensive, urban-standard sanitation infrastructure across the state; ODF status specifically certifies the absence of open defecation through adequate toilet access, a meaningfully narrower standard than the fuller sanitation and wastewater treatment infrastructure discussed in section 10.5.

Taken together, sections 10.1 through 10.3 of this chapter illustrate a consistent pattern in Kerala's water and basic sanitation infrastructure: formal national milestone achievements — ODF certification in 2019, near-complete institutional tap water coverage in schools and anganwadis — sit alongside continuing gaps in household-level piped water coverage and in the fuller wastewater and liquid waste management infrastructure examined in sections 10.4 and 10.5. This pattern is broadly consistent with the recurring institutional theme identified throughout this report: Kerala frequently achieves strong performance on discrete, well-defined policy milestones — particularly those amenable to panchayat-level community mobilisation, the same decentralised delivery model credited in Chapters 6 and 7 with the state's maternal and child health and social welfare achievements — while facing more persistent difficulty in the comparatively more capital-intensive, less easily decentralised infrastructure investments, such as centralised sewerage networks and large-scale solid waste processing facilities, that require sustained capital expenditure of the kind shown in Chapter 2 to be in chronically short supply.

10.3a Comparative State Performance and Lessons

Kerala's water, sanitation and waste management performance, viewed comparatively against other Indian states with broadly similar levels of overall human development, suggests the gaps identified in this chapter are not primarily attributable to weak governance capacity in the sense that might apply to lower-capacity states, but rather to the specific combination of fiscal constraint documented in Chapter 2, the settlement-pattern-driven infrastructure

economics discussed in section 10.4, and a degree of historical underinvestment in centralised water and waste infrastructure relative to the scale of investment Kerala has, by contrast, sustained in education and primary healthcare over a comparable period, as documented in Chapters 5 and 6. States such as Tamil Nadu and Gujarat, which have historically combined strong human development outcomes with more developed centralised water and sewerage infrastructure, offer a useful comparative benchmark suggesting that Kerala's water and sanitation infrastructure gap, while real, is not an inevitable consequence of the state's other social-development priorities, but rather reflects a specific historical pattern of infrastructure investment sequencing that subsequent state planning, including the Vision 2047 roadmap developed in Chapter 21, has scope to correct through deliberately increased capital allocation to this specific infrastructure category.

10.4 Solid Waste Management: Municipal, Biomedical and Hazardous Waste

Kerala's solid waste management challenge is shaped decisively by the same dispersed, near-continuous small-town settlement pattern documented throughout this report, beginning in Chapter 1: unlike states where urban waste generation is concentrated in a small number of large metropolitan centres that can justify large, centralised waste-processing and landfill facilities, Kerala's waste generation is spread across a dense lattice of small and medium urban local bodies, discussed further in Chapter 11, each individually too small to economically justify the scale of centralised waste infrastructure that effective modern solid waste management typically requires. This structural mismatch between settlement pattern and conventional waste-infrastructure economics has historically produced significant solid waste management stress in Kerala, manifesting in periodic high-profile local controversies over landfill siting and waste-disposal capacity in several of the state's urban centres. The national GOBARdhan initiative, which promotes biogas, compressed biogas, and organic manure production from biodegradable waste as both an environmental and a rural livelihood intervention, represents one policy response with direct relevance to Kerala's settlement-pattern-driven waste management challenge, since decentralised, panchayat-level biogas and composting infrastructure is inherently better suited to a dispersed small-town settlement geography than large centralised processing facilities would be (DDWS, 2025).

Kerala's struggles with centralised solid waste infrastructure have, at points, surfaced as significant public crises rather than purely technical management challenges: the Brahmapuram waste-processing facility fire in Kochi in March 2023, which burned for an extended period and produced a substantial air pollution event affecting large parts of the city, became a widely cited national illustration of the risks inherent in allowing municipal solid waste to accumulate at large centralised sites without adequate ongoing processing capacity, sorting infrastructure, or fire-safety management. The episode catalysed renewed state policy attention towards decentralised, source-segregation-based waste management models, building on Kerala's pre-existing Kudumbashree-linked waste collection and composting initiatives discussed in Chapter 3 and Chapter 6, under which local self-help groups and resident associations are engaged directly in household-level waste segregation, organic

waste composting, and the collection of recyclable and non-biodegradable waste streams for processing at a smaller, more manageable local scale rather than relying solely on large centralised dumping or processing sites of the kind that failed so visibly at Brahmapuram. This shift towards decentralisation is consistent with, and reinforces, the broader institutional pattern this report has identified repeatedly across health, nutrition, and now solid waste management: Kerala's most resilient and effective service delivery models tend to be those built around panchayat- and community-level engagement rather than large, centralised infrastructure alone, even though, as the Brahmapuram episode demonstrates, the transition away from centralised dumping towards genuinely decentralised, source-segregated processing at the necessary scale and consistency across all of Kerala's local self-government bodies remains, on the evidence reviewed for this chapter, a work in progress rather than a fully realised policy success.

Biomedical and hazardous waste management presents a related but analytically distinct challenge, given Kerala's extensive healthcare infrastructure documented in Chapter 6, spanning the Aardram Mission's Family Health Centre network, the state's medical college hospitals, and dedicated cancer treatment institutions, each of which generates biomedical waste streams requiring specialised collection, treatment and disposal protocols distinct from conventional municipal solid waste. The Common Biomedical Waste Treatment Facility model, under which a centralised, specialised facility serves multiple healthcare institutions across a defined catchment area rather than requiring every individual hospital and clinic to maintain its own treatment infrastructure, has been adopted across Kerala broadly in line with the national Biomedical Waste Management Rules framework, though, consistent with the broader settlement-pattern-driven solid waste management challenge discussed above, the dispersed, small-facility-dominated structure of Kerala's healthcare delivery network — itself a direct consequence of the dense, decentralised Family Health Centre model examined in Chapter 6 — means that biomedical waste collection logistics across a large number of small and geographically dispersed health facilities is inherently more complex than in a healthcare system organised around a smaller number of large, centralised hospitals. Hazardous industrial waste, generated by the state's legacy chemical and petrochemical industrial base in the Aluva belt discussed in Chapter 3 and Chapter 4, similarly requires specialised treatment, storage and disposal infrastructure distinct from both municipal solid waste and biomedical waste streams, and the long industrial history of facilities such as Fertilisers and Chemicals Travancore and Travancore Cochin Chemicals means that legacy hazardous waste and contaminated site remediation, alongside ongoing current-generation hazardous waste management, represents a continuing environmental management obligation for the state's industrial regulatory authorities that this report flags, alongside the broader pollution assessment developed in Chapter 13, as warranting continued dedicated regulatory attention. Plastic waste management, identified as one of four core SLWM focus areas under SBM-G Phase II alongside biodegradable solid waste management, greywater management, and faecal sludge management (ACQ IAS Academy, 2024), is a particularly visible concern in Kerala given the state's high per capita consumption levels, documented in Chapter 3's discussion of remittance-financed consumption growth, and the resulting waste-generation intensity that accompanies rising household income and retail consumption.

10.5 Liquid Waste and Sewerage: Urban and Peri-Urban Treatment Infrastructure

Liquid waste and sewerage treatment infrastructure represents, on the evidence reviewed for this chapter, one of the more significant remaining gaps in Kerala's urban and peri-urban environmental infrastructure. The greywater and faecal sludge management components of SBM-G Phase II, discussed in section 10.4, extend in principle to liquid waste management in rural and peri-urban areas, but centralised sewerage and wastewater treatment coverage in Kerala's urban centres has historically lagged behind the state's otherwise strong infrastructure and public health record, with a substantial share of urban and peri-urban households relying on individual septic systems rather than connection to a centralised sewerage network — a pattern that, in a state with Kerala's high population density and high water table, documented in section 10.1 and Chapter 1 respectively, raises meaningful groundwater contamination risk where septic system maintenance is inadequate or where septic tank density in a given area exceeds what the local soil and water table can safely accommodate. The national AMRUT (Atal Mission for Rejuvenation and Urban Transformation) and Jal Jeevan Mission–Urban frameworks, the latter explicitly tasked with facilitating secure tap and sewer connections in urban areas, undertaking water body rejuvenation, and establishing a circular water economy in urban settings (ACQ IAS Academy, 2024), provide the principal national policy and funding vehicles through which Kerala's urban sewerage gap is intended to be addressed, complementing the rural-focused JJM discussed in section 10.1; the specific pace and adequacy of Kerala's drawdown of these urban water and sewerage funding streams was not separately quantified in the sources reviewed for this chapter, representing a further specific data gap that, consistent with the pattern identified across several other chapters of this report, should be addressed as part of the statistical strengthening agenda developed in Chapter 20.

Among Kerala's urban centres, Kochi has historically possessed the state's most developed centralised sewerage network, reflecting its status as the state's largest and most commercially significant urban agglomeration, examined in Chapter 11's treatment of urban governance; even there, however, sewerage network coverage has not kept pace with the city's rapid peri-urban expansion, documented in Chapter 3's discussion of construction-driven secondary-sector growth, leaving a substantial and growing share of newly developed residential and commercial areas dependent on individual septic or soak-pit systems rather than centralised treatment. This pattern recurs, generally with even lower centralised coverage levels, across Kerala's other major urban centres — Thiruvananthapuram, Kozhikode, Thrissur and Kollam — each of which faces a broadly similar combination of legacy infrastructure concentrated in older city cores and rapidly expanding peri-urban development proceeding largely without centralised sewerage extension keeping pace. The cumulative public health and environmental consequence of this gap, examined from the river and water-body health angle in Chapter 13, is a continuing low-level but widespread risk of groundwater and surface water contamination from inadequately treated household wastewater, a risk that compounds rather than substitutes for the industrial and agricultural pollution sources examined separately in Chapter 13's broader

pollution assessment. Addressing this sewerage gap at the pace and scale the state's continuing urbanisation, documented throughout this report, requires represents one of the more capital-intensive infrastructure investment needs identified in this report, and one whose financing, like the road, rail and port infrastructure examined in Chapter 8 and the energy infrastructure examined in Chapter 9, will likely require some combination of central scheme funding (through AMRUT and JJM-Urban), state budgetary allocation constrained by the fiscal pressures documented in Chapter 2, and potentially private or public-private partnership financing structured along the lines discussed in Chapter 4.

The sequencing question this raises — whether sewerage and liquid waste infrastructure should be prioritised ahead of, alongside, or after the road, rail, port and energy infrastructure investments catalogued in Chapters 8 and 9 — is ultimately a question of comparative return on a constrained capital expenditure budget, the scarcity of which Chapter 2 has established as the binding constraint across virtually every infrastructure domain examined in this report. This chapter's assessment is that liquid waste and sewerage infrastructure, despite lacking the visible, headline-generating character of a Vizhinjam port or a Silver Line rail corridor, delivers a comparatively high public health and environmental return per rupee invested, given the direct linkage, established throughout this chapter, between inadequate sewerage and both groundwater contamination risk and the river and wetland degradation examined in Chapter 13 — a linkage that, unlike many of the higher-profile infrastructure investments discussed elsewhere in this report, connects directly and immediately to the health outcomes documented in Chapter 6 and the environmental sustainability priorities developed in Chapters 13 and 14. Given the direct linkage between inadequate sewerage and liquid waste treatment and the water body and wetland degradation discussed in Chapter 13's treatment of river ecosystem health, closing this specific infrastructure gap is, in this report's assessment, a priority that connects the urban development agenda of Chapter 11 directly to the environmental governance priorities of Chapter 13 and the broader water security concerns raised throughout this chapter.

Chapter 11: Urban Development, Housing and Smart Cities

11.1 Urbanisation Trends and Urban Governance Architecture

Kerala's urbanisation pattern, introduced in Chapter 1, remains among the most distinctive in India: an urban population share of 47.7 per cent as of the 2011 Census, having grown by close to twenty-two per cent over the preceding decade, distributed across a near-continuous corridor of small and medium towns rather than concentrated in a small number of large metropolitan cores. This settlement geography has profound implications for urban governance architecture, since the conventional Indian policy distinction between "urban" and "rural" administration — appropriate in states where large cities are physically and administratively distinct from a clearly separate rural hinterland — maps only imperfectly onto Kerala's actual settlement pattern, where urban-density activity, commuting patterns, and economic integration frequently extend well beyond formally notified municipal boundaries into adjoining panchayat areas. The formation of a dedicated Kerala Urban Commission, discussed in the broader national urban policy literature as a state-level response to this challenge, reflects explicit recognition within Kerala's policy establishment that global and national urbanisation trends — and the comprehensive policy frameworks needed to manage them — require revisiting and re-evaluating conventional urban-rural administrative distinctions specifically in light of Kerala's settlement pattern, rather than applying generic national urban policy templates designed primarily around the metropolitan-and-hinterland model dominant elsewhere in India (Civildaily, 2025).

This distinction between Kerala's "rurban" continuum and the conventional Indian metropolitan model has direct implications for how urban infrastructure investment should be prioritised and sequenced relative to the more familiar large-city-focused frameworks that dominate national urban policy discourse, including the Smart Cities Mission discussed in section 11.4, which by design selected a curated list of 100 mid-to-large Indian cities for dedicated investment — a competitive, city-by-city selection model that maps awkwardly onto a state where economically significant urban-density activity is distributed across dozens of small and medium towns rather than concentrated in a handful of competition-winning metropolitan centres. Kerala's own response to this mismatch has been to develop urban policy instruments — the LIFE Mission discussed in section 11.3, and the AMRUT implementation discussed in section 11.4 — that are designed to operate across this dispersed municipal landscape rather than concentrating investment in only the state's two largest, internationally recognised urban centres, Kochi and Thiruvananthapuram.

The practical consequence of this more dispersed investment approach is that individual project scale tends to be smaller, and the visible, headline-generating character of any single Kerala urban infrastructure project tends to be more modest than the flagship metro or smart-city showcase projects more typical of states with a small number of dominant metropolitan cores, even though the cumulative reach of Kerala's dispersed urban investment approach, properly understood, addresses a larger share of the state's total urban population

than a small-number-of-flagship-cities approach would. This urban governance challenge connects directly to the broader national policy shift documented in this chapter's review of central urban mission funding: with no successor mission to the concluded Smart Cities Mission and a clear move in national policy away from centrally designed urban schemes towards a more decentralised, market-oriented framework relying on municipal bonds, public-private partnerships and reform-linked incentives rather than direct budgetary grants (Centre for Public Policy Research [CPPR], 2026), Kerala's urban local bodies will increasingly need to develop their own financing and planning capacity rather than relying primarily on centrally designed and centrally funded urban transformation programmes.

This urban governance challenge is compounded by Kerala's specific exposure to urban flooding, a risk this report's national policy review identified directly: among the major Indian cities affected by significant flooding events over the past five years, the same review specifically named Palakkad, Thrissur, Cochin and Malappuram in Kerala as having experienced major urban flooding in both 2018 and 2020 (PRS Legislative Research, 2024), placing Kerala's urban centres alongside Hyderabad, Bengaluru and parts of Delhi and Punjab among India's most flood-affected urban areas over this period.

The Fifteenth Finance Commission's recommendation of dedicated urban flood management allocations — ₹500 crore each for Mumbai, Chennai and Kolkata, and ₹250 crore each for Bengaluru, Hyderabad, Ahmedabad and Pune (PRS Legislative Research, 2024) — notably did not extend a comparable dedicated allocation to any Kerala city despite the documented flooding impact on Palakkad, Thrissur, Cochin and Malappuram, an allocation gap that this report flags as a specific area warranting advocacy by the state government in future Finance Commission cycles, particularly given the direct connection between this urban flooding vulnerability and both the paddy-land conversion trend discussed in Chapter 10 and the broader climate vulnerability assessment developed in Chapter 14. The Ministry of Housing and Urban Affairs' 2017 Standard Operating Procedure for Urban Flooding provides the principal national policy framework guiding state and municipal-level urban flood response (PRS Legislative Research, 2024), but its application within Kerala's specific dispersed, small-town urban geography, discussed throughout this chapter, requires the kind of locally adapted implementation that the state's own urban planning institutions, rather than a generic national template, are best positioned to design and execute.

11.2 Urban Local Bodies: Financial Health, Capacity and Service Delivery

Kerala's urban local government architecture, comprising municipal corporations, municipalities, and the urbanising fringe of panchayats discussed in section 11.1, operates within the broader decentralised governance framework examined in fuller institutional detail in Chapter 12, but the financial health of these specific urban bodies presents distinct challenges relative to their rural panchayat counterparts. The national policy shift documented above — away from direct central grant funding and towards bonds, PPPs and reform-linked incentives, with the Centre's role shifting "from that of a funder to a facilitator"

and financial and execution risk increasingly falling on states and urban local bodies themselves (CPPR, 2026) — places particular strain on Kerala's urban local bodies given the broader state fiscal constraints documented extensively in Chapter 2, where own-tax revenue, debt sustainability, and capital expenditure capacity were all shown to be under sustained pressure. Urban local bodies that are expected to issue municipal bonds or structure public-private partnerships to finance their own infrastructure investment require a level of financial management sophistication, credit rating readiness, and revenue-base strength that few of Kerala's smaller and medium-sized municipalities, dispersed across the dense small-town settlement pattern discussed in section 11.1, currently possess, creating a meaningful capacity-building gap that this report identifies as a priority area for the urban governance reform agenda developed further in Chapter 15's treatment of administrative governance.

Kerala's urban local bodies do, however, possess one comparative institutional advantage relative to many other Indian states' municipalities: the state's long-standing tradition of decentralised governance, anchored in the 73rd and 74th Constitutional Amendments and substantially deepened through Kerala's own People's Planning Campaign of the late 1990s, examined in fuller detail in Chapter 12, has built a multi-decade institutional culture of local-body planning and participatory budgeting that few other Indian states have sustained at comparable intensity. This pre-existing institutional capacity in participatory planning, even where it has not yet been matched by equivalent financial-management and bond-market readiness capacity, provides a stronger foundation for adapting to the reform-linked incentive structures now emphasised in national urban policy than would be the case in states without a comparable decentralisation history.

The specific reform actions typically required to unlock reform-linked central incentives — property tax base modernisation, double-entry municipal accounting, e-governance adoption, and ring-fenced utility-style accounting for water and sewerage services — map reasonably well onto institutional capabilities Kerala's local bodies have already partially developed through earlier decentralisation and e-governance initiatives, including the digital infrastructure discussed in Chapter 3's treatment of KFON, suggesting that with targeted technical assistance, Kerala's urban local bodies may be better positioned than the national policy shift's overall framing suggests to adapt successfully to this more decentralised, incentive-based funding model, even though the underlying revenue-base and credit-readiness gap identified above remains a genuine and unresolved constraint.

Property tax reform represents perhaps the single most consequential, and most directly actionable, lever available to Kerala's urban local bodies for strengthening their own-revenue base ahead of the bond-market and PPP-readiness requirements that national urban policy increasingly expects them to meet. Kerala's urban property tax collection has historically operated on an annual rental value basis in many municipalities, a valuation methodology that, absent regular and rigorous reassessment, tends to under-capture genuine property value appreciation over time relative to capital-value or unit-area-based assessment systems that

several other Indian states have progressively adopted. Modernising this valuation methodology, expanding the formally assessed property base to capture previously unregistered or under-assessed urban and peri-urban construction — a meaningful gap given the rapid, often informally regularised peri-urban residential expansion documented in section 11.3 — and digitising property tax administration to reduce collection leakage would each directly strengthen the own-revenue base that Kerala's urban local bodies will need if they are to credibly access the municipal bond and structured PPP financing instruments that now represent the principal available channel for the kind of urban infrastructure investment that direct central grant funding, discussed throughout this chapter, is steadily receding from.

11.3 Housing: Demand Assessment, Affordability and Flagship Schemes

Kerala's principal state-level housing intervention is the LIFE (Livelihood Inclusion and Financial Empowerment) Mission, the state government's flagship comprehensive housing scheme explicitly designed to address landlessness and housing deprivation across both rural and urban Kerala through a combination of direct house construction support, land allocation, and livelihood-linkage components — reflecting the Mission's broader ambition to treat housing not merely as a shelter intervention but as part of a wider strategy of economic empowerment for beneficiary households (CBGA India, 2024). The LIFE Mission operates alongside, and in coordination with, the national Pradhan Mantri Awas Yojana–Urban (PMAY-U) scheme, one of the three flagship urban transformation missions — alongside the Smart Cities Mission and AMRUT — launched together by the Government of India on 25 June 2015 specifically to address India's urban housing, water and sanitation, and smart-infrastructure needs in an integrated fashion (PIB, 2021). Kerala's housing affordability challenge, while less acute in absolute deprivation terms than in several other large Indian states given the state's comparatively low poverty headcount documented in Chapter 1, is nonetheless shaped by the same land-value and construction-cost pressures documented in Chapter 3's discussion of remittance-financed property demand: high land prices driven by NRI investment in housing and property assets have pushed housing costs upward across Kerala's urban and peri-urban areas at a pace that, for lower-income households without access to remittance income, has outstripped local wage growth, reinforcing the LIFE Mission's livelihood-linkage design as a deliberate attempt to address affordability through income support as well as direct construction subsidy.

The LIFE Mission's scale and design draw directly on Kerala's broader decentralised, panchayat-engaged welfare delivery model documented throughout this report: beneficiary identification under the Mission has typically proceeded through local self-government bodies in coordination with the Kudumbashree network discussed in Chapters 3, 6 and 7, ensuring that the same community-level institutional infrastructure that has supported the state's nutrition, health and livelihood programmes is also leveraged for housing delivery, rather than requiring a wholly separate beneficiary identification and verification bureaucracy. This integration is consistent with the broader pattern this report has identified as one of Kerala's genuine comparative institutional strengths — the capacity to deliver

welfare programmes through a dense, locally embedded network of panchayat and self-help-group institutions rather than through centralised, top-down administration alone. At the national level, the PMAY-Urban scheme with which the LIFE Mission coordinates has itself been a major driver of formal housing construction across urban India since 2015, and Kerala's urban housing stock improvement over the past decade should be understood as the product of this dual-track approach — national PMAY-U funding combined with state-specific LIFE Mission targeting and livelihood integration — rather than attributable to either programme operating in isolation. A specific design feature of both the national PMAY-U framework and Kerala's own LIFE Mission that merits particular note is the priority given to women as primary beneficiaries or co-owners of constructed housing units, a gender-equity-oriented design choice that connects this section directly to the gender equity discussion developed in Chapter 7, since formal property ownership has historically been a significant determinant of women's economic security and bargaining power within Indian households, and housing schemes that register property explicitly in women's names, or jointly with male household members, represent one of the more concrete mechanisms available to a state housing programme for advancing the broader gender-equity objectives discussed in that chapter.

Land scarcity, a constraint that recurs across multiple infrastructure domains examined throughout this report, presents a particular challenge for Kerala's housing sector given the state's high population density documented in Chapter 1. Unlike states with larger areas of available low-cost peripheral land for horizontal housing expansion, Kerala's housing development increasingly relies on smaller plot sizes, subdivided ancestral landholdings, and a gradual, if still nascent, shift towards higher-density vertical apartment construction in and around the state's major urban centres, a trend most visible in Kochi and Thiruvananthapuram, where multi-storey apartment construction has expanded considerably faster than in most of the state's smaller towns. This shift towards vertical housing, while necessary given the land constraint, introduces its own set of infrastructure-adequacy questions — particularly regarding water supply pressure, sewerage capacity, and parking and traffic generation in legacy urban areas not originally planned for higher-density occupancy — that connect directly to the urban infrastructure gaps documented in section 11.2 and the AMRUT-funded water and sewerage investment discussed in section 11.4.

The LIFE Mission's own approach to addressing landlessness, discussed above, has in several cases adopted a multi-storey apartment-complex model rather than single-unit detached housing specifically in response to this land scarcity, a design choice — visible in the LIFE Mission apartment complex construction documented in the national urban policy review (CBGA India, 2024) — that represents a deliberate adaptation of conventional Indian rural and economically weaker section housing programme design, which has historically defaulted to single detached units, to Kerala's specific land-constrained context.

11.4 Smart Cities Mission and AMRUT: State-Level Implementation Review

Kerala's implementation of the national AMRUT programme has, on the evidence available for this chapter, achieved a comparatively strong completion record relative to the national picture. Under AMRUT's first phase, Kerala recorded a total outlay of ₹2,357.69 crore across 1,108 projects, with central assistance of ₹1,161.2 crore approved and fully received, and of this project portfolio, 1,045 projects had been completed with the remaining 63 ongoing projects targeted for completion by December 2025 (Local Self Government Department [LSGD] Kerala, 2025) — a completion rate of roughly ninety-four per cent that compares favourably with the national AMRUT 1.0 completion rate of only around sixty per cent by the end of 2023, a shortfall the Centre for Budget and Governance Accountability attributed nationally to COVID-19 pandemic disruption and administrative hurdles (CBGA India, 2024). Within Thiruvananthapuram specifically, AMRUT-funded projects achieved a combined water treatment capacity of 165 million litres per day (MLD) across five water treatment plants, alongside GIS-based master plan preparation, local area planning, and town planning scheme development under the mission's capacity-building component (LSGD Kerala, 2025). The mission's second phase, AMRUT 2.0, launched for the five-year period to 2025–26 with a national outlay of ₹2,99,000 crore (of which the Union government's direct contribution is ₹76,760 crore), explicitly targets universal water supply and sewerage connections, a circular economy approach through City Water Balance Plans, water body rejuvenation, and treated wastewater recycling (CBGA India, 2024) — objectives directly relevant to the sewerage and liquid waste management gap identified in Chapter 10.

Kerala's AMRUT 2.0 implementation includes the "Jalam Jeevitham" information, education and communication campaign, which progressed from a "Campus-to-Campus" model in 2023 to a broader "Campus to Community" framework in 2024, aimed at building public awareness of water conservation and sanitation specifically among student and general populations, alongside the selection and onboarding of seven Kerala-based startups under the mission's dedicated Technology Sub-Mission, and the training of women's self-help-group members — directly connecting to the Kudumbashree network discussed in Chapters 3, 6 and 7 — in water-meter reading, water quality testing, and related community monitoring activities (LSGD Kerala, 2025). Unlike AMRUT, which continues into its second phase, the national Smart Cities Mission has now concluded without a designated successor programme, with its allocation reduced by seventy per cent in the 2024–25 budget cycle as remaining projects neared completion and the scheme's final central assistance tranche of ₹48,000 crore was released nationally (PRS Legislative Research, 2024) — meaning Kerala's own Smart Cities-funded projects, concentrated in Kochi and Thiruvananthapuram as the state's two designated Smart Cities, are now operating in a post-mission phase in which any further smart-infrastructure investment must be financed through the state's own resources, AMRUT 2.0 where applicable, or the bond and PPP-based instruments discussed in section 11.2, rather than through continued dedicated central Smart Cities grant funding.

Kochi's Smart City portfolio, prior to the mission's national conclusion, concentrated investment in integrated traffic management systems, smart parking infrastructure, and public Wi-Fi networks across the city's commercial core, building on the digital infrastructure base the city already possessed through its established IT park ecosystem discussed in Chapter 4. Thiruvananthapuram's Smart City investments similarly emphasised urban mobility and digital governance infrastructure, complementing the AMRUT-funded water treatment capacity expansion documented above. With the Smart Cities Mission now concluded nationally and its funding tranches fully disbursed, the durability of these smart-infrastructure investments — whether the digital traffic management, surveillance, and citizen-service platforms established under the mission continue to receive adequate operations and maintenance funding from municipal corporation budgets now that dedicated central mission funding has ended — represents a genuine sustainability question that recurs across virtually every Smart City in India, not Kerala's two cities alone, and one that connects directly to the urban local body financial capacity constraints discussed in section 11.2: a municipal corporation already under pressure to develop bond-market readiness and PPP structuring capacity for AMRUT 2.0 and future infrastructure investment may find it more difficult to simultaneously sustain adequate recurring maintenance budgets for legacy Smart Cities-funded digital infrastructure, creating a risk that some of the mission's physical and digital infrastructure investments could degrade over time without dedicated, ring-fenced municipal maintenance budgeting.

The transition from a fully centrally funded Smart Cities model to a maintenance phase financed primarily from municipal corporation operating budgets parallels a broader fiscal sustainability challenge this report has identified across multiple infrastructure domains: capital grants, whether from central missions or from one-time investment summit pledges of the kind discussed in Chapter 4, are comparatively straightforward to attract relative to the recurring operations and maintenance funding required to sustain the resulting infrastructure over its full operational life. Kerala's municipal corporations, already managing the property-tax-base and revenue-generation constraints discussed in section 11.2, will need to build dedicated, ring-fenced maintenance budget lines for Smart Cities-era digital infrastructure into their regular annual budgeting processes if the investment already made under the concluded mission is not to depreciate prematurely through inadequate upkeep — a recurring budgeting discipline that, on the evidence available to this report, has not yet been uniformly institutionalised across Kerala's Smart Cities-designated urban local bodies.

11.5 Heritage Cities, Cultural Landscapes and Urban Tourism

Kerala's urban heritage landscape spans a distinctive mix of colonial-era port city architecture, particularly in Fort Kochi with its layered Portuguese, Dutch and British colonial built heritage, alongside the traditional Kerala vernacular architectural tradition evident in the state's older temple towns, churches, mosques and tharavadu (traditional family residence) structures across the midland and highland regions. This heritage urban fabric intersects directly with the tourism infrastructure discussed in fuller detail in Chapter 19,

since Fort Kochi and comparable heritage precincts function simultaneously as living residential and commercial urban areas and as significant domestic and international tourism destinations, a dual function that creates characteristic urban-heritage-management tensions around building height restrictions, commercial use intensification, and infrastructure upgrading in zones where heritage conservation guidelines constrain the kind of redevelopment that might otherwise be pursued under conventional urban renewal or AMRUT-style infrastructure modernisation programmes. The state's urban planning framework has, in heritage-designated precincts, generally sought to balance these competing pressures through conservation-sensitive infrastructure upgrading — underground utility relocation, heritage-appropriate streetscape design, and controlled rather than wholesale redevelopment — though the available sources reviewed for this chapter do not provide a comprehensive, current assessment of how successfully this balance has been struck across Kerala's various heritage urban precincts, representing a further area where dedicated state-level urban heritage impact assessment would strengthen the evidentiary basis for ongoing heritage-zone planning decisions.

Fort Kochi's heritage urban fabric has additionally been leveraged as a platform for contemporary cultural production through the Kochi-Muziris Biennale, India's largest and most internationally recognised contemporary art exhibition, held periodically across a network of heritage warehouses, colonial-era buildings, and public spaces throughout Fort Kochi and the adjoining island of Mattancherry since its inaugural edition. The Biennale represents a distinctive model of heritage-asset activation in which historic structures — many of them disused colonial-era spice warehouses and trading buildings connected to Kochi's centuries-long history as a major Indian Ocean trade port — are adaptively reused as temporary exhibition spaces rather than being preserved purely as static heritage monuments, generating both direct tourism revenue, examined further in Chapter 19, and a broader positioning of Kochi as a centre of contemporary cultural production within India's wider arts ecosystem. This model offers a template that other Kerala heritage precincts beyond Fort Kochi — including Kollam's colonial-era trading quarter, Thalassery's spice-trade heritage zone, and the Jewish heritage sites of Kochi's historic Mattancherry quarter — could potentially adapt, applying a similar adaptive-reuse-through-cultural-programming approach to extend the economic and cultural value generated from the state's broader colonial and maritime trading heritage beyond Fort Kochi alone.

11.6 Urban Poverty, Slum Rehabilitation and In-Situ Upgradation

Urban poverty in Kerala, while less extensive in absolute headcount terms than in several other large Indian states given the state's generally low poverty ratio documented in Chapter 1, nonetheless presents distinct challenges connected directly to the dispersed urbanisation pattern discussed in section 11.1: rather than concentrating in large, clearly bounded slum settlements of the kind that dominate urban poverty discourse in cities such as Mumbai or Delhi, urban poverty and substandard housing in Kerala's dispersed small-town urban geography tends to be more spatially distributed, occurring in pockets within and adjacent to

otherwise mixed-income urban and peri-urban neighbourhoods, a pattern that complicates the application of conventional, geographically targeted slum-rehabilitation programming designed around large, spatially concentrated informal settlements.

One specific category of urban and peri-urban poverty in Kerala that does present a more geographically concentrated pattern, and that consequently has received somewhat more targeted policy attention than the dispersed pattern described above, is the housing and infrastructure deprivation found in traditional coastal fisherfolk settlements, examined in connection with the fisheries economy in Chapter 3 and Chapter 18. These settlements, concentrated along Kerala's coastline in proximity to traditional fish-landing centres in districts such as Alappuzha, Kollam and Thiruvananthapuram, frequently combine housing inadequacy with elevated exposure to coastal erosion, storm surge and the broader climate vulnerability examined in Chapter 14, creating a distinctive and geographically identifiable urban-and-peri-urban poverty cluster that the LIFE Mission and related coastal housing schemes have specifically targeted through dedicated coastal rehabilitation components, often involving managed relocation away from the most erosion- and surge-exposed shoreline strips into safer, though still nearby, housing sites — a more geographically targeted intervention model than the household-level, dispersed-pattern approach this section has identified as the dominant model for Kerala's broader urban poverty.

The LIFE Mission's landlessness-focused design, discussed in section 11.3, is in this respect well suited to Kerala's actual urban poverty geography, since it targets housing deprivation directly at the household level rather than relying on area-based slum-redevelopment targeting that would be less effective against Kerala's more dispersed pattern of urban housing inadequacy. In-situ upgradation — improving housing, water, sanitation and electricity access for low-income households within their existing settlement location rather than relocating them to new housing developments — has been the dominant approach within Kerala's urban poverty programming, consistent with the state's broader preference, documented throughout this report, for decentralised, community-embedded service delivery models over large, centralised relocation or redevelopment schemes, and connecting this section's urban poverty discussion directly to the same institutional pattern this report has identified repeatedly in the health, nutrition, water and sanitation chapters preceding this one.

Drawing together the evidence assembled across this chapter, Kerala's urban development trajectory exhibits the now-familiar combination this report has documented across multiple infrastructure and social sectors: genuine institutional strength in decentralised, community-embedded delivery — evident in the LIFE Mission's integration with Kudumbashree, in the participatory planning legacy that gives Kerala's urban local bodies a head start in adapting to reform-linked national funding incentives, and in the in-situ upgradation approach to urban poverty that fits the state's dispersed settlement geography better than area-based slum redevelopment would — operating against persistent capacity and fiscal constraints, most acutely the urban local body financial sophistication gap documented in section 11.2 and the broader capital expenditure squeeze established in

Chapter 2, both of which will become more consequential as national urban policy continues its documented shift away from direct central grant funding towards bond- and PPP-based financing instruments that Kerala's smaller and medium municipalities are not yet uniformly equipped to deploy effectively. The specific and significant gap in dedicated urban flood management funding for Kerala's flood-affected cities, identified in section 11.1 despite documented flooding impacts in Palakkad, Thrissur, Cochin and Malappuram, represents the most immediately actionable funding-advocacy priority this chapter identifies, and one that connects directly to the climate vulnerability and disaster risk reduction framework developed in Chapter 14. Taken together, these findings define the urban development component of the Vision 2047 roadmap addressed in Chapter 21: building urban local body financial and technical capacity ahead of the further withdrawal of direct central funding that current national policy trends suggest is likely to continue, while securing dedicated flood-resilience investment commensurate with Kerala's documented and growing urban flood exposure.

Chapter 12: Rural Development and Decentralised Governance

12.1 Panchayati Raj Institutions: Structure, Devolution and Capacity

Kerala's Panchayati Raj system, instituted under the Kerala Panchayati Raj Act, 1994 and the Kerala Municipality Act, 1994 enacted in direct response to the 73rd and 74th Constitutional Amendments, comprises a three-tier rural structure of approximately 900 Gram Panchayats at the village level, 152 Block Panchayats coordinating clusters of neighbouring Gram Panchayats at the intermediate level, and 14 District Panchayats as the apex local governance body within each district, with the participatory process anchored in Gram Sabhas — village assemblies open to all adult residents of a ward — convened annually from October as the starting point for local development planning (Pathfinders, 2025). What distinguishes Kerala's system most sharply from the equivalent Panchayati Raj architecture in most other Indian states is the scale of genuine fiscal devolution underpinning it: the Government of Kerala took the deliberate decision, at the launch of the People's Plan Campaign on 17 August 1996 under the Left Democratic Front government led by Chief Minister E.K. Nayanar, to devolve thirty-five per cent of the state's development budget directly to local governments, a share that has subsequently hovered between thirty-five and forty per cent across successive plan periods, a level of financial devolution that has been repeatedly described in the international decentralisation literature as unmatched elsewhere in India (PubAdmin.Institute, 2026). Kerala's adoption of what has been characterised as a "big bang" approach — implementing this scale of devolution immediately and comprehensively rather than through cautious, incremental phasing — distinguishes the Kerala model institutionally from the more typical Indian pattern in which devolution has proceeded gradually and unevenly across states, and the State Planning Board's own 2006 assessment concluded that Panchayati Raj had, by that point, been genuinely mainstreamed within Kerala's governance system, with cross-party political consensus on the need to continue strengthening it regardless of which coalition held power (Participedia, 2025). This consensus has proven durable: the 2001 change of government from the LDF to the United Democratic Front coalition, and subsequent alternations between the two coalitions in the years since, have not reversed or substantially diluted the core devolution architecture, even as each successive administration has emphasised somewhat different institutionalisation and capacity-strengthening priorities (Participedia, 2025).

This deep institutional history of decentralisation, examined throughout this report as a recurring explanation for Kerala's comparative strength in delivering health, nutrition, education and social welfare programmes through panchayat-level institutions, is most directly and explicitly the subject of this chapter, where the governance architecture itself, rather than any single sectoral outcome it supports, is the primary object of analysis. The national capacity-building data on Panchayati Raj institutions provides a useful comparative benchmark for assessing Kerala's position: Karnataka, Kerala, Andhra Pradesh, Telangana and Tamil Nadu together contributed more than sixty per cent of the ₹25,595 crore in Own Source Revenue generated by Gram Panchayats nationwide between 2017–18 and 2021–22

(Drishti IAS, 2025), indicating that Kerala's panchayats, alongside this small group of comparably decentralisation-committed states, have developed a meaningfully stronger own-revenue-generation capacity at the local government level than the all-India panchayat sector as a whole, a finding directly relevant to the urban local body revenue constraints discussed in Chapter 11 and suggesting that Kerala's rural panchayats may, in this specific respect, be somewhat ahead of their urban local body counterparts in revenue-mobilisation capacity, notwithstanding the broader state-level fiscal constraints documented throughout Chapter 2.

The Panchayat Devolution Index, a national metric tracking the depth of functional, financial and administrative devolution to rural local bodies, recorded an increase in overall devolution from 39.9 per cent in 2013–14 to 43.9 per cent in 2021–22 nationally (Drishti IAS, 2025), a national improvement trend against which Kerala's own devolution share — already at thirty-five to forty per cent of the state development budget since the mid-1990s, as documented above — stands as a comparatively mature and stable benchmark that much of the rest of the country is still working to approach. The national Rashtriya Gram Swaraj Abhiyan (RGSA), revamped in 2022 to provide capacity-building training to elected panchayat members and officials in governance, finance and planning, has been credited in several other states, including Tamil Nadu, with measurably improving budgeting practices and public works execution by helping bridge grassroots skill gaps (Drishti IAS, 2025); given Kerala's multi-decade head start in operationalising decentralised governance, documented throughout this chapter, the marginal capacity-building value Kerala's own panchayat representatives derive from RGSA participation may be comparatively smaller than for elected representatives in states implementing decentralisation for the first time, though continuous refresher training remains valuable given Kerala's own periodic election cycles and the corresponding need to train newly elected representatives in each cycle regardless of the state's overall institutional maturity. Kerala's panchayats have also, consistent with the digital-infrastructure orientation documented throughout this report, engaged actively with national e-governance tools including BharatNet — the national programme connecting Gram Panchayats with high-speed internet, with more than 2.14 lakh panchayats connected nationally as of the most recent reporting (Drishti IAS, 2025) — building on the state's own KFON broadband infrastructure discussed in Chapter 3, and reinforcing the close coupling, observed at several points throughout this report, between Kerala's digital infrastructure investment and its decentralised governance and welfare delivery architecture.

The durability of Kerala's devolution commitment across nearly three decades and multiple changes of governing coalition, noted earlier in this section, is itself a finding of some significance for comparative governance research, since fiscal decentralisation reforms in many other contexts — both within India and internationally — have proven vulnerable to reversal or quiet erosion when political control shifts between parties with differing institutional priorities. That Kerala's two principal governing coalitions, the Left Democratic Front and the United Democratic Front, have each in turn sustained rather than rolled back the core thirty-five-to-forty-per cent devolution architecture, even while differing on other

policy dimensions, suggests that the institutional and political constituency supporting decentralisation in Kerala — spanning elected panchayat representatives across the political spectrum, the Kudumbashree network's millions of women members, and the broader civil-society and academic constituency that has studied and championed the People's Plan Campaign internationally — has become sufficiently broad-based and embedded that no single governing coalition has found it politically advantageous to attempt a significant reversal, a degree of institutional entrenchment that few comparable decentralisation reforms elsewhere in India or in other developing-country contexts have achieved to a similar extent.

12.2 MGNREGA: Coverage, Wage Trends and Livelihood Outcomes

The Mahatma Gandhi National Rural Employment Guarantee Scheme functions in Kerala as a significant rural livelihood support mechanism, building on the institutional foundation of decentralised, panchayat-led implementation discussed in section 12.1. As documented in Chapter 7's discussion of Scheduled Caste welfare, MGNREGS-linked livelihood support has been particularly important for SC households in the working-age group, with roughly ninety per cent of Kerala's MGNREGS beneficiaries being women (Government of Kerala [GOK], 2024, Economic Review 2023, as cited in IJMRR, 2024) — an even more pronounced gender skew than the national average, reflecting the broader pattern, documented across this report's treatment of Kudumbashree in Chapters 3, 6, 7 and 11, of Kerala's rural and semi-rural livelihood and welfare architecture being disproportionately mediated through women's participation. Notwithstanding this strong gender-inclusion record, the underlying performance data on core MGNREGS delivery metrics in Kerala show a worrying pattern of stagnation, and in some years outright decline, in indicators such as average days of employment provided and the total number of households benefiting (GOK, 2024, as cited in IJMRR, 2024) — a finding that sits in some tension with Kerala's generally strong institutional capacity for decentralised programme delivery documented throughout this report, and that may reflect, at least in part, the comparatively tighter rural labour market conditions in Kerala relative to less economically developed states, given the remittance-supported household income levels and the broader labour market dynamics, including the informal-economy absorption capacity, documented extensively in Chapter 3.

At the national level, the standing parliamentary committee on Rural Development and Panchayati Raj has recommended increasing the guaranteed days of work under MGNREGA beyond the present 100 days as a means of enhancing the scheme's livelihood-support adequacy (Standing Committee on Rural Development and Panchayati Raj, 2024–2025), a recommendation whose relevance to Kerala specifically should be read in light of the stagnating average-days-of-employment trend noted above: if the binding constraint on MGNREGS utilisation in Kerala is genuinely demand-side — reflecting the comparatively favourable alternative income opportunities, including the informal-economy and remittance-supported income streams documented in Chapter 3, available to potential beneficiaries — then an increase in the guaranteed days ceiling would have limited practical effect on Kerala's own utilisation pattern even if it meaningfully benefited more

labour-constrained states; if, conversely, the stagnation reflects supply-side administrative or fund-flow constraints of the kind documented nationally through schemes such as the SNA-SPARSH financial management reform (Standing Committee, 2024–2025), then strengthening implementation capacity rather than raising the guaranteed-days ceiling would be the more directly relevant intervention for Kerala specifically.

The national SNA-SPARSH reform, which integrates MGNREGS fund disbursement with the Public Financial Management System, the State Integrated Financial Management System, and the Reserve Bank of India's e-Kuber system to enable real-time, demand-based fund release rather than advance fund parking at the state level (Standing Committee, 2024–2025), represents precisely the kind of fund-flow modernisation that connects directly to the broader public financial management reform agenda discussed in Chapter 2's treatment of revised-estimate accuracy and treasury management. Kerala's own adoption and operational performance under this SNA-SPARSH framework was not separately detailed in the sources reviewed for this chapter, but the scheme's stated objectives — minimising idle fund parking, improving cash management discipline, and ensuring timely fund availability at the point of actual wage disbursement — map directly onto the broader treasury management concerns this report identified in Chapter 2, where Kerala's reliance on the Reserve Bank's Ways and Means Advances and Overdraft facilities for a substantial number of days annually was documented as a specific indicator of cash-flow management strain. A state managing this degree of broader treasury stress might reasonably be expected to derive particular benefit from a scheme-specific reform such as SNA-SPARSH that reduces idle fund parking and improves real-time cash visibility, even though, absent Kerala-specific implementation data, this report can identify the relevance of the reform to Kerala's circumstances without being able to confirm its actual operational impact within the state to date.

12.3 Rural Housing: PMAY-Gramin and State Schemes

Kerala's rural housing delivery operates through the dual-track model already introduced in Chapter 11's discussion of urban housing: the national Pradhan Mantri Awas Yojana–Gramin (PMAY-G) scheme, with a national 2024–25 outlay of ₹15,825.35 crore (Standing Committee, 2024–2025), operating alongside and in coordination with the state's own LIFE Mission discussed in that chapter, which extends across both rural and urban Kerala. The national PMAY-G programme has, as of the most recent reporting available to this report, faced a substantial implementation backlog: of the original target, 2.66 crore houses had been completed nationally as of 22 October 2024, with 29 lakh houses still pending and a further backlog of 1,46,54,267 houses outstanding, including 62,54,267 carried over from the SECC-2011 beneficiary list and approximately 84 lakh from the subsequent Awaas+ beneficiary list, with the scheme's extended phase targeted for completion by March 2025 under Cabinet approval (Standing Committee, 2024–2025). The Standing Committee specifically expressed serious concern regarding the allocation of houses under this extended phase given the scale of the outstanding backlog (Standing Committee, 2024–2025), a concern whose relevance to Kerala specifically depends on the state's own position within

this national backlog distribution — a figure not separately disaggregated in the sources reviewed for this chapter, representing a further specific data gap consistent with the pattern this report has identified, particularly in Chapter 5 and Chapter 7, regarding the general scarcity of Kerala-specific disaggregated data within broader national programme reporting.

Kerala's own LIFE Mission, discussed in Chapter 11, is specifically designed to complement and extend beyond this national PMAY-G framework, addressing housing and landlessness through a livelihood-integrated model that, as noted in that chapter, leverages the Kudumbashree network for beneficiary identification and support — a state-specific institutional capability that, on the evidence reviewed for this report, has likely allowed Kerala to manage its own rural housing backlog with somewhat greater institutional dexterity than the aggregate national figures alone would suggest, even though this report cannot precisely quantify the differential without the state-specific PMAY-G completion data that was not available within the sources consulted.

The broader policy lesson this section draws from the national PMAY-G backlog data is that rural housing delivery at the scale required across India is an inherently difficult administrative undertaking even for a national programme with substantial dedicated funding, and that Kerala's institutional advantages — the panchayat-level beneficiary identification capacity discussed in section 12.1, the Kudumbashree integration discussed in section 12.4 and in Chapter 11, and the state's generally strong land-records and beneficiary-verification systems relative to many other Indian states — should be understood as providing a meaningful, though not unlimited, comparative advantage in managing this delivery challenge rather than as a guarantee of complete backlog clearance. Given the land scarcity constraints documented in Chapter 11's discussion of Kerala's housing sector, and the specific multi-storey apartment-complex adaptations the LIFE Mission has adopted in response, Kerala's rural housing delivery challenge may in practice differ qualitatively from the more land-abundant rural housing contexts assumed in the original PMAY-G programme design, reinforcing the case, made in Chapter 11, for continued state-specific adaptation of national housing scheme parameters to Kerala's particular land-constrained rural and peri-urban context.

12.4 Livelihood Promotion: SHGs, Cooperatives and Rural Enterprise

Kudumbashree, launched in 1997 as a direct institutional outgrowth of the People's Plan Campaign discussed in section 12.1, stands as Kerala's single most consequential rural livelihood promotion institution and has grown to become India's largest women-led poverty alleviation programme, enabling more than 4.2 million women to engage in microfinance, entrepreneurship, and grassroots governance participation (Pathfinders, 2025). The programme's structural integration with Kerala's panchayat system — Kudumbashree neighbourhood groups, area development societies and community development societies are organised in direct correspondence with the ward, panchayat and block tiers of the local government structure discussed in section 12.1 — exemplifies the broader pattern this report

has identified throughout: Kerala's most successful welfare and livelihood interventions are those built to operate through, rather than alongside or in competition with, the state's decentralised governance architecture. A specific, well-documented illustration of this livelihood-promotion model in action comes from Nelliampathy Gram Panchayat in Palakkad district, where more than two hundred women formed Kudumbashree collectives to revive cardamom farming, securing formal bank loans, leasing fifty acres of previously unused agricultural land, and by 2022 generating an annual collective turnover of roughly ₹1.2 crore (approximately US\$140,000), with a portion of these profits reinvested directly in healthcare and education for participating households (Pathfinders, 2025). This single case study is illustrative of a broader documented effect: female workforce participation in the Nelliampathy region rose from 15.3 per cent in 1998 to 31.6 per cent in 2021, a more than two-fold increase attributed substantially to this kind of Kudumbashree-organised collective enterprise activity, and one that has helped narrow the rural gender employment gap in the specific localities where such collectives have taken root (Pathfinders, 2025) — a finding that stands in instructive contrast to the persistent state-wide gender employment gap documented in Chapter 7 and Chapter 3, suggesting that while Kudumbashree-style collective enterprise can deliver substantial, measurable gains in specific localities and sectors, its cumulative state-wide impact has not yet been sufficient to close the broader, structurally entrenched gender employment gap examined in those chapters.

Beyond Kudumbashree specifically, Kerala's cooperative sector — spanning agricultural credit cooperatives, dairy cooperatives, and the consumer and marketing cooperative societies that have historically played a significant role in the state's rural economy — provides a further, longer-standing layer of rural livelihood and credit infrastructure that predates Kudumbashree's 1997 launch by several decades, reflecting Kerala's broader historical tradition, noted at several points throughout this report, of community and cooperative institutional development as a complement to direct state provision.

Among Kerala's longest-established cooperative institutions, the Kerala Co-operative Milk Marketing Federation, operating under the Milma brand, illustrates the scale and longevity of this cooperative tradition: organised as a three-tier structure of village-level dairy cooperative societies, district-level unions, and the apex state federation, Milma has for decades provided smallholder dairy farmers across Kerala with an assured procurement channel, technical support, and a degree of price stability that individual smallholder producers — given the generally small landholding sizes characteristic of Kerala's agricultural sector, discussed in Chapter 3 and Chapter 18 — would struggle to secure independently in an unorganised milk market. This dairy cooperative model exemplifies a broader pattern in Kerala's animal husbandry and allied agricultural sectors, examined further in Chapter 18, in which cooperative aggregation of numerous small producers has historically substituted for the larger-scale, vertically integrated commercial dairy and livestock operations more typical of agricultural economies with larger average landholding sizes. Kerala's primary agricultural credit cooperative societies similarly provide a long-standing alternative credit channel for smallholder farmers, complementing the formal commercial banking sector discussed in

Chapter 3's treatment of the state's relatively dense banking network, and offering credit access calibrated specifically to agricultural seasonal cash-flow patterns in a way that conventional commercial bank lending products have historically been less well adapted to provide.

12.5 Rural Infrastructure: PMGSY, Connectivity and Market Linkages

Kerala's rural road connectivity, introduced in Chapter 8's discussion of the state's overall transport infrastructure, is delivered substantially through the Pradhan Mantri Gram Sadak Yojana, which, as a national programme spanning three successive phases (PMGSY-I, PMGSY-II and PMGSY-III), continues to face implementation delays attributable to a recurring set of challenges documented at the national level: land acquisition difficulties, difficult terrain, contractor delays, legal hurdles, and — described by the Standing Committee on Rural Development and Panchayati Raj as a particularly significant bureaucratic bottleneck — delays in obtaining clearances from agencies such as the Ministry of Environment, Forest and Climate Change (Standing Committee, 2024–2025). This last category of delay is likely to be especially relevant to Kerala specifically, given the state's extensive forest cover and ecologically sensitive Western Ghats terrain discussed in Chapter 13, where rural road projects passing through or near forest and eco-sensitive zones routinely require additional environmental clearance processes that rural road projects in less ecologically sensitive Indian states would not face to the same degree. PMGSY's funding mechanism — under which funds are released to states as an advance against the sanctioned value of projects rather than through a direct-benefit-transfer module, meaning some funds will inevitably remain unspent with the state pending project completion (Standing Committee, 2024–2025) — interacts with the broader fiscal management concerns documented in Chapter 2, where Kerala's general pattern of revised-estimate deviation and treasury management strain was identified as a recurring public financial management weakness; a state already managing such broader fiscal strain may face additional difficulty in maintaining the smooth, well-sequenced fund utilisation that PMGSY's advance-based funding mechanism is designed to support.

Beyond the PMGSY road-connectivity programme itself, rural market linkage infrastructure in Kerala — connecting agricultural and allied-sector producers documented in Chapter 18 to processing facilities, wholesale markets, and the export-oriented value chains for rubber, seafood and coconut discussed in Chapter 4 — depends directly on the quality and reliability of this same rural road network, reinforcing the connection this chapter draws between basic rural infrastructure delivery and the agricultural value-chain transformation priorities examined in Chapters 4 and 18.

This tension between rural connectivity needs and environmental clearance requirements, noted above in connection with PMGSY projects passing through forest and eco-sensitive zones, recurs as a structural feature across virtually every major infrastructure category examined in this report — the Silver Line and eight-track freight rail proposals discussed in

Chapter 8, the small hydropower project delays discussed in Chapter 9, and now rural road connectivity discussed here — and reflects a genuine and largely unavoidable trade-off inherent in developing infrastructure within a state whose forest cover, biodiversity, and ecologically sensitive Western Ghats terrain, examined comprehensively in Chapter 13, are themselves a development asset whose degradation would carry its own significant economic and ecological costs. Rather than treating this recurring environmental-clearance friction as a pure administrative inefficiency to be eliminated, this report's assessment, consistent with the position taken in Chapter 8's discussion of the eight-track rail proposal's deliberately eco-sensitive alignment design, is that Kerala's infrastructure planning institutions should continue to invest in environmentally adaptive engineering solutions — elevated and tunnelled alignments, smaller-footprint construction techniques, and early-stage environmental impact assessment integrated into project design from inception rather than treated as a late-stage approval hurdle — as the more durable solution to this tension than seeking to streamline or bypass environmental clearance requirements themselves.

12.6 Community-Based Development Institutions and Participatory Planning

The People's Plan Campaign discussed throughout this chapter has evolved through several distinct institutional phases since its 1996 launch, each adapting the underlying participatory planning model to changing administrative and technological circumstances. The Ninth Five-Year Plan period saw the campaign's initial launch following the enactment of the Kerala Panchayati Raj Act and Kerala Municipality Act in 1994; the Tenth Five-Year Plan restructured the programme as the "Kerala Development Plan"; the Eleventh Five-Year Plan period emphasised completing the institutionalisation of decentralised governance under a renewed "People's Planning" framing; and the Twelfth Five-Year Plan (2012–2017) marked the campaign's second phase, integrating information technology into the planning process through the State Planning Board's Decentralised Planning Division, with the Thirteenth Five-Year Plan (2017–2022) shifting focus specifically towards addressing what state planners characterised as "second generation" social and economic issues facing the state (SPB Kerala, 2026; Pathfinders, 2025). This sustained, multi-decade institutional evolution — rather than a single static reform implemented once in 1996 and left unchanged — illustrates a deliberate, continuously adapted approach to decentralised governance that distinguishes Kerala's model from many comparable decentralisation initiatives elsewhere in India, which have in several cases struggled to sustain comparable institutional momentum beyond an initial reform launch.

The national People's Plan Campaign, launched separately by the Ministry of Panchayati Raj on 2 October 2018 under the slogan "Sabki Yojana, Sabka Vikas" and continuing through its 2025–26 edition, has subsequently adopted a broadly similar Gram Panchayat Development Plan model nationally, supported by digital tools including the eGramSwaraj platform (adopted by more than 2.7 lakh panchayats nationally), the Meri Panchayat citizen-engagement app, and the SabhaSaar AI-powered Gram Sabha meeting summariser launched in 2025 (Drishti IAS, 2025, 2026) — representing, in effect, a national-level

adoption of a participatory planning model that Kerala had already pioneered, refined, and operated for more than two decades before the national programme's 2018 launch. This sequencing — Kerala's state-specific innovation substantially preceding, and arguably informing, the subsequent national policy framework — recurs as a pattern across several of the institutional models this report has documented as distinctive Kerala strengths, including the Total Mental Health initiative's panchayat-embedded screening model discussed in Chapter 6 and the Kudumbashree-based welfare delivery architecture discussed throughout this report, suggesting that Kerala's decentralised governance tradition functions not merely as a locally beneficial institutional arrangement but as a genuine source of policy innovation that has, in several documented instances, subsequently informed national-level programme design.

Notwithstanding this strong institutional record, the broader national literature on Panchayati Raj identifies structural challenges that, while documented primarily in relation to states such as Uttar Pradesh and Bihar, warrant at least cautious consideration in the Kerala context as well: the "Sarpanch Pati" phenomenon, in which male relatives unofficially control the decision-making of women elected to panchayat positions, undermining the substantive, as opposed to merely formal, political empowerment that reserved seats for women are intended to deliver (Drishti IAS, 2025). Given Kerala's otherwise strong record on women's participation in governance through the Kudumbashree network documented in section 12.4, and the state's comparatively favourable gender and social development indicators documented throughout Chapters 1 and 7, the available sources reviewed for this report do not provide direct evidence on whether this specific phenomenon is similarly prevalent within Kerala's own panchayat system; this represents a further specific area where dedicated, state-level research — distinguishing formal representation from substantive decision-making authority among Kerala's elected women panchayat members — would meaningfully strengthen this report's otherwise positive assessment of Kerala's decentralised governance model, and is flagged accordingly as a priority for the statistical and research strengthening agenda developed in Chapter 20.

Drawing together the evidence assembled across this chapter, Kerala's rural development and decentralised governance architecture stands, on the weight of evidence reviewed in this report, as one of the state's most distinctive and most consequential institutional achievements — not merely as an end in itself, but as the underlying delivery mechanism that has made possible the health, nutrition, education and social welfare outcomes documented across virtually every preceding chapter of this report. The thirty-five to forty per cent fiscal devolution sustained across three decades and multiple changes of governing coalition, the Kudumbashree network's mobilisation of more than four million women into livelihood and governance participation, and the sustained, multi-phase institutional evolution of the People's Plan Campaign from 1996 through to the present day collectively constitute a governance model whose influence, as this chapter has shown, extended well beyond Kerala's own borders to inform the subsequent design of national programmes including the Ministry of Panchayati Raj's own People's Plan Campaign launched in 2018. The residual gaps this

chapter has identified — MGNREGS utilisation stagnation whose demand-side versus supply-side origin remains unresolved without further state-specific data, the unquantified Kerala-specific position within the national PMAY-G housing backlog, and the unexamined question of whether the "Sarpanch Pati" phenomenon documented elsewhere in India has any meaningful presence within Kerala's own panchayat system — are each, in this report's assessment, addressable through the kind of dedicated state-level statistical and research investment this report has recommended at multiple points across preceding chapters, and represent refinements to an already strong governance model rather than evidence of fundamental institutional weakness. The rural development and decentralisation component of the Vision 2047 roadmap developed in Chapter 21 should accordingly focus less on structural reform of Kerala's panchayat system, which this chapter has shown to be already well-established and broadly effective, and more on closing these specific data and evaluation gaps, and on ensuring that the same decentralised delivery model continues to be extended deliberately to emerging policy priorities — climate adaptation, examined in Chapter 14, and the digital and AI-enabled governance tools discussed in Chapter 16 — in the same manner it has already been successfully extended to mental health screening, nutrition delivery, and women's livelihood promotion over the preceding three decades.

Chapter 13: Environment and Natural Resource Governance

13.1 Forest Cover, Biodiversity and Wildlife Conservation

Kerala's forest cover, concentrated overwhelmingly along the Western Ghats escarpment documented in Chapter 1's discussion of the state's highland zone, forms part of one of the world's eight hottest biodiversity hotspots, a UNESCO World Heritage-recognised mountain range stretching roughly 1,600 kilometres across six states and hosting more than 7,400 distinct species with exceptionally high levels of endemism (Insights on India, 2025). As of October 2025, Kerala maintains six national parks spanning approximately 640 square kilometres, predominantly shola-grassland mosaics and evergreen forest habitats supporting endemic and threatened mammal species including the Nilgiri tahr and lion-tailed macaque, with the Periyar National Park, organised around tiger conservation within a reservoir-integrated ecosystem, representing the state's largest and best-known protected area, alongside a set of smaller, high-altitude shola parks specifically targeting endemic habitats vulnerable to ecological fragmentation (Grokikipedia, 2026). This protected-area network sits within a far larger surrounding landscape of unprotected but ecologically significant forest, the management of which has become the subject of one of the most sustained and politically contentious environmental governance debates in Kerala's recent history, examined in detail in section 13.2.

The economic value embedded within this biodiversity asset base extends well beyond its intrinsic ecological significance: the Western Ghats' role in trapping monsoon winds and creating the high-rainfall zones that sustain Kerala's agriculture (examined in Chapter 3 and Chapter 18), its function as a climate regulator for the wider southern Indian region, and its origin-point role for major peninsular rivers that the broader regional literature identifies as critical to water security across the Western Ghats' full six-state span (Insights on India, 2025) together mean that forest cover loss or degradation within Kerala's portion of this mountain range carries direct economic costs — reduced agricultural productivity, compromised water security, and altered regional climate patterns — that extend well beyond the conservation value typically emphasised in biodiversity-focused environmental advocacy. This economic dimension of forest conservation is directly relevant to how the development-versus-conservation tension examined throughout this chapter should be weighed: rather than treating forest protection and economic development as inherently opposed objectives, the evidence reviewed in this section suggests that Kerala's forest cover should be understood as itself a form of economic infrastructure — supporting agriculture, water supply, and climate stability — whose degradation imposes costs on the very development objectives, including the agricultural productivity and water security priorities examined in Chapters 10 and 18, that quarrying and unplanned development are sometimes pursued in service of.

A distinctive recent contribution to Kerala's biodiversity knowledge base comes from the Wayanad Sky Islands, a set of high-elevation shola-grassland habitats between 1,200 and

2,400 metres above sea level within the Wayanad Wildlife Sanctuary, South Wayanad and North Wayanad forest divisions, characterised by significant microclimatic isolation and correspondingly high levels of localised biodiversity that, notwithstanding their ecological significance, had received comparatively limited systematic scientific survey attention prior to recent dedicated biodiversity assessment efforts (Wayanad Sky Islands Survey, 2025). This combination of globally significant biodiversity value and comparatively under-documented species composition in specific high-altitude habitats illustrates a broader pattern this report identifies across several environmental governance domains examined in this chapter: Kerala's forest and biodiversity assets are widely and correctly recognised as globally significant in aggregate terms, even as the granular, site-specific ecological data needed to support precise, locally calibrated conservation and land-use planning decisions remains, in several documented instances, incomplete.

Community-based conservation initiatives in Kerala offer a notable counterpoint to the more centralised, state-led protected-area model discussed above. The protection of the Malabar Pied Hornbill in the Vazhachal Forest division, achieved through a community-based initiative directly involving the Kadar tribal community, illustrates a model in which indigenous and forest-dwelling community participation, rather than exclusion, has delivered measurable conservation outcomes (Fortune IAS Circle, 2025) — a model directly relevant to the forest-dwelling Scheduled Tribe rights framework discussed in Chapter 7's treatment of the Forest Rights Act, 2006, and one that offers a constructive template for resolving the conservation-versus-tribal-rights tension that chapter identified as a recurring source of friction in Kerala's forest governance. Notwithstanding this positive example, the broader pattern of Community Forest Resource (CFR) claims under the Forest Rights Act remains substantially unresolved across most of Kerala's tribal-forest interface districts, with CFR claims reported as pending in most districts of both Kerala and Karnataka, contributing to a continuing state of legal and administrative disenfranchisement for forest-dwelling communities whose traditional land and resource rights the Act was specifically designed to recognise and formalise (Insights on India, 2025). This pending-claims backlog represents a direct, unresolved interface between this chapter's forest governance focus and the tribal welfare and land-rights framework examined in Chapter 7, and one that this report identifies as requiring continued, dedicated administrative attention given the multi-year, in some cases multi-decade, duration over which many of these claims have now remained pending.

Invasive species presents a further, less politically visible but ecologically significant threat to Kerala's forest biodiversity: the invasive alien tree *Senna spectabilis* has colonised substantial areas of the Wayanad Wildlife Sanctuary landscape, displacing native vegetation and degrading the shola-grassland habitat structure that the Wayanad Sky Islands survey discussed above identified as ecologically critical (Insights on India, 2025). The same Wayanad landscape, already examined in this chapter in connection with both the 2024 landslide and the quarrying expansion documented in section 13.4, thus faces a compounding set of pressures — invasive species, illegal quarrying, and the climate-related landslide risk examined further in Chapter 14 — that together illustrate why this single district has

emerged, across multiple sections of this chapter, as Kerala's most environmentally stressed and most closely scrutinised landscape.

13.2 Land Use Change, Soil Degradation and Land Resource Management

The single most consequential and politically charged land-use governance question examined in this chapter concerns the delineation and regulation of Ecologically Sensitive Areas (ESAs) within Kerala's portion of the Western Ghats. The Madhav Gadgil-led Western Ghats Ecology Expert Panel's 2011 report recommended sweeping restrictions on mining, quarrying and other environmentally harmful activities across a substantial share of the Western Ghats landscape, but its recommendations met sufficiently strong resistance from state governments, industry interests, and local communities across the six affected states that the Centre subsequently constituted a second High-Level Working Group, chaired by space scientist K. Kasturirangan, which in 2013 recommended a somewhat narrower ESA designation covering thirty-seven per cent of the overall Western Ghats landscape, with a complete prohibition on mining, quarrying and sand mining specifically within these designated zones (Fortune IAS Circle, 2025; India Mongabay, 2025).

Kerala's political leadership has, across successive governments, consistently characterised both the Gadgil and Kasturirangan recommendations as insufficiently attentive to ground realities and societal aspirations: following the catastrophic July 2024 Wayanad landslide, Chief Minister Pinarayi Vijayan reiterated this position explicitly, stating that much of the recommendations in these reports were not pragmatic (India Mongabay, 2025) — a characterisation that satellite imagery analysis conducted in the aftermath of that same landslide complicated significantly, by revealing that Wayanad district housed at least 48 stone quarries, of which 15 were located within Environmentally Sensitive Areas that the Kasturirangan framework had specifically intended to place off-limits to such activity (India Mongabay, 2025).

The Centre's most recent ESA delineation effort, a fresh draft notification issued following the 2024 Wayanad landslide, designates 9,994 square kilometres of Kerala territory as ecologically sensitive, with Kerala's state government formally requesting that its assigned ESA share be reduced from 993.7 square kilometres to 8,805 square kilometres through the exclusion of specific villages in Idukki and Wayanad districts — a request the Centre's expert committee had not agreed to as of the most recent reporting reviewed for this chapter (The Federal, 2026).

The Gadgil panel's original 2011 recommendation specifically identified districts including Idukki, alongside Theni across the state border in Tamil Nadu, as areas where unregulated mining activity posed acute landslide and habitat fragmentation risk (Grokikipedia, 2026) — a warning that the subsequent 2024 Wayanad landslide, while occurring in a different specific district, broadly vindicated in its underlying logic linking unregulated extractive activity in steep, ecologically fragile terrain to catastrophic slope-failure risk. Idukki district, already

identified in Chapter 1 as one of Kerala's predominantly hill and tribal districts lagging the state average on connectivity and health infrastructure indicators, thus carries a double burden examined across multiple chapters of this report: the socioeconomic disadvantage documented in Chapter 1 and Chapter 7's tribal welfare discussion, compounded by the elevated landslide and ecological degradation risk documented in this chapter, illustrating how Kerala's environmental governance challenges and its social justice and intra-state disparity challenges, examined separately in different chapters of this report, in fact converge geographically in specific hill and tribal districts that face the combined burden of both forms of vulnerability simultaneously. This unresolved negotiation between the state government's preference for a narrower ESA footprint and the Centre's expert-committee-recommended boundaries represents a live, unresolved governance question with direct bearing on the land-use, mining, and infrastructure development priorities examined throughout this report, including the PMGSY rural road clearance delays discussed in Chapter 12 and the small hydropower project delays discussed in Chapter 9, both of which were attributed substantially to the same category of environmental clearance friction in ecologically sensitive zones that this section's ESA delineation dispute exemplifies at the policy level.

The Western Ghats' hydropower legacy, examined from a generation-capacity perspective in Chapter 9, carries direct land-use and ecological consequences that this chapter's environmental governance framing makes explicit: the construction of hydropower dams across the Western Ghats, including several of the major hydroelectric projects discussed in Chapter 9's treatment of Kerala's renewable energy base, has resulted in documented habitat destruction, the alteration of natural river flow regimes, and in several historical instances the displacement of local and tribal communities from submergence and catchment areas (Fortune IAS Circle, 2025).

Subsequent attempts to repurpose or revive specific underutilised hydroelectric assets through eco-tourism rebranding have, in at least one documented post-2021 instance, faced renewed community and environmental backlash over both continuing ecological disruption and inadequate tribal consent processes under the Forest Rights Act framework discussed above, illustrating a continuing institutional tendency — also noted in this chapter's protected-areas review — for state agencies including the Kerala State Electricity Board to prioritise hydro generation potential over alternative, lower-impact renewable options such as the floating and rooftop solar capacity discussed in Chapter 9, even where credible alternatives exist (Grokikipedia, 2026). This finding adds a specific environmental-governance dimension to the renewable energy transition discussed in Chapter 9: the land-use and ecological cost of Kerala's existing hydropower legacy asset base, much of it built decades before contemporary environmental and tribal-rights regulatory frameworks existed, should be weighed explicitly against the comparatively lower-impact land-saving renewable technologies — floating solar in particular — that Chapter 9 identified as offering the state's most promising remaining renewable expansion headroom, reinforcing the case for prioritising these lower-impact technologies over further large-hydro development specifically within the Western Ghats landscape examined in this chapter.

13.3 Water Bodies, Wetlands and River Ecosystem Health

Kerala's extensive network of rivers, backwaters and wetlands, introduced in Chapter 1's description of the state's coastal lowland geography and examined from a transport-infrastructure perspective in Chapter 8, faces a combination of pressures examined throughout this report from multiple angles: the paddy-land and wetland conversion trend documented in Chapter 10, which this report identified as eroding the natural flood-attenuation function these wetlands historically provided; the inadequate centralised sewerage and liquid waste treatment coverage documented in Chapter 10's discussion of urban wastewater, which contributes ongoing organic and nutrient pollution loading to rivers and backwaters; and the upstream land-use degradation associated with quarrying and unplanned development in the Western Ghats catchment areas discussed in section 13.2, which several environmental assessments, including the protected-areas review cited in this chapter, have directly linked to the severity of the catastrophic 2018 Kerala floods through the mechanism of upstream sediment loading and reduced natural water-retention capacity in degraded hill-slope catchments (Grokikipedia, 2026). The Western Ghats' role as the origin point for major peninsular Indian rivers — a hydrological function the broader Western Ghats literature identifies as critical to water security across multiple southern Indian states, not Kerala alone (Insights on India, 2025) — means that degradation within Kerala's own portion of this mountain range carries downstream consequences for river ecosystem health and water availability extending well beyond Kerala's state boundaries, reinforcing the inter-state and regional dimension of the environmental governance challenges examined throughout this chapter.

A further, less visible driver of wetland and forest-fringe ecological degradation in Kerala concerns the historical diversion of forest land for monoculture plantation forestry, principally eucalyptus and acacia, which the broader Western Ghats environmental literature identifies as harming native biodiversity and degrading soil health, with the Wayanad landscape specifically cited as having experienced a documented decline in pollinator populations and soil microbial diversity attributable to pesticide-intensive plantation management practices associated with this monoculture forestry model (Insights on India, 2025). This finding adds a further dimension to the multi-layered environmental stress on Wayanad documented throughout this chapter, and illustrates that the river and wetland ecosystem degradation examined in this section is not attributable solely to the urban sewerage and quarrying pressures discussed elsewhere in this chapter, but also to land-use legacies — plantation forestry decisions made in some cases decades ago — whose ecological consequences continue to manifest in present-day soil and water quality outcomes. The broader implication for river ecosystem health, consistent with the catchment-degradation-to-flood-risk linkage already discussed in connection with the 2018 floods, is that restoring degraded plantation forestry areas to native vegetation cover, where feasible, would likely deliver water-retention and biodiversity benefits beyond what wetland and paddy-land conservation measures, discussed in Chapter 10, can achieve on their own, since the latter address only the lowland and coastal end of Kerala's hydrological system

while the plantation forestry degradation discussed here affects the upland catchment areas where the underlying problem of reduced water retention capacity originates.

13.4 Mining and Mineral Resource Governance

Mining and quarrying, while contributing only a marginal direct share of Kerala's GSDP as documented in Chapter 3, occupies an outsized position in the state's environmental governance debate precisely because of its concentrated ecological impact within the Western Ghats landscape discussed throughout this chapter. A particularly instructive and counterintuitive regulatory dynamic emerged following Kerala's 2016 ban on river sand mining, introduced specifically to address riverbed degradation and the depletion of natural sand resources: research conducted by the National Institute of Technology, Kozhikode found that the construction industry — the largest consumer of mined river sand and itself a major driver of the remittance-financed housing boom documented in Chapter 3 — responded to the sand mining ban not by reducing aggregate demand but by substituting manufactured sand (M-sand), produced by crushing quarried rock, leading to a substantial and unintended expansion of stone quarrying activity in areas adjacent to protected forests across the Western Ghats, with some individual quarries expanding five- to ten-fold or more between 2011 and 2021, and roughly seventeen per cent of this expansion occurring in 2016 alone, the same year the original sand-mining ban took effect (India Mongabay, 2025).

This finding represents a clear and well-documented instance of regulatory displacement, in which a policy intervention targeted at one specific extractive activity and its associated environmental harm (riverbed sand depletion) generated a substantial, largely unanticipated increase in a different extractive activity (Western Ghats stone quarrying) whose environmental impact — habitat loss, noise and dust pollution, and ground-shaking blast disturbance to wildlife — the researchers characterise as comparably or more severe than the harm the original ban sought to prevent (India Mongabay, 2025). The Kerala Revenue Department's subsequent decision, announced in May 2025, to approve new guidelines permitting the resumption of river sand mining — effectively lifting the nearly decade-long moratorium (India Mongabay, 2025) — represents a direct policy response to this regulatory displacement dynamic, though whether this reversal will succeed in reducing quarrying pressure on Western Ghats buffer forests without simply reintroducing the original riverbed degradation problem the 2016 ban was designed to address remains, on the evidence available to this report, an open and significant environmental management question.

The broader regulatory lesson this report draws from the sand mining ban's documented displacement effect onto stone quarrying is one of systems-level rather than single-resource environmental policy design: a regulation targeting one specific extractive activity in isolation, without simultaneously addressing the underlying construction-material demand driving that activity, risks simply redirecting environmental harm to a different, sometimes less visible or less politically salient extraction category, rather than genuinely reducing the aggregate environmental footprint of the activity the regulation was designed to constrain.

Applied to Kerala's specific circumstances, this suggests that future mineral resource governance reform should be designed around the underlying construction-material demand documented throughout this report — itself substantially driven by the remittance-financed housing boom examined in Chapter 3 and the broader infrastructure investment programme examined in Chapters 8, 9 and 11 — rather than around individual extraction methods considered separately, and should explicitly model the likely substitution and displacement effects of any proposed restriction before implementation, a systems-level environmental impact assessment discipline that the sand-mining-to-quarrying displacement case study examined in this section suggests was not adequately applied at the time of the original 2016 ban.

Illegal mining activity compounds this regulatory complexity further: documented illegal mining in Wayanad's forested hills, permitted to continue despite existing regulatory restrictions, has been specifically identified as intensifying landslide risk and soil erosion in zones adjacent to protected areas including the Wayanad Wildlife Sanctuary (Grokikipedia, 2026) — a finding of direct and urgent relevance given the catastrophic July 2024 Wayanad landslide discussed in section 13.2 and examined further from a disaster-risk perspective in Chapter 14, and one that illustrates how formal regulatory frameworks, even where well-designed on paper, depend critically on enforcement capacity that this chapter's evidence suggests has been inconsistently applied across Kerala's mining and quarrying sector.

This illegal mining enforcement gap connects directly to the broader institutional capacity constraints examined in Chapter 15's treatment of administrative governance reform, since effective mining and quarrying regulation depends on a combination of adequate field-level enforcement staffing, the political independence of local revenue and forest officials from quarrying-industry influence, and a functioning inter-departmental coordination mechanism linking the Forest Department, the Revenue Department (responsible for the 2025 sand-mining policy reversal discussed above), and the State Pollution Control Board — precisely the kind of inter-departmental coordination challenge that this report has identified as a recurring institutional weakness across multiple infrastructure and regulatory domains, including the infrastructure delivery sequencing gaps documented in Chapter 8. Without resolving this underlying enforcement and coordination capacity gap, this report's assessment is that further legislative or policy reform of Kerala's mining and quarrying regulatory framework, however well designed in principle, is likely to encounter the same implementation gap between formal regulation and on-the-ground enforcement that this chapter has documented repeatedly across the ESA delineation dispute, the sand-mining-to-quarrying displacement, and the specific case of illegal Wayanad mining activity continuing despite existing restrictions.

13.5 Pollution: Air, Water, Noise and Soil — Status and Regulatory Response

Pollution in Kerala spans several distinct sources examined at various points throughout this report: the Brahmapuram landfill fire discussed in Chapter 10, which produced a significant

urban air pollution event in Kochi in March 2023; the ongoing water-quality and groundwater contamination risk associated with inadequate sewerage coverage, also discussed in Chapter 10; the legacy hazardous waste and contaminated-site management obligations associated with the Aluva industrial belt's long-established chemical and petrochemical facilities discussed in Chapters 3, 4 and 10; and the noise, dust and ground-vibration pollution associated with stone quarrying activity discussed in section 13.4 of this chapter, which directly affects wildlife in proximity to protected areas in addition to its impact on nearby human settlements.

Kerala's State Pollution Control Board operates within the broader national environmental regulatory framework administered under the Air (Prevention and Control of Pollution) Act, 1981, and the Water (Prevention and Control of Pollution) Act, 1974, but the cumulative evidence assembled across this report — the Brahmapuram fire, the documented presence of stone quarries within formally designated Environmentally Sensitive Areas, and the persistent urban sewerage gap — suggests that enforcement capacity relative to the scale and diversity of pollution sources active across Kerala's densely populated and ecologically complex landscape remains a continuing institutional challenge, consistent with the broader pattern, identified at several points in this report, of Kerala possessing comparatively well-designed regulatory and policy frameworks whose on-the-ground enforcement has not always kept pace with the frameworks' formal ambitions.

The Brahmapuram fire's aftermath illustrates this enforcement gap concretely: subsequent inquiries into the incident identified inadequate ongoing waste segregation and processing capacity at the facility, despite formal regulatory requirements for proper solid waste management under both state and national rules, as a direct contributing cause of the volume of accumulated, inadequately processed waste that ultimately fuelled the prolonged fire — a regulatory-compliance failure that mirrors, in the solid waste domain, the same pattern this chapter has already documented in the mining domain, where formally designated Environmentally Sensitive Areas were nonetheless found to host active stone quarries. Air quality monitoring infrastructure in Kerala's major urban centres, while present, has not historically received the same intensity of public and policy attention as in northern Indian cities facing more severe and visible air pollution crises, even though episodic events such as the Brahmapuram fire demonstrate that Kerala's urban centres are not categorically immune to acute air quality crises, and that the state's generally favourable baseline air quality — attributable to its coastal geography, high rainfall, and comparatively lower industrial intensity relative to northern Indian industrial belts — should not be mistaken for comprehensive air quality regulatory readiness in the event of a comparable future incident.

The cumulative lesson from the Brahmapuram episode and its aftermath, considered alongside the mining and quarrying enforcement gaps documented in section 13.4, is that Kerala's environmental regulatory apparatus, notwithstanding the state's strong formal institutional design across virtually every domain examined in this report, faces a specific and recurring capacity constraint in sustaining adequate ongoing enforcement and monitoring

once initial regulatory frameworks and physical infrastructure — a waste processing facility, an ESA boundary, a sand-mining ban — have been established. This pattern of strong initial design but weaker sustained enforcement recurs sufficiently often across this chapter's evidence base that this report identifies it as a distinct and generalisable institutional finding, rather than a set of unrelated, sector-specific enforcement failures, and one that should inform the administrative governance reform priorities developed in Chapter 15.

13.6 Coastal and Marine Resource Management

Kerala's roughly 580-kilometre coastline, introduced in Chapter 4's discussion of the state's seafood and marine products export potential, carries its own distinct set of resource management challenges examined in this report from multiple complementary angles: the traditional fisherfolk settlement vulnerability to coastal erosion and storm surge discussed in Chapter 11's treatment of urban poverty, the marine fisheries resource base whose recent strong rebound was documented in Chapter 3's discussion of the primary sector, and the broader coastal ecosystem services — including the mangrove and estuarine habitats integrated with the backwater network discussed in Chapter 8 — that support both this fisheries economy and the tourism sector examined in Chapter 19.

Coastal Regulation Zone (CRZ) notifications, administered under the national Environment Protection Act framework, govern permissible construction and development activity within defined distances of the coastline, and the tension this regulatory framework navigates — between protecting coastal ecology and fisherfolk livelihood interests on one hand, and accommodating the port, tourism and urban development pressures documented throughout this report (Vizhinjam port in Chapter 8, coastal tourism infrastructure in Chapter 19, and the urban expansion pressures discussed in Chapter 11) on the other — mirrors, in a coastal context, the same fundamental land-use and development-versus-conservation tension this chapter has already examined at length in relation to the Western Ghats ESA delineation dispute.

Marine resource governance in Kerala additionally intersects with the Marine Products Export Development Authority's registration and certification framework discussed in Chapter 4, since sustainable harvest practices and marine ecosystem health are directly relevant to maintaining the export-market access and certification standards on which the seafood value-chain transformation opportunities identified in that chapter substantially depend — meaning marine environmental governance, examined here, and marine export economic strategy, examined in Chapter 4, are not separable policy domains but two facets of the same underlying coastal resource management challenge.

Drawing together the evidence assembled across this chapter, Kerala's environmental and natural resource governance presents the report's clearest and most politically charged illustration of the development-versus-conservation tension that recurs, in less acute form, across virtually every infrastructure and economic development domain examined in

preceding chapters. The Gadgil-Kasturirangan ESA dispute, the sand-mining-to-quarrying regulatory displacement, the documented presence of illegal and ESA-zone quarrying in landslide-prone Wayanad, and the Brahmapuram solid waste enforcement failure collectively demonstrate that Kerala's environmental governance challenge is not primarily one of inadequate scientific knowledge or absent regulatory frameworks — the Gadgil and Kasturirangan reports represent genuinely rigorous scientific assessment, and Kerala's solid waste, mining, and pollution control regulations are formally comprehensive — but rather one of political economy and enforcement capacity, in which formally adequate regulatory frameworks face sustained resistance from the same construction, quarrying and development interests whose economic activity, documented throughout Chapters 3, 4 and 11, this report has also identified as central to Kerala's growth trajectory.

Resolving this tension does not require choosing definitively between development and conservation, but rather, as this chapter's discussion of the eight-track rail proposal's eco-sensitive alignment design and the floating solar land-saving renewable strategy both illustrate, developing the kind of environmentally adaptive infrastructure and resource-extraction practices that can deliver development objectives while genuinely respecting, rather than formally designating but practically circumventing, the ecological constraints this chapter has documented. This reconciliation between development and environmental governance represents one of the most consequential, and most politically difficult, components of the Vision 2047 roadmap developed in Chapter 21, and connects directly to the climate vulnerability and disaster risk reduction priorities examined in the chapter that follows.

Chapter 14: Climate Change and Ecological Security

14.1 State Climate Vulnerability and Risk Profile

Kerala's State Action Plan on Climate Change explicitly classifies nine of the state's fourteen districts, Wayanad, Kozhikode, Kasaragod, Palakkad, Alappuzha, Idukki, Kannur, Malappuram and Kollam, as falling within the "high" climate vulnerability class, with Thiruvananthapuram and Kottayam placed in the "medium" vulnerability category and only Thrissur, Ernakulam and Pathanamthitta classified as "low" vulnerability (Government of Kerala [GOK], 2023). This vulnerability classification, drawn directly from the state's own official climate planning document, provides the clearest available evidence that the geographically concentrated environmental stress this report has documented repeatedly in Chapter 13, particularly in Wayanad, Idukki, Kozhikode and Kasaragod, is not incidental but reflects a formally recognised, state-assessed pattern of disproportionate climate exposure in precisely the same districts already identified in this report as facing compounding socioeconomic disadvantage (Chapter 1), tribal welfare challenges (Chapter 7), and acute environmental governance stress including quarrying and landslide risk (Chapter 13). The action plan further notes that Kerala ranks as the fifth-lowest greenhouse gas emitting state in India (GOK, 2023), an important framing point that distinguishes Kerala's climate policy challenge from that of higher-emitting industrial states: Kerala's climate vulnerability is overwhelmingly a function of physical exposure to climate change impacts generated elsewhere, sea level rise, altered monsoon patterns, and intensifying extreme weather events driven by global emissions, rather than a function of the state's own substantial contribution to the underlying problem, even as the state's mitigation commitments, examined in section 14.2, demonstrate that Kerala has nonetheless adopted ambitious emissions-reduction targets disproportionate to its modest contribution to the national emissions total.

Kerala's specific exposure to recurring extreme weather events over the past decade illustrates this vulnerability concretely: the state experienced Cyclone Ockhi in 2017, severe flooding in both 2018 and 2019, and the Nipah virus outbreaks discussed in Chapter 6, alongside a documented and continuing trend of rising temperatures, increasingly irregular monsoon timing and intensity, and seasonal water scarcity of the kind discussed in Chapter 10 (Centre for Science and Environment [CSE], 2025). This clustering of distinct hazard types, cyclonic, flood, epidemiological and water-scarcity, within a single decade for a state of Kerala's size illustrates why the action plan's vulnerability classification, discussed above, should be read as describing a genuinely multi-hazard risk profile rather than a single dominant climate threat, a finding with direct implications for the disaster risk reduction institutional architecture examined in section 14.4.

This multi-hazard exposure has direct economic and human-development consequences that connect this chapter back to several preceding chapters of this report. The nine high-vulnerability districts identified in the action plan overlap substantially with the districts identified in Chapter 1 as facing intra-state social development disparities, in Chapter 7 as

having significant Scheduled Tribe populations, and in Chapter 13 as facing the most acute mining and quarrying enforcement gaps. This overlap is unlikely to be coincidental: hill and forest-fringe districts such as Wayanad and Idukki combine, in the same geographic space, steep and ecologically fragile terrain prone to landslide risk, a tribal population whose forest-rights and land-tenure situation, examined in Chapter 7, is already administratively unresolved, and a documented history of quarrying and land-use pressure, examined in Chapter 13, that independently elevates landslide and soil-erosion risk beyond what climate change alone would generate. The practical implication is that climate adaptation investment targeted at these nine high-vulnerability districts cannot be designed as a purely climatic intervention; it must be integrated with the tribal welfare, land-rights, and environmental enforcement reforms examined in Chapters 7 and 13, since addressing only the climatic dimension of risk while leaving the compounding socioeconomic and land-use drivers unaddressed would likely deliver a materially incomplete resilience outcome for the populations most exposed.

Cyclone Ockhi in 2017, the earliest of the major disaster events catalogued in this section, illustrates a distinct hazard category from the flood and landslide events that dominate the remainder of this chapter, an offshore meteorological event whose primary impact fell on Kerala's marine fishing community, the same coastal fisherfolk population whose housing vulnerability was discussed in Chapter 11 and whose economic role in the fisheries sector was examined in Chapter 3 and Chapter 18. Ockhi's rapid intensification, occurring with limited warning time for vessels already at sea, exposed specific gaps in marine weather forecasting and fisherfolk safety communication systems that differ materially from the inland flood and landslide early-warning gaps discussed in section 14.5, indicating that Kerala's disaster preparedness architecture must encompass distinct early-warning and response protocols calibrated separately to marine, riverine, and upland hazard types rather than a single generic disaster-warning system applied uniformly across all hazard categories the state faces.

14.2 State Action Plan on Climate Change: Review and Second Generation Reforms

Kerala's State Action Plan on Climate Change sets out specific, quantified mitigation targets for 2030, including an increase in renewable energy installed capacity to 3.46 GW, raising residential energy efficiency to fifty-three per cent, expanding the share of electric vehicles within public transport, and the broader adoption of solar-based and energy-efficient strategies across multiple sectors (GOK, 2023), targets that connect directly to, and in several respects pre-date or run in parallel with, the more detailed 2040-renewable and 2050-carbon-neutral targets and the 10,000 MW by 2030 capacity expansion plan examined in Chapter 9. The action plan additionally sets a specific target of 100,000 electric vehicles by 2025, a target the state has pursued in part through Open Access electricity market rules specifically designed to allow EV charging infrastructure to draw on renewable energy sources, with some renewable-energy-powered EV charging infrastructure already operational as of the most recent reporting reviewed for this chapter (CSE, 2025), directly

connecting to the Time-of-Day EV tariff design discussed in Chapter 9's treatment of KSERC's regulatory framework. Notably, the action plan's preparation process explicitly excluded detailed energy storage system planning, on the stated grounds that the necessary demand-and-supply assessment through 2030 had not yet been undertaken at the time of the plan's drafting, even while acknowledging that Kerala's pumped-hydro storage potential, as assessed by the Central Electricity Authority, stands at approximately 4,400 MW (CSE, 2025), a striking gap given the storage-capacity modelling subsequently undertaken by CSTEP and discussed in Chapter 9, which identified storage as a critical enabling requirement for the state's renewable transition; this sequencing, in which the state's primary climate action planning document was finalised before the detailed storage-requirement modelling that Chapter 9 shows to be essential for the renewable transition's success, illustrates a coordination gap between Kerala's climate planning and energy planning institutions that this report identifies as a priority for resolution in any future revision of the action plan.

Beyond mitigation, the action plan envisages a substantial adaptation agenda spanning land-use planning, sustainable coastal protection, rehabilitation of climate-vulnerable communities, the development of sustainable drainage systems for flood prevention, integrated coastal management, a dedicated climate change monitoring system, and climate awareness and education programming (GOK, 2023), an agenda whose scope deliberately mirrors the multi-hazard vulnerability profile discussed in section 14.1. The action plan also explicitly identifies inadequate irrigation infrastructure and poor groundwater and surface water quality as priority issues requiring resolution (GOK, 2023), directly corroborating this report's own water resource findings in Chapter 10, where Kerala's seasonal water-stress pattern and the irrigation infrastructure mismatch with the state's now-dominant plantation-crop agriculture were identified as significant, if currently under-addressed, structural concerns.

The action plan's specific 2030 renewable energy capacity target of 3.46 GW, while substantial, is notably more conservative than the considerably more ambitious 10,000 MW by 2030 capacity expansion plan subsequently adopted by KSEBL and discussed in Chapter 9, suggesting that the state's energy sector planning has, in the period since the action plan's original drafting, moved to a more ambitious target trajectory than the climate action plan itself originally anticipated. This apparent divergence between the two planning documents, the climate action plan's 3.46 GW renewable target and KSEBL's own subsequently announced, considerably larger capacity expansion ambition, is best read not as a genuine policy conflict but as evidence of the same sequencing and coordination gap this section has already identified between climate planning and energy planning institutions: KSEBL's more recent and more detailed energy sector planning, informed by the CSTEP-modelled storage requirements and demand growth trajectory discussed in Chapter 9, has evidently progressed beyond the assumptions embedded in the State Action Plan on Climate Change at the time of its drafting, and a future revision of the climate action plan would benefit from formally reconciling its renewable energy targets with KSEBL's own most current capacity expansion

planning rather than retaining separately maintained, potentially inconsistent target figures across the state's two principal climate and energy planning documents.

14.3 Disaster Risk Profile: Hazard, Exposure and Vulnerability Mapping

The catastrophic August 2018 Kerala floods remain the single most consequential disaster event examined in this chapter, and the benchmark against which the state's subsequent disaster risk reduction reforms, discussed in section 14.4, are most directly measured. Kerala received forty-two per cent excess rainfall relative to the normal seasonal average between 1 June and 19 August 2018, triggering widespread flooding and landslides across the state that resulted in the loss of 445 lives alongside large-scale destruction to infrastructure, the broader socioeconomic sector, and the natural environment, in what has been characterised as the worst flooding event Kerala had experienced in nearly a century (Parsa & Zehra, 2023). Critically, the academic post-event analysis reviewed for this chapter emphasises that the disaster's severity was not attributable to extreme rainfall alone: "the havoc caused by the 2018 Kerala flood was not only the result of unprecedented downpour but there were other reasons also which turned it more" severe (Parsa & Zehra, 2023), a finding directly consistent with this report's own analysis in Chapter 13, where upstream catchment degradation from quarrying and unplanned development, and the conversion of natural flood-attenuating paddy land and wetlands documented in Chapter 10, were both identified as contributing factors that amplified the underlying rainfall-driven flood hazard into a substantially more severe and widespread disaster than the rainfall intensity alone would have produced.

A specifically and repeatedly identified contributing factor in the 2018 disaster's severity was inadequate dam management: the independent academic assessment reviewed for this chapter identifies inadequate dam management, alongside delayed response times and limited inter-agency cooperation, as a specific policy implementation deficiency that compounded the flood's impact, with insufficiently coordinated reservoir release decisions across the state's extensive hydroelectric dam network, the same network examined from a generation-capacity perspective in Chapter 9 and from an ecological-impact perspective in Chapter 13, contributing to the speed and volume of downstream flooding (Kronika Journal, 2025). This finding illustrates a further dimension of the cross-cutting institutional theme this report has identified throughout: Kerala's extensive hydroelectric infrastructure, a genuine asset for renewable energy generation as documented in Chapter 9, simultaneously functions as a disaster-risk-relevant water-management system whose operational coordination during extreme rainfall events requires dedicated, real-time inter-agency disaster management protocols that, on the evidence of the 2018 floods, were not adequately in place at the time.

The Mullaperiyar dam, situated in Idukki district and operated under a long-standing interstate water-sharing arrangement with Tamil Nadu, illustrates a further dimension of dam-management complexity specific to Kerala's disaster risk profile: because the dam's operation and water-release decisions are governed by an interstate agreement rather than by Kerala's own water authorities acting unilaterally, disaster-relevant reservoir management

during extreme rainfall events must be coordinated not only across the state's own internal agencies, as discussed above, but also with Tamil Nadu's water management authorities, adding a further layer of interstate coordination complexity to the already significant intra-state coordination challenge this chapter has identified as a contributing factor in the 2018 floods. This interstate dimension of Kerala's dam management and disaster risk profile has periodically surfaced as a distinct point of political and legal contention between the two states, separate from but related to the purely technical reservoir-operation coordination challenge this chapter has documented, and represents a further specific institutional complexity that any future revision of Kerala's river basin and dam management protocols, discussed in section 14.4, will need to address explicitly given the demonstrated stakes involved.

Placed within the broader national context, India's overall disaster profile makes floods one of the most frequent and destructive hazard categories the country faces, with flood frequency and severity varying considerably across different states and regions depending on local geography and monsoon exposure (Parsa & Zehra, 2023). Kerala's particular combination of steep, ecologically fragile upland terrain feeding directly into a narrow, densely populated coastal plain, documented throughout Chapter 1's discussion of the state's three-zone topography, means that excess rainfall in the highland and midland zones translates into downstream flood and landslide risk over a comparatively short and rapid hydrological pathway relative to states with broader, flatter river basins that allow floodwater more time and space to disperse before reaching populated areas. This topographic compression, already identified in this report's discussion of road and rail infrastructure sequencing in Chapter 8 and of wetland degradation in Chapter 10 and Chapter 13, recurs here as a further structural driver of Kerala's specific flood and landslide vulnerability profile, one that is unlikely to be substantially altered by any feasible policy intervention and that therefore must be treated as a fixed parameter around which the state's adaptation and disaster-preparedness strategy, examined in section 14.4, is designed.

14.4 Disaster Risk Reduction: Institutional Mechanisms and Preparedness

The 2018 floods catalysed a substantial institutional reform programme that this report identifies as one of the more significant governance responses to a single disaster event documented anywhere in this report. The Government of Kerala established the Rebuild Kerala Initiative (RKI) specifically to coordinate what has been characterised as a transformational shift in the state's approach to disaster management, moving from a reactionary, post-disaster response model towards risk-informed, sustainable development planning embedded across the state's policies, institutions and systems (World Bank, 2022). Under RKI, the state developed a Disaster and Climate Action Tracking (DCAT) tool and a Risk-Informed Master Plan (RIMP) framework, explicitly aimed at building a model of climate-adaptive governance operationalised at the local government level through Local Action Plans for Climate Change Adaptation (LAP CC) mechanisms (LSGD Kerala, 2025), a direct extension, into the climate and disaster domain, of the decentralised, panchayat-level

governance architecture this report has identified throughout as one of Kerala's core institutional strengths, examined comprehensively in Chapter 12. Every local government body in the state subsequently conducted a situation analysis covering its own historical disaster experience, disaster-proneness by hazard type, identification of vulnerable communities, and the specific preventive and mitigative interventions available to reduce future disaster impact (LSGD Kerala, 2025), a genuinely comprehensive, locally disaggregated disaster risk assessment exercise whose scale, covering all of Kerala's local government bodies rather than only a sample or a small number of pilot panchayats, is itself a notable institutional achievement consistent with the state's broader decentralised delivery capacity.

This local-government-level resource inventory, originally developed for disaster risk management purposes, was subsequently put to substantial additional use during the COVID-19 pandemic (LSGD Kerala, 2025), providing direct empirical confirmation of the institutional learning-capacity argument this report developed in Chapter 6's discussion of Kerala's Nipah-to-COVID response trajectory: a disaster-preparedness investment made for one specific hazard (flooding) generated institutional capacity, local resource mapping, vulnerability assessment, and inter-agency coordination protocols, that proved directly transferable to an entirely different hazard category (a pandemic) several years later, reinforcing this report's broader finding that Kerala's institutional learning capacity, once built for a specific crisis, has repeatedly demonstrated genuine cross-hazard transferability rather than remaining narrowly confined to the original triggering event.

The World Bank's First Resilient Kerala Development Policy Operation programme, structured around enhancing the state's institutional and financial capacity for managing disaster and climate risk as its first pillar, recorded as an achieved result indicator, by April 2022, the satisfactory completion of a state-wide emergency management exercise conducted in accordance with the state's updated Disaster Risk Management Plan, covering both disaster and climate resilience dimensions and verified through independent observer assessment (World Bank, 2022), providing external, independently verified confirmation that the institutional reforms catalogued above have progressed from policy design into demonstrated operational capability, rather than remaining only formally adopted but unexercised plans.

The Result Indicator framework underpinning the World Bank's Resilient Kerala programme also tracked improved river basin planning and water infrastructure operations management for climate resilience at the state level, with the 2019 baseline assessment explicitly characterising river basin planning and management functions as inadequate at that time (World Bank, 2022). This baseline finding corroborates, from an independent international development institution's own assessment, the dam-management and inter-agency coordination weaknesses identified in the 2018 floods' own academic post-mortem and discussed in section 14.3, confirming that the river basin and reservoir coordination gap was not merely an isolated criticism from a single academic source but a finding sufficiently well established to anchor a formal World Bank programme result indicator with associated

funding and monitoring commitments. The specific institutional reforms pursued under this result area, including strengthened inter-agency protocols between the Kerala State Electricity Board's dam operators, the State Disaster Management Authority, and district-level emergency response agencies, represent a direct attempt to close the exact coordination gap this chapter has identified as a key amplifying factor in the 2018 disaster's severity.

Kerala's State Disaster Management Authority, established under the national Disaster Management Act, 2005 framework, now operates alongside the RKI-developed DCAT and RIMP tools discussed above to provide both the statutory institutional backbone and the more recently developed data and planning infrastructure needed to coordinate disaster response across the state's various line departments, local government bodies, and the national disaster response architecture. This layered institutional structure, statutory authority combined with locally embedded planning tools and panchayat-level vulnerability assessment, mirrors the broader institutional pattern this report has identified repeatedly across health (Chapter 6), social welfare (Chapter 7), and rural governance (Chapter 12): formal state-level authority paired with genuinely decentralised, community-level implementation capacity, rather than either a purely top-down or purely localised approach operating in isolation.

14.5 Post-Disaster Response, Relief and Reconstruction Framework

Notwithstanding the substantial institutional reform programme documented in section 14.4, the academic assessment of the 2018 floods' immediate aftermath identifies specific and persistent weaknesses in the state's then-existing response and reconstruction framework: inadequate real-time monitoring technology and insufficient early warning mechanisms undermined the effectiveness of the State Action Plan on Climate Change's flood-resilience provisions in practice, while poor communication between state-level entities and local authorities contributed to delayed evacuation and rescue operations during the disaster itself (Kronika Journal, 2025). These specific, documented shortcomings, real-time monitoring, early warning communication, and state-to-local coordination, map directly onto the subsequent World Bank-supported data and digital infrastructure investment discussed in section 14.6, suggesting that Kerala's post-2018 reform programme has been substantially, and appropriately, targeted at the specific operational failure points the 2018 disaster's own post-event assessment identified, rather than pursuing generic disaster-management capacity-building disconnected from the lessons of the triggering event itself. The UNDP's Post-Disaster Needs Assessment, completed in October 2018 in the immediate aftermath of the floods, provided the foundational diagnostic basis from which the Rebuild Kerala Development Programme's broader roadmap, covering cross-cutting and sector-based policy, regulatory and institutional reforms, was subsequently developed following extensive public consultation (World Bank, 2022), an evidence-led, consultation-based reconstruction planning process that this report identifies as a methodologically sound approach to post-disaster institutional reform, consistent with the broader pattern of genuine policy learning this chapter has documented throughout Kerala's post-2018 disaster governance evolution.

Financing the reconstruction effort that followed the 2018 floods drew on a combination of central disaster relief assistance through the National Disaster Response Fund, World Bank development policy financing structured around the result indicators discussed in section 14.4, and the state's own budgetary resources, the latter inevitably interacting with the fiscal constraints documented extensively in Chapter 2. The scale of physical and economic damage from the 2018 floods, affecting infrastructure, housing, agriculture and the broader economy simultaneously, meant that reconstruction financing needs were correspondingly large relative to the state's existing capital expenditure capacity, reinforcing this report's recurring finding that Kerala's narrow fiscal margin constrains not only routine infrastructure investment, examined throughout Chapters 8 through 11, but also the state's capacity to respond robustly to large-scale disaster events without substantial external financing support. Insurance penetration for both agricultural and residential property losses in Kerala, while improving through national schemes such as the Pradhan Mantri Fasal Bima Yojana for crop losses, has historically remained below the level that would allow affected households and farmers to recover fully from a disaster of the 2018 floods' scale through insurance payouts alone, meaning a substantial share of the recovery burden continued to fall on direct government relief and reconstruction assistance rather than being absorbed through pre-existing risk-transfer mechanisms, a gap that connects this section's reconstruction financing discussion to the broader agricultural risk management priorities examined in Chapter 18.

14.6 Green Economy Transition: Opportunities and Structural Challenges

Kerala's broader green economy transition, examined throughout this report from the specific angles of renewable energy (Chapter 9), green hydrogen development (Chapter 9), and floating solar deployment leveraging the state's reservoir and backwater surface area (Chapter 9), is increasingly underpinned by a deliberate investment in open data and digital decision-support infrastructure for climate resilience. Following the 2018 floods, Kerala partnered with the World Bank to develop several targeted data solutions addressing specific resilience gaps identified through the disaster's aftermath, though a comprehensive assessment of this work concluded that the state still requires a more genuinely shared digital ecosystem to support timely, effective decision-making around climate and disaster risk across the eighteen-plus government departments that have been engaged in this diagnostic and consultation process (World Bank, 2024). The stated rationale for this continued investment, that open data concepts can reduce climate vulnerability, increase access to risk information, communicate risk more effectively to affected communities, and provide policymakers with new, genuinely data-driven risk assessments, directly extends the institutional learning and digital-infrastructure themes this report has traced throughout, from KFON's broadband connectivity discussed in Chapter 3 through to the e-Health and Total Mental Health digital architecture discussed in Chapter 6 and the eGramSwaraj and eGovernance tools discussed in Chapter 12, into the specific domain of climate and disaster risk management.

Kerala's mangrove ecosystems, identified explicitly in the academic climate resilience literature as a critical nature-based solution resource (Kronika Journal, 2025), illustrate a further green-economy opportunity directly connected to the coastal and marine resource management priorities discussed in Chapter 13: mangrove restoration and protection offers a comparatively low-cost, ecologically beneficial coastal protection mechanism against the erosion and sea-level-rise pressures this chapter has identified as a key dimension of Kerala's coastal climate vulnerability, while simultaneously supporting the fisheries habitat and biodiversity values examined in Chapters 3 and 13.

Kerala's traditional ecological knowledge systems, referenced explicitly in the academic climate resilience literature as a substantial resource for developing innovative, nature-based climate solutions (Kronika Journal, 2025), warrant particular attention given the cultural and community institutional strengths this report has documented at multiple points. Traditional water management practices associated with the state's historic paddy and wetland systems, discussed in Chapter 10's treatment of the now-contracting Kuttanad cultivation belt, and traditional agroforestry practices integrated within the plantation crop systems discussed in Chapter 3, both encode generations of locally adapted knowledge about managing Kerala's specific monsoon-dominated, topographically compressed hydrological environment that formal engineering solutions, however technically sophisticated, do not automatically replicate.

Integrating this traditional ecological knowledge with the more recently developed digital and data-driven climate resilience tools discussed earlier in this section represents a further specific opportunity this report identifies for strengthening Kerala's adaptation capacity, one that would draw on the same community-embedded institutional model, panchayat-level engagement, Kudumbashree network participation, and local self-help-group mobilisation, that this report has shown repeatedly throughout to be one of Kerala's most distinctive and most consistently effective delivery mechanisms across health, nutrition, livelihood and now climate adaptation policy domains alike. The structural challenge this chapter's evidence identifies for Kerala's green economy transition as a whole is one of integration rather than absence of ambition: the state possesses genuinely ambitious mitigation targets (section 14.2), a sophisticated and progressively strengthening disaster risk reduction institutional architecture (section 14.4), and substantial nature-based-solution potential through its biodiversity and traditional ecological knowledge systems (Kronika Journal, 2025), but realising the full value of these complementary assets requires precisely the kind of cross-departmental, data-integrated coordination that both the energy-versus-climate-planning sequencing gap identified in section 14.2 and the broader shared-digital-ecosystem gap identified in this section suggest has not yet been fully achieved. Closing this integration gap, linking climate planning, energy planning, disaster risk management, and the environmental governance priorities examined in Chapter 13 within a single, genuinely coordinated institutional and data framework, represents, in this report's assessment, the single most consequential remaining reform priority within Kerala's

climate and ecological security agenda, and forms a central component of the Vision 2047 roadmap developed in Chapter 21.

Drawing together the evidence assembled across this chapter, Kerala's climate and ecological security profile is best characterised as a state that has, since the watershed 2018 floods, undertaken a genuinely substantial and substantively evidence-led institutional reform programme, the Rebuild Kerala Initiative, the DCAT and RIMP frameworks, the panchayat-level vulnerability mapping exercise, and the World Bank-supported result indicators, while still facing unresolved coordination gaps between its climate, energy, and disaster management planning institutions, and a continuing need to integrate this institutional reform programme more fully with the environmental governance findings of Chapter 13 and the tribal and social welfare findings of Chapters 1 and 7.

The fact that Kerala contributes only a modest share of national greenhouse gas emissions while facing disproportionate physical climate exposure underscores that the state's climate strategy is, fundamentally, an adaptation and resilience strategy responding to a global problem largely generated elsewhere, even as the state has nonetheless adopted mitigation commitments, the 2030 renewable and electric vehicle targets discussed in section 14.2, that exceed what its own modest emissions profile alone would require. This combination of disproportionate exposure and disproportionately ambitious response defines the distinctive character of Kerala's climate policy position within the broader Indian and global climate governance landscape, and the priority for the remainder of this decade, as this chapter has argued throughout, is less about adopting new targets or new institutions than about genuinely integrating the substantial institutional capacity Kerala has already built across climate, energy, disaster management, and environmental governance into a single, coherently coordinated framework.

Chapter 15: Administrative Governance Reform

15.1 Structure of State Administration and Inter-Departmental Coordination

Kerala's state administration operates through the conventional Indian secretariat-department structure, headed by the Chief Secretary and organised into functional departments corresponding broadly to the chapter divisions of this report, alongside the decentralised local self-government architecture examined at length in Chapter 12. The recurring inter-departmental coordination weakness this report has identified across multiple infrastructure and policy domains, including the sequencing gap between Vizhinjam port and its surface rail connectivity discussed in Chapter 8, the divergence between climate action planning and energy sector planning discussed in Chapter 14, and the mining and quarrying enforcement gaps spanning the Forest Department, Revenue Department and State Pollution Control Board discussed in Chapter 13, points to a structural feature of Kerala's administrative architecture that this chapter examines directly: departments with genuinely strong individual institutional capacity, KSEBL's transmission engineering capability, the Forest Department's conservation expertise, the Revenue Department's land administration capacity, do not always coordinate effectively with one another when a policy challenge spans multiple departmental jurisdictions simultaneously. This pattern is not unique to Kerala among Indian states, but the sheer density and overlap of infrastructure, environmental and welfare policy domains examined throughout this report, each requiring coordination across at minimum three or four separate departments, makes the cumulative cost of this coordination weakness particularly significant for a state pursuing the scale of simultaneous transformation this report has documented across energy, transport, urban development, and climate adaptation alike.

A dedicated cross-departmental delivery coordination mechanism, of the kind this report proposed in Chapter 8's discussion of infrastructure sequencing, bringing together the Finance Department's oversight of KIIFB discussed in Chapter 2, the Industries Department's oversight of KSIDC discussed in Chapter 4, the relevant transport and energy authorities, and the Forest and Revenue Departments' environmental clearance functions discussed in Chapter 13, under a single project-tracking and sequencing framework, represents the most direct and actionable administrative reform this report identifies across the full range of sectoral findings assembled in preceding chapters. The State Planning Board, examined in Chapter 12's discussion of the People's Plan Campaign's institutional evolution, already possesses some of the planning and coordination capacity such a mechanism would require, suggesting that an expanded coordination mandate for the existing Planning Board, rather than the creation of an entirely new institution, may be the most efficient path to closing this gap.

The specific organisational design question this recommendation raises, whether such an expanded coordination mandate should be vested in the State Planning Board itself, in the Chief Secretary's office directly, or in a newly constituted cross-departmental delivery unit reporting to the Chief Minister, is one this report does not attempt to resolve definitively,

since the relative merits of each option depend on administrative and political considerations beyond the scope of the sectoral evidence this report has assembled. What this report's evidence does support clearly is the underlying functional requirement: whichever institutional home is chosen, the coordination mechanism must possess sufficient authority to compel timely information sharing and joint decision-making across departments that have historically operated with considerable functional independence from one another, since the infrastructure sequencing gaps, environmental clearance frictions, and climate-energy planning divergences documented throughout this report each arose, on the evidence reviewed, not from any single department's individual incompetence but from the absence of a mechanism with sufficient authority to identify and resolve cross-departmental dependencies before they became consequential delivery bottlenecks.

This finding carries a broader implication for how this report's recommendations across preceding chapters should be read collectively rather than as a list of independent, sector-specific reforms. The Vizhinjam rail-link sequencing gap discussed in Chapter 8, the climate-energy planning divergence discussed in Chapter 14, the mining enforcement coordination gap discussed in Chapter 13, and the PMGSY environmental clearance friction discussed in Chapter 12 are not four unrelated administrative weaknesses requiring four separate, sector-specific solutions; they are four manifestations of a single underlying institutional gap, the absence of an empowered cross-departmental coordination mechanism, that, if addressed once at the administrative governance level examined in this chapter, would plausibly improve delivery outcomes across all four of these previously sector-specific findings simultaneously. This reframing, from a long list of sector-specific coordination failures towards a single, generalisable administrative governance reform priority, represents this chapter's most significant synthesis contribution to the report as a whole, and the rationale for placing this finding at the centre of the administrative governance component of the Vision 2047 roadmap developed in Chapter 21.

15.2 Anti-Corruption Framework: Lokayukta, Vigilance and Enforcement

Kerala's anti-corruption institutional architecture is anchored in the Kerala Lok Ayukta, an ombudsman-type institution explicitly conceived, consistent with the broader national Lokayukta model, to investigate public grievances regarding administrative wrongdoing and to combat corruption at both the administrative and political levels, operating on the underlying premise, well established in the Indian governance literature, that maladministration and corruption are closely linked phenomena that together impose a significant strain on the economy (Kerala Lok Ayukta, 2025). The Lok Ayukta functions alongside the state's Vigilance and Anti-Corruption Bureau, which conducts investigation and enforcement functions against corrupt practices by public servants, and the two institutions together form the core of Kerala's formal anti-corruption enforcement architecture, operating within the broader national Right to Information Act and Prevention of Corruption Act legal framework that applies uniformly across Indian states. The available sources reviewed for this chapter do not provide a recent, comprehensive quantitative assessment of case disposal

rates, conviction rates, or comparative corruption-perception trends specific to Kerala relative to other Indian states, representing a further data gap consistent with the pattern this report has identified at multiple points, particularly in Chapters 5, 6 and 7, regarding the general scarcity of detailed, disaggregated institutional performance data available for Kerala-specific administrative governance assessment.

Kerala's implementation of the national Right to Information Act, 2005 provides a complementary transparency mechanism to the Lok Ayukta and Vigilance Bureau's direct investigative functions, enabling citizens to request information directly from government departments and local self-government bodies, the latter discussed extensively in Chapter 12, as a means of strengthening public oversight of administrative decision-making and resource allocation. Kerala's decentralised governance tradition, examined throughout Chapter 12, plausibly provides the RTI framework with a more receptive institutional environment than would be the case in states with weaker local government transparency norms, given the State Planning Board's own multi-decade emphasis on participatory planning and the open-budget practices the People's Plan Campaign has historically encouraged at the panchayat level. Notwithstanding this generally favourable institutional context, the specific volume, response-time performance, and disposal-rate statistics for RTI applications filed with Kerala state departments and local bodies were not available within the sources reviewed for this chapter, representing a further specific gap in the transparency and accountability data this report has sought, without complete success, to assemble across this administrative governance chapter.

Comparative assessment of Kerala's anti-corruption enforcement performance against other Indian states would ideally draw on standardised metrics such as Transparency International's Corruption Perceptions Index methodology adapted to the sub-national level, or the National Crime Records Bureau's state-disaggregated corruption-case registration and conviction data, neither of which was available with sufficient Kerala-specific granularity within the sources reviewed for this chapter. In the absence of such standardised comparative data, this report's assessment of Kerala's anti-corruption institutional architecture rests primarily on the formal design adequacy of the Lok Ayukta and Vigilance Bureau framework, which appears broadly comparable to equivalent institutions in other well-governed Indian states, rather than on a verified, outcome-based performance comparison, a methodological limitation this report acknowledges explicitly rather than allowing to be obscured by confident-sounding but ultimately unsubstantiated claims about Kerala's relative corruption-control performance.

15.3 Legal and Judicial Administration: Pendency, Access and Reform

Kerala shares its High Court jurisdiction with the Union Territory of Lakshadweep, a structural arrangement that the India Justice Report's comparative judicial performance framework explicitly accounts for when benchmarking Kerala's judicial indicators against other large and mid-sized Indian states (India Justice Report, 2025).

The India Justice Report's broader comparative ranking framework evaluates states across multiple judicial performance dimensions, including population per High Court judge, judge vacancy rates, case clearance rates, and the proportion of cases pending for extended periods, alongside diversity indicators tracking the representation of women, Scheduled Caste, Scheduled Tribe and Other Backward Class judges across both High Court and subordinate court levels (India Justice Report, 2025).

This multi-dimensional framework is methodologically valuable for the present report's purposes because it allows judicial performance to be assessed not merely through the single, often-cited pendency figure, but through the fuller combination of access, diversity, and efficiency indicators that together determine whether a state's judicial system is functioning adequately for the population it serves; Kerala's specific standing across this fuller indicator set, however, was not separately reported within the sources reviewed for this chapter, meaning this report can identify the existence and structure of this valuable comparative framework without being able to draw on its specific Kerala results, a further instance of the recurring evidentiary limitation this chapter has documented throughout its treatment of judicial administration.

India's judiciary as a whole faces a severe and worsening pendency crisis: by June 2026, the total number of pending cases across all levels of the Indian judicial system exceeded 56 million, including more than 180,000 cases pending for more than thirty years in district and high courts combined, with district courts alone accounting for 49 million of the total 56 million pending cases, or more than eighty-five per cent of the national caseload (Wikipedia, 2026). High Courts nationally reported 327 judicial vacancies against a collective sanctioned strength of 1,114 judges as of an April 2024 Department of Justice report, with vacancy levels having remained broadly stable across recent years, at 324 in 2023 and 330 in 2022 (Supreme Court Observer, 2024), indicating that the national judicial vacancy crisis is a persistent, structural feature of the Indian judicial system rather than a temporary or rapidly resolving administrative lag. India's overall judge-to-population ratio of 14.4 judges per million people, only marginally improved from 13.2 in 2016, compares starkly with the 210 judges per million people reported in Europe and 150 in the United States (Wikipedia, 2026), illustrating that even with full sanctioned-strength staffing, India's judicial capacity relative to its population would remain a fraction of comparable developed-country benchmarks.

The specific Kerala-disaggregated judicial pendency and vacancy figures within this national crisis were not separately detailed in the sources reviewed for this chapter, though the structural national pressures documented above, rising case filings consistently outpacing disposal rates, chronic appointment delays driven by coordination failures between the judicial collegium system and the union government, and non-judicial staff vacancy rates reaching as high as twenty-five per cent in some states as of the most recent reporting reviewed (Wikipedia, 2026), apply to Kerala's judicial system as a constituent part of the same national framework, even in the absence of state-specific disaggregated figures. Kerala's broader civil litigation culture, and the state's comparatively high rate of land and

property-related disputes connected to the land scarcity and high property-value dynamics documented in Chapter 11, plausibly generate a distinct caseload composition relative to states with lower population density and lower land-value pressure, though this report cannot confirm this hypothesis without the state-specific case-type disaggregation data that was not available within the sources consulted, a further specific data gap this report flags for the statistical strengthening agenda developed in Chapter 20.

Beyond land and property disputes, Kerala's family court system handles a substantial caseload of matrimonial and family-related litigation that the broader migration patterns documented throughout this report plausibly shape in distinctive ways: households affected by prolonged parental or spousal absence due to Gulf migration, discussed in Chapter 6's treatment of transnational family structures, generate specific categories of family law dispute, including maintenance claims, custody arrangements, and divorce proceedings complicated by a spouse's continued residence and employment abroad, that differ materially in their evidentiary and procedural requirements from family law disputes in a non-migration-intensive population.

Kerala's judiciary has, over time, developed informal institutional familiarity with these migration-related family law complexities given their relative frequency within the state's caseload, though this report did not locate quantified data on the specific volume or disposal-rate performance of this particular case category, again pointing to the broader pattern of insufficiently granular Kerala-specific judicial administration data this report has identified throughout this section. The Kerala State Legal Services Authority, operating under the national Legal Services Authorities Act framework, provides free legal aid and advice specifically targeted at economically disadvantaged litigants, a service whose reach and effectiveness relative to the scale of unmet legal need among Kerala's lower-income population, including the dispersed urban poverty population discussed in Chapter 11 and the Scheduled Caste and Scheduled Tribe populations discussed in Chapter 7, represents a further area where this report's evidence base remains incomplete.

15.4 Police Modernisation and Internal Security Management

Kerala Police recruitment, administered through the Kerala Public Service Commission, follows a structured, multi-category process spanning open market recruitment, ministerial-staff promotional channels, and constabulary promotional channels for serving police and vigilance department personnel, with successful candidates undergoing a one-year formal training period followed by ten and a half months of practical training and a subsequent two-year probationary period before confirmation (Entri, 2025). This multi-stage, multi-category recruitment and training pipeline reflects a deliberate effort to balance fresh open-market recruitment with internal career progression pathways for existing constabulary and ministerial staff, a structure broadly consistent with police recruitment frameworks across other Indian states but one whose specific adequacy relative to Kerala's policing needs, given

the state's distinctive population density and settlement pattern discussed throughout this report, was not assessed in comparative detail within the sources available for this chapter.

Kerala's internal security management responsibilities intersect directly with several of the disaster, environmental and social challenges examined elsewhere in this report: police and vigilance department personnel are involved in disaster response coordination examined in Chapter 14's discussion of the Rebuild Kerala Initiative, in enforcement actions against illegal mining and quarrying activity examined in Chapter 13, and in child protection and POCSO enforcement examined in Chapter 7. This cross-cutting role for the police and vigilance apparatus, spanning conventional law enforcement, environmental enforcement, and disaster response coordination simultaneously, reinforces the broader administrative coordination theme developed in section 15.1: police modernisation in Kerala cannot be assessed purely as a standalone law-and-order capacity question, but must be understood as one node within the wider, multi-departmental coordination architecture this chapter has identified as a recurring institutional challenge across the full breadth of policy domains examined in this report.

Kerala Police's recruitment notifications explicitly extend eligibility to women candidates across the open market, ministerial and constabulary recruitment categories discussed above, consistent with the broader gender-inclusion themes this report has documented across multiple welfare and governance domains, including the women's participation patterns in Kudumbashree and panchayat governance examined in Chapter 12 and the gender equity discussion developed in Chapter 7. The specific representation of women within Kerala Police's sworn officer ranks, and the extent to which this representation has grown over recent recruitment cycles, was not quantified within the sources available for this chapter, though the explicit inclusion of women candidates across all recruitment categories indicates that formal eligibility barriers to women's participation in policing have been removed, even if the resulting actual representation rate remains a separate empirical question this report cannot resolve with the available evidence. Kerala Police's community policing initiatives, including the Janamaithri Suraksha Project, which embeds community liaison officers within local neighbourhoods specifically to build trust and improve information flow between residents and police, represent a further distinctive institutional feature that, consistent with the decentralised, community-embedded delivery model this report has identified repeatedly across health, welfare and now policing domains alike, extends the panchayat-level engagement architecture examined in Chapter 12 into the internal security domain.

The cumulative finding from this section, considered alongside the broader administrative coordination theme developed throughout this chapter, is that Kerala's police and internal security apparatus functions as a genuinely cross-cutting institution whose effectiveness depends substantially on its coordination with departments well outside the conventional law-and-order domain, the Forest Department in environmental enforcement contexts, the Health Department in disaster response contexts, and the Social Justice Department in child protection contexts. This cross-departmental embeddedness means that police modernisation investment narrowly focused on conventional policing capability, equipment, training, and

recruitment numbers, while necessary, would on this report's evidence address only part of what effective internal security management in Kerala's specific institutional context actually requires; the remainder depends on the same cross-departmental coordination capacity this chapter has identified as the central, generalisable administrative governance reform priority across virtually every domain examined in this report.

15.5 Regulatory Governance: Quality, Consistency and Independence

Kerala's regulatory governance architecture spans a range of sector-specific regulatory bodies examined throughout this report, including the Kerala State Electricity Regulatory Commission discussed in Chapter 9, the State Pollution Control Board discussed in Chapter 13, and the various licensing and clearance authorities governing mining, construction, and industrial activity discussed in Chapters 4, 10, 11 and 13. The consistent finding across this report's examination of these individual regulatory bodies is one already summarised in Chapter 13's conclusion: Kerala's regulatory frameworks are, in most of the specific instances examined throughout this report, formally well designed and substantively comprehensive, yet enforcement consistency, the actual, sustained application of these frameworks against politically or economically influential interests over an extended period, has proven to be the more persistent institutional weakness.

The ESA-zone quarrying documented in Chapter 13, the Brahmapuram waste management compliance failure also documented in Chapter 13, and the broader pattern of strong policy design alongside uneven implementation documented across the social welfare chapters of this report (Chapters 5, 6 and 7) together suggest that Kerala's regulatory governance challenge is most accurately characterised as an implementation and political-economy challenge rather than a regulatory-design deficiency, a finding with direct implications for how future administrative governance reform should be prioritised: strengthening enforcement capacity, monitoring mechanisms, and the institutional independence of regulatory bodies from the specific economic interests they regulate is, on this report's assessment, a higher-value reform priority than further regulatory framework redesign.

The specific mechanism through which regulatory independence erodes in practice, on the evidence assembled throughout this report, appears to operate less through overt, identifiable corruption of the kind the Lok Ayukta and Vigilance Bureau discussed in section 15.2 are designed to detect and prosecute, and more through a subtler pattern of under-resourced field-level enforcement combined with diffuse, ongoing political and economic pressure from regulated industries operating at the local level, the construction and quarrying interests discussed in Chapter 13 being the clearest documented example. This distinction matters for reform design: strengthening the Lok Ayukta and Vigilance Bureau's investigative and prosecutorial capacity, while valuable, addresses primarily the overt corruption end of this spectrum, whereas the more pervasive enforcement-consistency problem this report has documented, ESA-zone quarries operating despite formal prohibition, Brahmapuram's accumulated unprocessed waste despite formal solid waste management rules, requires a

different reform instrument: adequately staffed, technically equipped, and politically insulated field-level enforcement units within each relevant regulatory body, supported by routine, independent third-party compliance auditing rather than relying solely on the regulated entities' own self-reporting, of the kind the hospitality-sector sanitation self-assessment process discussed in Chapter 10 illustrated to have a meaningful, though incomplete, compliance failure rate even among entities voluntarily submitting to certification.

15.6 Reduction of Red-Tapism: Simplification and Way Forward

Kerala's K-SWIFT single-window clearance system, discussed in Chapter 4's treatment of the state's ease-of-doing-business reforms, represents the most concrete and well-documented red-tape reduction initiative examined in this report, having consolidated multiple separate departmental approvals into a unified digital clearance process for new enterprise registration. The broader pattern this report has identified, in which Kerala's own claimed ease-of-doing-business ranking (first nationally according to government sources) sits in some tension with the State Planning Board's own more modest reported rank of fifteenth nationally for 2023, illustrates a recurring challenge in red-tape reduction measurement more broadly: different methodologies and reporting periods can generate substantially different headline rankings for what is, in substance, the same underlying regulatory environment, and resolving this measurement inconsistency, rather than necessarily pursuing further substantive reform, may itself be a useful near-term administrative governance priority, since policymakers, investors and the public alike benefit from a single, methodologically consistent, and transparently reported ease-of-doing-business assessment rather than multiple, only partially reconcilable figures circulating simultaneously.

Beyond K-SWIFT, the environmental and forest clearance delays documented repeatedly throughout this report, in Chapter 8's discussion of PMGSY and rural road clearances, Chapter 9's discussion of small hydropower project delays, and Chapter 13's discussion of the broader ESA delineation dispute, represent the most consequential remaining category of regulatory friction this report has identified, one whose resolution, as argued in Chapter 12's discussion of environmentally adaptive infrastructure design, is better pursued through improved engineering and early-stage environmental impact integration than through any straightforward streamlining or weakening of the underlying environmental clearance standards themselves.

Land acquisition procedure represents a second major category of administrative friction this report has documented repeatedly, from the Outer Ring Road and Silver Line land-acquisition contestation discussed in Chapter 8, to the Vizhinjam rail link's land requirements in Balaramapuram, Pallichal and Athiyanthoor discussed in the same chapter, to the rural infrastructure clearance delays discussed in Chapter 12. Kerala's land acquisition procedures operate under the national Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, which mandates social impact

assessment, public hearings, and negotiated compensation processes designed to protect landholders' interests but which, as the evidence assembled throughout this report demonstrates, also extends project timelines considerably relative to the simpler, more administratively centralised land acquisition processes available in states with larger contiguous government landholdings or lower population density. Streamlining specific procedural steps within this legally mandated framework, without weakening the underlying compensation and consultation protections the Act provides, represents a narrower and more administratively tractable reform target than attempting to alter the Act's substantive provisions themselves, which fall under national rather than state legislative authority in any case, and this report identifies dedicated land acquisition case-management units, staffed specifically to expedite the administrative steps within the existing legal framework rather than to alter that framework's substance, as a concrete, near-term red-tape reduction priority directly responsive to the land acquisition delays documented repeatedly across this report's infrastructure chapters.

15.7 Civil Service Strength: Vacancy Rates and Training Institutions

Civil service staffing across Kerala's government departments exhibits the same pattern of specific, persistent vacancy concentrations that this report has already documented in specialist health-sector positions within the Aardram Mission's Family Health Centres in Chapter 6, even as the state's overall civil service recruitment system, administered centrally through the Kerala Public Service Commission for the great majority of state government positions, operates as a generally well-established and broadly trusted merit-based recruitment institution by the standards of comparable Indian state public service commissions. The specific, granular vacancy-rate data needed to assess the scale of this challenge across Kerala's full civil service workforce, comparable to the detailed judicial and health-sector vacancy figures this report has been able to document in sections 15.3 and Chapter 6 respectively, was not available with the same granularity within the sources reviewed for this chapter, representing a further specific instance of the recurring data-availability gap this report has identified across multiple administrative and sectoral domains.

Kerala's civil service training infrastructure includes institutions analogous to the national Lal Bahadur Shastri National Academy of Administration, discussed in Chapter 4 in connection with the "Year of Enterprises" campaign's adoption as an IAS training case study, alongside state-specific training academies for police, judicial, and other specialised civil service cadres. The cross-departmental coordination challenge identified throughout this chapter, and particularly in section 15.1, suggests that civil service training reform in Kerala could usefully place greater emphasis on cross-departmental coordination skills and joint, multi-departmental training exercises, of the kind already piloted through the state-wide emergency management exercise discussed in Chapter 14's review of the World Bank's Resilient Kerala programme, rather than training exclusively within single-department silos, since this chapter's evidence suggests that the specific coordination failures documented

throughout this report, spanning infrastructure sequencing, environmental enforcement, and climate-energy planning integration alike, are precisely the kind of administrative capability that cross-departmental training exercises are best positioned to address directly.

A further civil service workforce planning consideration, distinct from the specific vacancy and coordination-capacity findings discussed above, concerns the interaction between Kerala's civil service age and retirement profile and the state's broader pension liability pressures documented in Chapter 7's discussion of social security expenditure. A state civil service workforce that, like much of Kerala's wider population, is itself ageing, given the demographic transition documented in Chapter 1 and Chapter 6, generates a corresponding wave of impending retirements and consequent pension drawdown obligations whose fiscal interaction with the committed-expenditure pressures documented in Chapter 2 represents a further dimension of administrative governance planning this report has not been able to quantify with the precision the underlying fiscal stakes would warrant, given the absence of detailed civil service age-cohort and pension-liability projection data within the sources reviewed for this chapter. This represents a further, specific addition to the statistical strengthening agenda this report has developed cumulatively across multiple preceding chapters, and one with particularly direct fiscal sustainability implications given the already substantial pension and committed-expenditure pressures documented in Chapter 2. This recommendation, that future civil service training investment in Kerala prioritise cross-departmental coordination capability over further deepening of already strong single-department technical expertise, represents this chapter's most specific and actionable contribution to the administrative governance component of the Vision 2047 roadmap developed in Chapter 21.

Chapter 16: Technology-Enabled Service Delivery

16.1 Digital Infrastructure: Broadband, Optical Fibre and Connectivity Coverage

Kerala's core digital infrastructure backbone, introduced in Chapter 3's discussion of the Kerala Fibre Optic Network, rests on a state-wide optical fibre network conceived explicitly to bridge the digital divide and to make internet access a basic citizen entitlement, with KFON envisaged as the information superhighway providing affordable, scalable broadband connectivity of up to 100 Mbps to organisations and households alike (Kerala IT, 2026; Department of IT, 2026). The network's underlying physical infrastructure was built through a distinctive institutional arrangement: the Kerala State Electricity Board, examined extensively in Chapter 9, had separately undertaken a Reliable Communication and Data Acquisition Network project to lay optical fibre cable along its existing extra-high-tension transmission lines, connecting substations to improve grid communication and remote management of its own transmission and distribution network, and the state government subsequently decided to leverage this same KSEBL infrastructure as the physical backbone for the broader citizen-facing KFON network, with Kerala State IT Infrastructure Limited and KSEBL established as equal partners in the joint venture company, Kerala Fibre Optic Network Limited (Department of IT, 2026).

This arrangement removed the considerable administrative burden of separately securing right-of-way permissions for a wholly new fibre network, since KSEBL's existing transmission corridors already carried the necessary right-of-way clearances, and the project's aerial fibre-laying mode along these existing electricity towers allowed the network to be completed on what the implementing agencies describe as a mission-mode timeline (Department of IT, 2026). This institutional design, repurposing KSEBL's electricity transmission infrastructure for digital connectivity delivery, represents a particularly efficient example of cross-sectoral infrastructure integration, directly connecting this chapter's digital infrastructure discussion to the energy transmission infrastructure examined in Chapter 9, and stands in useful contrast to the more frequently documented cross-departmental coordination weaknesses this report identified in Chapter 15.

KFON's intended reach spans two parallel delivery tracks: Track 1 establishes a state-wide core optical fibre network connecting more than 30,000 government institutions, while Track 2 provides free internet access to economically backward families and subsidised broadband access to the wider population by leveraging the same core infrastructure (Department of IT, 2026). The programme specifically targets roughly twelve lakh below-poverty-line families for free internet connectivity, alongside government offices, hospitals and schools, and complements this fixed-line connectivity with approximately 2,000 WiFi hotspots distributed across the state intended to extend free internet access to around thirty million people, supported by an allocation of roughly 300 MB of free data per user for accessing other internet services (Kerala IT, 2026). KFON's underlying network architecture, comprising three Network Operating Centres, fourteen District Headquarters connections, 152 Block

Headquarters connections, and 63 Mini Points of Presence (Kerala IT, 2026), mirrors precisely the three-tier Panchayati Raj administrative structure examined in Chapter 12, district, block and village level, illustrating once again the close institutional coupling this report has identified throughout between Kerala's digital infrastructure investment and its decentralised governance architecture.

The actual operational utilisation of KFON's free and subsidised connectivity tracks relative to the originally stated targets, twelve lakh below-poverty-line households and roughly thirty million WiFi hotspot users, was not separately verified within the sources reviewed for this chapter, an important caveat given the broader pattern this report has documented across multiple infrastructure domains in which announced project targets and timelines have not always been matched by verified completion data at the same level of specificity. KFON's institutional design, however, offers a structural advantage relative to several of the other large infrastructure projects examined in this report: because the network leverages KSEBL's existing transmission infrastructure and right-of-way access rather than requiring entirely new land acquisition, the project was substantially insulated from the land-acquisition delays that this report identified in Chapter 8 and Chapter 11 as a recurring bottleneck across Kerala's road, rail and urban infrastructure programmes, suggesting that KFON's rollout pace, whatever its precise current completion percentage, has likely proceeded considerably faster than would have been the case for a comparable digital infrastructure project requiring independent right-of-way acquisition.

Kerala's Information Technology Policy 2023 extends this digital infrastructure ambition into frontier technology domains beyond conventional broadband and e-governance, establishing a dedicated agency, KSPACE, within the IT department specifically to harness opportunities in the space technology sector, supported by a twenty-acre Space Park campus under development (IT Policy, 2023).

This space technology pivot reflects an explicit acknowledgement, articulated in the policy document itself, that despite Kerala's successful track record nurturing high-tech industries to global competitiveness and despite decades of policy measures dating back to the state's first IT policy in 1998, Kerala has historically captured only a small portion of India's overall IT and electronics industry output relative to the sector's national scale, creating an identified need to reinvent the sector's growth trajectory by deliberately pursuing emerging domains such as space technology and electronic hardware rather than relying solely on the conventional IT services model that has anchored the state's technology sector for the past two decades (IT Policy, 2023). The policy further commits government support for high-speed internet access through KFON infrastructure with a twenty per cent subsidy on commercial rates for new technology units during their first year of operation, alongside a commitment to enable 5G connectivity across all IT parks, both state-run and private, subject to regulatory and infrastructure readiness (IT Policy, 2023), directly connecting this chapter's digital infrastructure discussion to the IT park and GCC expansion ambitions examined in Chapter 4.

16.2 e-Governance Architecture and Digital Public Infrastructure

Kerala's e-governance journey traces back to the early 2000s, when the state established FRIENDS centres as early government service dissemination points, subsequently expanding through a series of integrated digital platforms including the Service and Payroll Administrative Repository for Kerala (SPARK), the e-Health framework discussed in Chapter 6, e-Office for digital file management across government departments, e-Procurement, the Crime and Criminal Tracking Network and Systems (CCTNS) supporting the police administration discussed in Chapter 15, e-District services, and the Skill Delivery Platform Kerala discussed in connection with technical education in Chapter 5 (CDIT, 2026).

SPARK functions as an integrated personnel, payroll and accounts information system assigning every government employee a unique Permanent Employee Number that serves as a consistent identity marker across departments and services, intended to ensure consistent application of administrative rules and improved employee relations across Kerala's civil service workforce, the same workforce whose vacancy and coordination challenges were examined in Chapter 15 (Kerala IT, 2026). The e-Health platform, examined from a healthcare-delivery perspective in Chapter 6's discussion of the Aardram Mission, maintains a centralised database of healthcare information supporting nearly 50,000 healthcare service personnel spanning doctors, paramedical staff and non-clinical workers across the state's primary, secondary and tertiary care network (Kerala IT, 2026), directly underpinning the patient-record continuity benefits across the referral chain that Chapter 6 identified as a central objective of the Aardram Mission's digital health architecture.

Kerala's State Data Centre, described by the implementing agencies as the first facility of its kind in India dedicated exclusively to hosting e-governance applications, connects to all government offices through the Kerala State Wide Area Network, the network backbone linking the state's Network Operating Centres, District Headquarters, Block Headquarters and Mini Points of Presence discussed in section 16.1 (Kerala IT, 2026; CDIT, 2026). The Citizens' Call Centre functions as a single-window facility for citizen assistance spanning multiple government departments and projects simultaneously, while Akshaya Centres, distributed across the state to lie within easy reach of every household, provide localised information delivery and digital literacy support, particularly valuable for citizens without personal internet access or digital literacy, a knowledge-dissemination model that mirrors the panchayat-embedded, community-accessible service delivery architecture this report has identified repeatedly across health, welfare and now digital governance domains alike (Kerala IT, 2026).

The two-decade span of Kerala's e-governance journey, from the early FRIENDS service centres of the 2000s through to the current architecture of more than eighty integrated applications, illustrates a pattern of sustained, incremental institutional building rather than a single, large-scale digital transformation initiative implemented at one point in time. This incremental approach distinguishes Kerala's digital governance trajectory from states whose

e-governance investment has been more heavily concentrated in shorter, mission-funded bursts tied to specific national programme cycles, and is broadly consistent with the multi-decade, continuously evolving institutional pattern this report has already documented in Chapter 12's discussion of the People's Plan Campaign's successive Five-Year Plan phases. The e-Office platform's role in bringing efficiency, speed and transparency to file management across collectorates, sub-collectorates, directorates and line departments (Kerala IT, 2026) directly addresses the inter-departmental coordination and information-flow weaknesses this report identified as a recurring institutional challenge in Chapter 15, since a genuinely integrated digital file-management system, properly implemented and consistently used across departments, can in principle make cross-departmental information sharing considerably faster and more transparent than the paper-based, departmentally siloed file movement systems that e-Office was specifically designed to replace, even though this report's evidence in Chapter 15 suggests that the underlying coordination authority and accountability gap identified there extends beyond what digital file-management infrastructure alone can resolve.

The decision to establish a dedicated, single State Data Centre rather than allowing individual departments to maintain separate, independently managed server infrastructure carries direct implications for the cybersecurity considerations examined further in section 16.5, since a centralised hosting architecture allows security investment, monitoring, and incident response capability to be concentrated and standardised across a single facility rather than dispersed unevenly across dozens of separately managed departmental systems of varying technical sophistication. This centralisation strategy mirrors, in the digital infrastructure domain, the same institutional logic this report has documented in Chapter 9's discussion of KSEBL's centralised transmission grid management and in Chapter 6's discussion of the e-Health platform's centralised patient record database, suggesting that centralised, professionally managed core infrastructure paired with decentralised, locally accessible delivery points, such as the Akshaya Centres discussed above, represents a broader institutional design pattern that recurs across multiple domains of Kerala's public service architecture, combining the security and consistency benefits of centralisation at the infrastructure layer with the accessibility and inclusion benefits of decentralisation at the citizen-facing delivery layer.

16.3 Citizen Service Delivery: CSCs, Service Portals and Mobile Governance

Kerala's citizen-facing digital service delivery has progressed from a baseline of fewer than a handful of pioneering platforms in the early 2000s to more than eighty separate e-governance applications rolled out for public use as digital literacy and infrastructure availability have both expanded across the state (Kerala IT, 2026). This expansion in the sheer number of available digital government services reflects the same broader institutional trajectory this report has documented across multiple sectors: Kerala's early and sustained investment in foundational digital infrastructure, KFON's broadband backbone, the State Data Centre, and the KSWAN network discussed above, has subsequently enabled a progressively widening range of specific citizen-facing applications to be layered on top of that foundational

infrastructure, rather than each new service requiring its own separately built connectivity and hosting infrastructure. The Akshaya Centre network, discussed in section 16.2, plays a particularly important mobile and assisted-access governance role for citizens in rural and economically disadvantaged households who may lack personal smartphones, computers, or the digital literacy needed to navigate online government services independently, complementing the more conventional self-service digital portal model with a staffed, locally accessible assisted-service alternative that helps ensure Kerala's digital governance expansion does not inadvertently exclude the less digitally literate segments of the population whose welfare needs, examined throughout Chapters 6 and 7, this report has shown to be otherwise well served by the state's broader decentralised delivery architecture.

The Skill Delivery Platform Kerala (SDPK), referenced briefly in Chapter 5's discussion of technical and vocational education, maintains a database of approximately two lakh specialised engineering professionals across the state and operates by linking engineering colleges directly with the IT parks at Thiruvananthapuram, Kochi and elsewhere, with the explicit aim of helping engineering students upgrade their skill sets and enhance employability before entering the workforce (Kerala IT, 2026). The platform draws institutional support from Kerala State IT Infrastructure Limited, the Kerala State IT Mission, the APJ Abdul Kalam Technological University, and the ICT Academy, a public-private partnership specifically structured to build IT capacity (Kerala IT, 2026). This direct, structured linkage between higher education institutions and IT park employers represents a concrete institutional mechanism addressing precisely the higher-education-to-employment gap this report identified as a central challenge in Chapter 5's discussion of higher education and Chapter 3's discussion of youth unemployment, since SDPK is specifically designed to ensure that the technical skills graduates carry into the labour market are calibrated to actual, current employer demand within Kerala's IT sector rather than to a generic engineering curriculum disconnected from specific industry requirements.

Mobile governance specifically, as distinct from the broader web-based e-governance portal architecture discussed throughout this chapter, has become an increasingly central delivery channel as smartphone penetration has risen across Kerala's population, including among lower-income and rural households whose primary or sole internet access point is frequently a mobile device rather than a desktop computer or laptop. The available sources reviewed for this chapter do not provide a detailed, current inventory of Kerala's specific mobile application ecosystem for citizen services, comparable to the national-level mobile governance tools, such as the Meri Panchayat application discussed in Chapter 12's treatment of the national People's Plan Campaign's digital tools, but the general trajectory of Kerala's e-governance evolution documented throughout this chapter, from web portal to mobile-first design, mirrors the broader pattern observed across most Indian state digital governance programmes over the past decade, in which mobile delivery has progressively displaced desktop web access as the dominant citizen interaction channel for government digital services.

16.4 Data Governance, Open Data Policy and Privacy Framework

Kerala's emerging artificial intelligence policy framework, examined further in section 16.6, explicitly foregrounds data protection and privacy considerations alongside its economic and governance ambitions: the state's Chief Minister has stated publicly that artificial intelligence must be developed and deployed in alignment with democratic values, ethical principles and data protection, rather than pursued purely for technological or economic advantage without corresponding governance safeguards (Vijayan, as cited in Newkerala, 2026). The Digital University of Kerala's Vice Chancellor has similarly emphasised that the state must first develop a comprehensive policy framework focused specifically on data protection, ethical concerns and responsible AI usage before further scaling AI deployment across government and economic applications (Gopinath, as cited in Onmanorama, 2026), indicating that data governance policy development is being treated as a necessary precondition for, rather than an afterthought to, Kerala's broader digital and AI ambitions. The specific open data policy architecture governing access to the substantial volumes of citizen and administrative data Kerala's e-governance platforms, discussed in section 16.2, and the climate and disaster risk data systems discussed in Chapter 14's treatment of the World Bank-supported shared digital ecosystem initiative, was not detailed with full specificity within the sources reviewed for this chapter, representing a further specific data governance transparency gap that this report flags for the statistical and institutional strengthening agenda developed in Chapter 20, particularly given the explicit stated commitment to open data principles already documented in Chapter 14's climate resilience discussion.

Kerala's approach to data governance, as articulated through the public statements of both the Chief Minister and the Digital University's Vice Chancellor discussed above, situates the state's policy thinking within the broader global debate over balancing innovation speed against citizen data protection, a debate most prominently shaped internationally by the European Union's General Data Protection Regulation framework and, at the national level, by India's own Digital Personal Data Protection Act, 2023. Kerala's specific implementation of, and compliance mechanisms under, this national data protection framework across its various e-governance platforms, KFON, SPARK, e-Health and the broader citizen service architecture discussed in section 16.3, was not detailed with sufficient specificity in the sources reviewed for this chapter to allow a confident assessment of the state's actual operational compliance posture, as distinct from its stated policy intentions. Given the scale and sensitivity of citizen data already flowing through Kerala's e-Health platform alone, covering health records for nearly 50,000 healthcare personnel and, by extension, the patient populations they serve across the state's primary, secondary and tertiary care network discussed in Chapter 6, this report identifies a published, independently auditable data protection compliance assessment specific to Kerala's major e-governance platforms as a priority transparency measure that would substantially strengthen public confidence in the state's broader digital governance and forthcoming AI deployment ambitions, examined in section 16.6.

This priority for independently verified data protection compliance assessment is reinforced by the broader national context in which Kerala's digital governance ambitions are situated: India's Digital Personal Data Protection Act, 2023 establishes data localisation, consent management, and breach notification obligations that apply uniformly across all Indian states, but the practical, on-the-ground compliance maturity of any individual state's specific e-governance platforms relative to these national obligations varies considerably depending on the state's own institutional investment in data governance infrastructure and personnel, a variation this report cannot resolve definitively for Kerala specifically without the kind of independent compliance audit data this section has already identified as currently unavailable. Given Kerala's demonstrated institutional capacity for sustained, multi-decade digital infrastructure investment, documented throughout this chapter from KFON through to the Digital University's cybersecurity programmes, this report's assessment is that Kerala is comparatively well positioned, relative to many other Indian states, to achieve robust data protection compliance once the specific institutional and audit mechanisms discussed above are formally established and published, even though this report cannot confirm that this potential has yet been fully realised in practice.

16.5 Cybersecurity: State-Level Institutional Mechanisms

Kerala's cybersecurity institutional architecture is anchored substantially in the Digital University of Kerala, which functions simultaneously as a talent-development engine and a research hub for the state's broader cybersecurity ecosystem, offering specialised residential cybersecurity courses delivered under the national PM-AJAY scheme alongside postgraduate degree programmes in artificial intelligence and machine intelligence that train professionals specifically in intrusion detection, anomaly detection and threat analytics (eGov, 2025). The university is additionally spearheading the development of a dedicated Digital Science Park intended to host global partnerships spanning AI hardware, cybersecurity and autonomous systems research, extending Kerala's cybersecurity capacity-building beyond conventional university coursework into applied research and international collaboration (eGov, 2025).

This cybersecurity capacity-building effort is explicitly complemented by ethical AI frameworks, public awareness campaigns, and transparency initiatives including explainable AI approaches specifically designed to make complex algorithmic systems more comprehensible to ordinary citizens (eGov, 2025), connecting this section's cybersecurity discussion directly to the data governance and privacy considerations examined in section 16.4. Given the scale of citizen data now flowing through the KFON, SPARK, e-Health and broader e-governance architecture documented throughout this chapter, robust cybersecurity capability is not a peripheral consideration but a direct precondition for the continued public trust on which Kerala's entire digital governance model depends, particularly as the state's stated AI ambitions, examined in section 16.6, would substantially expand the volume and sensitivity of citizen data processed through automated systems.

The cybersecurity capacity-building agenda discussed in this section carries direct economic significance beyond its governance and citizen-protection function, given the close connection this report has documented between Kerala's technology talent base and the Global Capability Centre expansion examined in Chapter 4. Multinational firms establishing GCCs in Kochi and Thiruvananthapuram, particularly those handling sensitive financial, healthcare or personal data processing functions for their parent organisations, require assurance that the local talent pool and surrounding institutional ecosystem can support enterprise-grade cybersecurity operations, intrusion detection and threat response capability comparable to what these firms would expect from more established GCC destinations such as Bengaluru and Hyderabad. The Digital University's specialised cybersecurity training programmes, discussed above, accordingly serve a dual function within Kerala's broader economic strategy: building domestic cybersecurity capacity for the state's own e-governance and public service infrastructure, while simultaneously developing the specialised talent pipeline that the GCC and high-tech manufacturing investment ambitions documented in Chapter 4 depend upon to remain competitive against established technology hub rivals elsewhere in India.

The cybersecurity threat landscape facing Kerala's public digital infrastructure spans a range of distinct risk categories that the institutional architecture documented in this section must address simultaneously: conventional cybercrime targeting individual citizens through the e-governance and digital financial services platforms discussed throughout this chapter, more sophisticated threats targeting the state's critical digital infrastructure itself, including the KFON network and State Data Centre discussed in sections 16.1 and 16.2, and the emerging category of AI-specific security risks, including adversarial manipulation of machine learning systems and data poisoning attacks, that the state's expanding AI deployment ambitions, examined in section 16.6, will introduce as a comparatively new risk category beyond the more established cybersecurity threat models that conventional IT systems have historically faced. The Digital University's explicit focus on training professionals in anomaly detection and threat analytics, discussed above, positions Kerala's cybersecurity workforce development to address this evolving threat landscape, though the practical, measurable effectiveness of this training pipeline in actually reducing successful cyberattacks against Kerala's public digital infrastructure was not separately documented within the sources reviewed for this chapter, representing a further specific outcome-data gap consistent with the pattern this report has identified across multiple chapters regarding the general scarcity of disaggregated, outcome-based performance metrics for Kerala's various institutional initiatives.

16.6 Emerging Technologies: AI, Geospatial Systems and Smart Governance

Kerala has articulated an explicit ambition to position itself as a national implementation hub for AI-driven public systems ahead of the India AI Summit 2026, building deliberately on the existing digital infrastructure, talent base and innovation ecosystem documented throughout this report, KFON's universal broadband ambition, the Kerala Startup Mission discussed in

Chapter 4, and the Digital University's research capacity discussed in section 16.5 (Newkerala, 2026). The state's approach has explicitly drawn comparative inspiration from the United Arab Emirates and Saudi Arabia, both of which have integrated AI substantially into governance and economic planning functions, with Kerala technology policy experts suggesting the state's historical inclusive-access model, Akshaya centres, e-literacy programmes and KFON's universal connectivity ambition, offers a template for similarly inclusive AI adoption rather than an AI strategy benefiting only the state's most digitally sophisticated urban populations (Onmanorama, 2026). Specific priority application domains identified for AI deployment include public healthcare, precision agriculture connecting directly to the agricultural productivity priorities examined in Chapter 18, disaster and climate resilience extending the World Bank-supported data systems discussed in Chapter 14, intelligent transportation systems relevant to the multimodal logistics challenges documented in Chapter 8, tourism applications discussed further in Chapter 19, multilingual Malayalam language technology development reflecting Kerala's distinctive linguistic profile documented in Chapter 1, e-governance, cybersecurity, and AI-enabled skilling programmes connecting to the workforce alignment priorities examined in Chapter 17 (Onmanorama, 2026).

Kerala's policy narrative explicitly positions the state's AI strategy as aligned with, rather than independent of, the national India AI Mission, suggesting an intent to function as a state-level implementation partner for nationally coordinated AI infrastructure and standards rather than pursuing an entirely separate, state-specific AI development pathway (Newkerala, 2026). This alignment strategy carries practical advantages consistent with the broader pattern this report has documented regarding Kerala's effective use of national scheme funding and frameworks, AMRUT discussed in Chapter 11, JJM discussed in Chapter 10, and PMGSY discussed in Chapter 12, alongside state-specific complementary programmes: by positioning itself as a national AI implementation hub rather than a standalone AI development centre, Kerala can plausibly draw on national AI Mission funding, standards, and computing infrastructure investment, while contributing its own comparative advantages in digital governance experience, decentralised delivery architecture, and an already-established cybersecurity and data university ecosystem, a combination that this report's evidence suggests gives Kerala a genuinely differentiated value proposition relative to states pursuing AI development purely through private-sector investment attraction without the equivalent public-sector digital governance track record Kerala has built over the past two decades.

Kerala's stated AI strategy explicitly acknowledges a tension this report has identified across multiple preceding chapters between speed of deployment and governance rigour: while emphasising ethical deployment and democratic values, the state's own technology policy commentary cautions that excessive caution could slow innovation in a sector globally defined by rapid pace, even as deeper collaboration between government, academia and the startup ecosystem, agile procurement frameworks, and regulatory clarity are identified as necessary conditions for converting Kerala's stated AI policy intent into actual operational

outcomes (Newkerala, 2026). This explicit acknowledgement of the speed-versus-governance tradeoff is, in this report's assessment, a more mature and self-aware policy stance than a purely promotional AI strategy narrative would typically exhibit, and is broadly consistent with the pattern this report has identified throughout Chapters 13, 14 and 15: Kerala's policy and institutional design across multiple domains tends to be genuinely sophisticated in its diagnostic self-awareness, even where the corresponding implementation and enforcement capacity has not always matched that diagnostic sophistication in practice. Whether Kerala's emerging AI governance institutions can avoid this same implementation gap as the state's AI strategy moves from policy statement towards operational deployment represents, on the evidence available to this report, one of the more consequential open questions for the technology-enabled service delivery agenda carried forward into the Vision 2047 roadmap developed in Chapter 21.

The inclusive-access framing Kerala's technology policy commentators have applied to the state's emerging AI strategy, drawing explicitly on the Akshaya centre and KFON precedents discussed in sections 16.1 and 16.3, deserves particular scrutiny given the rural-urban and gender digital divides this report has documented across other domains, including the gender employment gap examined in Chapter 7 and the dispersed, small-town settlement geography examined in Chapter 11. An AI deployment strategy genuinely calibrated to Kerala's actual population distribution would need to ensure that AI-enabled public healthcare, precision agriculture, and disaster resilience applications, the priority domains identified in this section, are designed from the outset for delivery through the same Akshaya Centre and panchayat-level community access points that have proven effective for conventional e-governance services, rather than defaulting to smartphone-app-only delivery models that would systematically disadvantage citizens in Kerala's more rural and economically disadvantaged districts, the same nine high-climate-vulnerability districts identified in Chapter 14 and the tribal and hill districts examined in Chapter 7, who often face the most acute need for the precision agriculture and disaster resilience applications this section identifies as priority AI use cases. Whether Kerala's AI strategy implementation ultimately honours this inclusive-access design principle, or instead defaults towards the urban-concentrated deployment pattern more typical of AI rollouts elsewhere in India, represents a further specific and consequential test of the broader policy-design-versus-implementation-consistency theme this report has traced throughout Chapters 13, 14, 15 and now 16.

Chapter 17: Innovation, Research and Knowledge Economy

17.1 State Innovation Ecosystem: Startups and Accelerators

Kerala's startup ecosystem has achieved a scale and growth trajectory that places it among the most dynamic state-level innovation environments in India. The Kerala Startup Mission, the state's principal entrepreneurship and incubation agency operating under the Government of Kerala, has supported more than 6,400 startups through a network of 63 incubators, facilitating roughly \$665 million, approximately ₹58 billion, in cumulative funding while creating 65,000 jobs and engaging more than 100,000 students annually through its various outreach and training programmes (Ecosystem Startup Genome, 2026). The ecosystem's growth rate has been particularly striking in recent measurement periods: the 2024 Global Startup Ecosystem Report, drawing on data from more than 4.5 million companies across over 300 entrepreneurial innovation ecosystems worldwide, recorded Kerala's startup ecosystem reaching a valuation of \$1.7 billion over the eighteen months to the end of 2023, a compound annual growth rate of 254 per cent between July 2021 and December 2023, more than five times the 46 per cent global average growth rate recorded over the comparable period (Future Technology Show, 2024). Kerala's ecosystem value subsequently surged a further 147 per cent in 2025 alone, with the broader ecosystem now encompassing more than 3,500 active ventures and growing at roughly twenty per cent annually (Ecosystem Startup Genome, 2026), figures that, considered alongside the GSER ranking placing Kerala within the top 35 global ecosystems specifically on the Knowledge and Funding dimensions, the former assessing innovation through research and patent activity, the latter measuring early-stage funding and investor activity, confirm Kerala's position as the leading state-level startup ecosystem in India alongside a small comparator group including Telangana, Tamil Nadu and Karnataka (Future Technology Show, 2024).

Specific startup success stories emerging from this ecosystem illustrate the qualitative depth behind these aggregate growth figures. EyeROV, a marine robotics startup building advanced underwater remotely operated vehicles, has raised ₹13 crore in funding and secured a ₹47 crore contract with the Indian Navy, directly connecting Kerala's startup ecosystem to the coastal and marine resource priorities examined in Chapters 3, 4 and 13 (Kerala Startup Mission, 2026). NetraSemi, a fabless semiconductor startup developing energy-efficient AI edge chips, has raised ₹107 crore from investors including Zoho and Unicorn India Ventures (Kerala Startup Mission, 2026), an achievement of particular significance given the broader national semiconductor self-sufficiency ambitions examined in section 17.3. Kerala's creative technology sector has additionally produced internationally recognised work, including a Kerala-based gaming creator whose work, developed with support from the state's TiltLabs incubation programme, was featured on Fortnite's map in Japan, demonstrating that Kerala's innovation ecosystem extends beyond conventional technology and biotechnology startups into digital entertainment and creative industries as genuinely competitive global opportunities for the state's young professionals (Kerala Technology, 2025).

Kerala's startup support infrastructure is organised through the same hub-and-spoke technology park model discussed in Chapter 4's treatment of Technopark, Infopark and Cyberpark, with KSUM's 63 incubators distributed across this established physical infrastructure network rather than concentrated in a single centralised location, ensuring that the state's innovation support ecosystem reaches beyond Thiruvananthapuram and Kochi into the satellite technology centres serving the state's wider hinterland. This distributed accelerator and incubator model mirrors the broader dispersed urban and digital infrastructure pattern this report has identified throughout Chapters 11 and 16, in which Kerala's institutional design consistently favours reaching across its dense, small-town settlement geography rather than concentrating investment narrowly within its largest metropolitan centres alone, a design choice that, applied to the startup ecosystem specifically, plausibly broadens the geographic and socioeconomic base from which Kerala's next generation of entrepreneurs and innovators is drawn, relative to a more centralised incubation model that would risk concentrating innovation opportunity disproportionately among Thiruvananthapuram and Kochi's already more digitally and economically advantaged populations.

A more cautious assessment within the academic entrepreneurship literature complicates this otherwise strongly positive growth narrative. A dedicated academic study of Kerala's entrepreneurial ecosystem, examining how a socially developed state harnesses its human capital and cultural strengths to build a competitive entrepreneurial environment, finds that despite the institutional developments documented throughout this chapter, Kerala continues to exhibit certain structural weaknesses within its startup ecosystem relative to its full potential, even as comparative analysis across Indian state-level ecosystems confirms that policy flexibility, selective incentives, and industry specialisation are the key differentiating factors separating more successful state ecosystems from less successful ones (Journal of Asia Entrepreneurship and Sustainability, 2025). This more measured academic assessment is consistent with the broader pattern this report has identified throughout, in which Kerala's headline growth and achievement statistics, examined in this section through the GSER and ecosystem-value figures, coexist with more granular, less publicly emphasised structural weaknesses that require closer academic and policy scrutiny than the promotional growth narrative alone provides, a tension this report has already documented in domains ranging from ease-of-doing-business rankings discussed in Chapter 4 to PSU performance discussed in the same chapter.

17.2 Research and Development: Academic-Industry Linkages

Kerala's research institution density, examined briefly in Chapter 5's discussion of higher education, takes on particular significance in the context of shifting global geopolitics that are forcing India to reassess its national approach to research, advanced manufacturing and intellectual property, a context in which Kerala holds what industry analysts characterise as a relative comparative advantage given its concentration of well-established research and higher education institutions (Kerala Technology, 2025). Six Kerala institutions, including the

College of Engineering Trivandrum, the National Institute of Technology Calicut, Cochin University of Science and Technology, and Rajagiri School of Engineering and Technology, were selected for the central government's Chips to Startup programme, a national initiative specifically designed to build semiconductor design and entrepreneurship capacity within India's higher education system (Kerala Technology, 2025), directly connecting this chapter's research and development discussion to the NetraSemi semiconductor startup success story documented in section 17.1. Cochin University of Science and Technology and the Indian Institute of Space Science and Technology have separately been identified under the National Quantum Mission, the national programme tasked with building a domestic quantum computing ecosystem (Kerala Technology, 2025), positioning Kerala's research institutions at the frontier of two of the most strategically significant emerging technology domains within India's national technology policy, semiconductors and quantum computing, simultaneously.

The Trivandrum Research Cluster, bringing together seven premier central government research institutions within a single coordinated framework, is identified in the technology ecosystem literature as a concrete example of the opportunities available to Kerala's research ecosystem when coordination and follow-through across institutions are genuinely sustained (Kerala Technology, 2025), a finding that connects directly to the cross-departmental and cross-institutional coordination weaknesses this report has identified repeatedly throughout Chapters 8, 13, 14 and 15.

Notwithstanding this genuine institutional research strength, the broader question of whether Kerala's research and development investment intensity, measured as a share of state GSDP, matches the scale of its research institution base remains, on the evidence reviewed for this chapter, an area of continuing concern rather than confirmed achievement. India's overall research and development spending as a share of GDP has historically lagged behind comparable middle-income economies, and the available sources reviewed for this chapter do not provide a Kerala-specific research and development intensity figure that would allow this report to confirm whether Kerala's research institution density translates into a correspondingly above-average research investment intensity relative to other Indian states, or whether the state's research achievements documented in this section are instead concentrated within a comparatively small number of well-resourced flagship institutions, the Trivandrum Research Cluster's seven central government institutions, NIT Calicut, and Cochin University of Science and Technology among them, operating against a broader state research funding landscape that has not scaled proportionately to the achievements of these flagship institutions. This distinction between institutional excellence concentrated in flagship centres and broad-based research investment intensity across the wider higher education system matters directly for the policy question of whether further state investment should prioritise deepening support for already-successful flagship institutions or instead broadening research capacity and funding across Kerala's wider university system, a question this report's available evidence cannot resolve definitively but flags as a priority area for the statistical strengthening agenda developed in Chapter 20.

The Trivandrum Research Cluster's seven-institution model, discussed earlier in this section, offers a useful template for resolving this flagship-versus-broad-based investment tension, since the cluster's coordination structure is explicitly designed to allow smaller or less individually well-resourced institutions to benefit from shared access to the cluster's collective research infrastructure, personnel expertise, and funding relationships, rather than requiring each participating institution to independently replicate the full research infrastructure of the cluster's most well-resourced members. If extended successfully beyond Thiruvananthapuram to comparable institutional clusters in Kochi and Kozhikode, examined throughout this report as Kerala's other principal knowledge economy centres, this cluster-based coordination model could in principle deliver much of the benefit of broad-based research capacity expansion across Kerala's wider university system without requiring the scale of incremental direct funding that expanding flagship-institution-level research infrastructure to every individual university campus would otherwise demand, representing a potentially more fiscally efficient pathway to addressing the research capacity breadth concern this section has identified, particularly given the binding capital expenditure constraints documented extensively in Chapter 2. The Bharat Genome Database, launched in 2024 and aimed at building a comprehensive plant genome platform for India, exemplifies the kind of globally relevant scientific infrastructure that Kerala's research ecosystem has demonstrated capacity to host and develop, reflecting what industry observers describe as a growing institutional confidence that genuinely globally significant research platforms can originate from Kerala rather than only from India's more established northern research hubs (Kerala Technology, 2025).

17.3 Intellectual Property: Awareness, Registration and Commercialisation

Kerala Startup Mission's institutional support architecture extends specifically into intellectual property commercialisation, offering a five-year interest subsidy on bank loans availed for implementing projects based on a registered patent, alongside educational assistance of up to three lakh rupees annually for postgraduate studies or research extending over three years (IndiaFilings, 2026). This patent-linked financing support represents a deliberate institutional mechanism for converting Kerala's research output, documented in section 17.2, into commercially viable enterprise activity, addressing directly the broader national concern, noted in the technology ecosystem literature, that India's approach to intellectual property commercialisation has historically lagged behind its research output generation capacity. KSUM's scaling-stage support programmes explicitly prioritise startups working on products that have already obtained a patent, or that are actively scaling a patented product, when allocating mentorship and connection programme resources, including access to mentors of national and international standing through the Startup Leadership Academy and Training Programme (IndiaFilings, 2026), indicating that Kerala's innovation support architecture is deliberately structured to reward and accelerate patent-protected innovation specifically, rather than treating intellectual property registration as a peripheral or optional consideration within the broader startup support ecosystem.

The broader national context against which Kerala's patent commercialisation infrastructure should be assessed reveals a persistent structural challenge that applies across most of India, not Kerala specifically: India's overall patent filing and grant volumes, while growing substantially over the past decade, continue to lag considerably behind those of leading global innovation economies such as the United States, China, Japan and South Korea, both in absolute volume and in patents filed per capita or per unit of research and development spending. Kerala's specific patent filing and grant statistics relative to other Indian states were not separately detailed within the sources reviewed for this chapter, though the state's strong showing on the GSER's Knowledge ranking dimension, discussed in section 17.1, which specifically assesses innovation through research and patent activity, provides indirect evidence that Kerala's patent generation performance is comparatively favourable relative to other Indian state ecosystems even without precise quantification. The patent-linked financing mechanisms documented in this section, the interest subsidy and educational assistance schemes, represent a demand-side intervention addressing the commercialisation gap once a patent has already been secured, but this report's evidence does not allow a confident assessment of whether Kerala has made comparable investment in the upstream patent-filing process itself, including subsidised patent attorney services, expedited examination support, or other mechanisms that several leading global innovation hubs have used to reduce the cost and procedural complexity that often deters smaller research teams and individual inventors from pursuing formal patent protection in the first place.

A further consideration relevant to Kerala's intellectual property commercialisation infrastructure concerns the level of basic patent awareness among the state's wider population of small and medium enterprise owners, discussed in Chapter 4's treatment of the Year of Enterprises campaign and Mission 1000, beyond the more sophisticated technology startup founders who form the primary user base for KSUM's patent-linked financing schemes. The roughly 3.45 lakh new enterprises created under the Year of Enterprises campaign discussed in Chapter 4, spanning the full range of MSME activity from traditional coir and handicraft manufacturing to modern technology ventures, represent a vastly larger population of potential intellectual property holders than the technology startup ecosystem examined in this chapter's other sections, yet the available evidence does not indicate whether KSUM's patent commercialisation support, or comparable awareness and outreach programmes, have been extended systematically to this much larger MSME population, as distinct from the comparatively smaller, more digitally sophisticated technology startup cohort that appears to be the primary beneficiary of the schemes documented in this section.

Extending patent awareness and basic intellectual property registration support to Kerala's broader MSME base, including the traditional coir, handloom and agro-processing sectors discussed in Chapters 3 and 4, represents a further specific opportunity this report identifies for broadening the reach of Kerala's otherwise well-designed intellectual property commercialisation infrastructure beyond its current concentration within the technology startup sector specifically.

17.4 Knowledge Institutions as Engines of Development

Kerala's knowledge institution base, spanning the conventional university system discussed in Chapter 5 alongside the specialised research institutions discussed in section 17.2, has produced a distinctive technological achievement that illustrates the practical application of this institutional depth: the Digital University of Kerala developed Kairali, an indigenously designed AI chip, in 2024 (Invest Kerala Global Summit [IKGS], 2025), a development of particular strategic significance given the broader Indian national policy emphasis on reducing dependence on imported semiconductor and AI hardware technology. Kerala's broader digital infrastructure achievement record received external validation when KFON, discussed extensively in Chapter 16, was awarded the Infrastructure Initiative of the Year in India in 2024, specifically recognising the project's transformative impact on digital connectivity and inclusivity across the state (IKGS, 2025). Kerala additionally ranks eighth nationally in software exports as recorded by the Software Technology Parks of India, a ranking that, while not placing Kerala among the very top-ranked states on this specific metric, nonetheless confirms the state's software export base, documented in Chapter 3's discussion of IT services exports approaching ₹1,00,000 crore, as a genuinely competitive and internationally recognised component of Kerala's knowledge economy rather than a purely domestically oriented technology sector (IKGS, 2025).

Kerala's eighth-place national ranking in software exports merits closer examination given the broader comparison this report has drawn throughout Chapters 3 and 4 between Kerala's IT services strength and the more dominant technology hub states of Karnataka, Telangana, Tamil Nadu and Maharashtra, each of which substantially outranks Kerala on this specific metric. This ranking gap is consistent with the broader pattern this report has documented in Chapter 4's FDI inflow comparison, where Kerala's cumulative foreign direct investment of roughly ₹13,848 crore between 2019 and 2025 trailed considerably behind the investment volumes attracted by these larger, more established technology hub states. The knowledge economy strategy examined throughout this chapter, Kairali's chip development, the Chips to Startup and National Quantum Mission institutional participation, and the integrated innovation pipeline documented in section 17.6, should accordingly be understood not as evidence that Kerala has already closed the gap with India's leading technology states, but as a deliberate, differentiated strategy aimed at building competitive advantage in specific, frontier technology niches, quantum computing, AI chip design, marine robotics, where Kerala's research institution depth and startup ecosystem dynamism offer genuine comparative advantage, rather than attempting to compete head-on with Bengaluru, Hyderabad and Chennai across the full breadth of conventional IT services activity where these established hubs already possess decades of accumulated scale advantage.

Kerala's status as the chosen GCC expansion destination discussed in Chapter 4, attracting interest from multinational firms specifically because of its position as a lower-cost alternative to Bengaluru, Hyderabad and Chennai, illustrates how this differentiated competitive positioning operates in practice within the conventional IT services and business

process domains as well as within the frontier technology niches discussed above. Rather than competing with India's established technology hubs purely on cost, the GCC investment thesis examined in Chapter 4 combines Kerala's comparatively lower operating costs with the genuine knowledge institution depth, skilled workforce quality, and emerging-technology research capability documented throughout this chapter, a combination that positions Kerala's value proposition as meaningfully differentiated from a pure low-cost-alternative strategy, since firms establishing GCCs in Kerala specifically gain access to the Chips to Startup and National Quantum Mission-linked research talent, the Digital University's cybersecurity and AI capability discussed in Chapter 16, and the broader innovation ecosystem infrastructure documented throughout this chapter, advantages that a purely cost-driven GCC location decision would not by itself capture.

17.5 Building a Youth Innovation and Research Ecosystem

Kerala Startup Mission's Future Technologies Lab initiative provides dedicated tools, equipment and infrastructure specifically for research and development in emerging technology domains, functioning as a platform through which these emerging technologies are introduced systematically to both startups and students (IndiaFilings, 2026). This youth-focused research infrastructure is complemented by KSUM's International Entrepreneurship Exchange Programme, which provides Kerala's students and young entrepreneurs with structured exposure to the world's most advanced and mature startup ecosystems, including Silicon Valley, Menlo Park, London, Tokyo and Tel Aviv, through exchange programmes specifically designed to enhance marketing and funding opportunities for Kerala-based startups while providing participants with direct international exposure to global innovation practice (IndiaFilings, 2026). The FABLAB programme extends this youth innovation infrastructure into physical fabrication capability, establishing state-of-the-art fabrication laboratories across Kerala specifically to encourage student and youth engagement with printed electronics and related emerging hardware fields (IndiaFilings, 2026), directly connecting to the Industry-on-Campus initiative discussed in Chapter 5's treatment of technical and vocational education, under which a functioning robotics manufacturing unit was established on a Government Polytechnic College campus in partnership with the robotics firm Genrobotics in January 2025 (Ecosystem Startup Genome, 2026), providing students with embedded, hands-on industry experience rather than purely classroom-based or laboratory-simulated innovation exposure.

The International Entrepreneurship Exchange Programme's deliberate exposure of Kerala's young entrepreneurs to the world's most mature startup ecosystems carries a strategic rationale that extends beyond the immediate marketing and funding benefits noted above: by giving Kerala's student entrepreneurs direct, first-hand exposure to how globally leading innovation ecosystems actually operate, the programme is designed to build the kind of international ambition and self-confidence that the broader technology ecosystem literature, discussed in section 17.1's review of My Designation's fashion-industry ambition and Sabal Krishna's Fortnite success, identifies as an emerging and increasingly visible characteristic of

Kerala's younger innovation cohort. This confidence-building function is, in this report's assessment, at least as significant as the programme's more tangible marketing and funding-access objectives, since the broader pattern this report has documented throughout Chapter 3's discussion of skilled migration and Chapter 5's discussion of higher-education-to-employment gaps suggests that a meaningful constraint on Kerala's innovation ecosystem has historically been outward-oriented ambition, talented graduates seeking opportunity abroad rather than building globally ambitious enterprises from within the state, and programmes specifically designed to demonstrate that internationally competitive innovation can originate from Kerala itself address this underlying confidence and ambition gap directly, rather than addressing only the more conventional funding and skills gaps that dominate most innovation policy discourse.

A digitally mapped scientific instrumentation platform, developed by Kerala Startup Mission to create a unified access ecosystem connecting researchers and innovators across the state's various institutions to shared scientific equipment and facilities, represents a further infrastructure investment specifically targeted at lowering the capital-equipment barrier that might otherwise constrain younger researchers and student innovators from accessing the specialised instrumentation their research requires (Kerala Startup Mission, 2026). This shared-infrastructure model, combined with a collaborative platform specifically designed to transform research outcomes into market-ready solutions (Kerala Startup Mission, 2026), illustrates a deliberate institutional strategy to compress the traditionally long and often discontinuous pathway between academic research output and commercially viable innovation, addressing directly the intellectual property commercialisation gap discussed in section 17.3.

17.6 Skill Development, Employability and Workforce Alignment

The skills and employability challenges this report has documented extensively in Chapter 3's discussion of youth unemployment and Chapter 5's discussion of the higher-education-to-employment gap find their most direct policy response within the innovation ecosystem examined in this chapter. The Kerala Knowledge Economy Mission's January 2025 partnership with Coursera, discussed in Chapter 5, specifically targets equipping 60,000 learners with industry-relevant skills for high-demand digital roles through the state's Additional Skill Acquisition Programme, providing job-ready training calibrated directly to current labour market demand rather than to a generic technical curriculum (Ecosystem Startup Genome, 2026). Kerala's industrial policy, announced at the 2024 Generative AI Conclave in Kochi, identifies twenty-two priority sectors spanning artificial intelligence, blockchain, machine learning, big data, robotics, tourism and logistics (Ecosystem Startup Genome, 2026), and the state's AI policy, unveiled in July 2024, offers KSIDC investment support of up to roughly \$573,000, approximately ₹50 million, for AI startups that themselves commit investment of ₹100 million or more (Ecosystem Startup Genome, 2026), creating a direct financial incentive structure linking workforce skilling

investment to the same priority sectors the state's broader industrial and innovation policy is designed to attract.

The startup ecosystem's exit dynamics provide a further indicator of workforce and capital market maturity: the average age at exit for ventures within Kerala's startup ecosystem during the 2020 to 2024 period, while not separately quantified in absolute terms within the sources reviewed for this chapter beyond the global comparator average of 11.2 years, nonetheless situates Kerala's ecosystem within an internationally benchmarked maturity framework that allows ongoing comparison against global innovation ecosystem norms (Ecosystem Startup Genome, 2026). Average software engineer salary data, benchmarked against the global average of approximately \$52,000 and drawing on sources including Glassdoor, Salary.com and PayScale alongside local Kerala-specific sources (Ecosystem Startup Genome, 2026), provides a further internationally comparable workforce metric, though the specific Kerala figure relative to this global benchmark was not separately detailed within the sources consulted for this chapter, representing a further specific data gap this report flags for the statistical strengthening agenda developed in Chapter 20.

Notwithstanding these specific data limitations, the cumulative evidence assembled across this chapter, the patent-financing support documented in section 17.3, the Chips to Startup and National Quantum Mission institutional participation documented in section 17.2, the FABLAB and Future Technologies Lab youth innovation infrastructure documented in section 17.5, and the Coursera and AI policy skilling investments documented in this section, together demonstrate that Kerala's innovation and knowledge economy policy architecture has been deliberately designed as an integrated pipeline spanning research, intellectual property commercialisation, youth innovation training, and workforce skill alignment, rather than as a set of disconnected initiatives addressing each stage of the innovation pipeline in isolation. This integrated design represents one of the more coherent and well-sequenced policy architectures examined across this report, and provides a concrete, evidence-based foundation for the knowledge economy component of the Vision 2047 roadmap developed in Chapter 21.

The single most consequential remaining question this chapter's evidence raises, and one this report cannot fully resolve given the data limitations documented throughout, is whether this well-sequenced innovation pipeline architecture is succeeding at a scale sufficient to meaningfully reduce the youth unemployment and underemployment crisis documented in Chapter 3, where youth unemployment was shown to reach 27.7 to 29.9 per cent depending on the specific survey period, or whether the innovation ecosystem's genuine achievements, the GSER ranking, the EyeROV and NetraSemi funding successes, the Kairali chip development, remain concentrated within a comparatively small, highly skilled cohort of founders, researchers and early-stage employees whose numbers, even at 65,000 jobs created through KSUM-supported startups cumulatively, remain modest relative to the scale of Kerala's overall youth labour market documented in Chapter 3. This report's assessment, drawing on the broader pattern identified throughout preceding chapters, is that Kerala's innovation ecosystem represents a genuine and well-designed growth engine operating at a

scale that, while impressive relative to other Indian state ecosystems, has not yet reached the absolute scale required to function as the primary solution to the state's broader youth employment challenge on its own, meaning the innovation economy documented in this chapter should be understood as one important component of Kerala's broader employment strategy, working alongside the GCC expansion, value-added manufacturing, and blue economy priorities documented in Chapter 4, rather than as a standalone solution to the employment crisis documented in Chapter 3.

This synthesis finding, that Kerala's innovation ecosystem is genuinely strong but not yet sufficient in scale to resolve the state's broader employment challenge alone, recurs as a pattern across several of this report's sectoral assessments, the IT and GCC expansion discussed in Chapter 4, the value-added rubber and seafood opportunities discussed in the same chapter, and the innovation ecosystem examined in this chapter, each of which represents a genuine and well-designed growth engine whose individual scale, while impressive in isolation, has not yet aggregated to a combined employment impact commensurate with the scale of the youth unemployment and underemployment challenge documented in Chapter 3. The implication for the Vision 2047 roadmap developed in Chapter 21 is that these multiple growth engines, the innovation economy examined in this chapter, the value chain transformation and GCC expansion examined in Chapter 4, and the blue economy and tourism growth corridors examined respectively in Chapters 3 and 19, must be pursued simultaneously and at materially accelerated scale, rather than sequentially or in isolation, if Kerala's employment challenge is to be resolved within a realistic policy timeframe.

Chapter 18: Agriculture, Allied Sectors and Food Security

18.1 Cropping Pattern, Agricultural Productivity and Input Use

Kerala's cropping pattern, documented in Chapter 3's discussion of the state's land-use composition, remains dominated by tree crops and groves rather than the grain-dominated cropping systems characteristic of most major Indian agricultural states, with coconut and rubber together accounting for more than half of Kerala's gross cropped area, a concentration in tree crop cultivation that the national farmland classification literature identifies as significant specifically to Kerala, alongside comparable tree crop concentrations in Karnataka, Assam's tea cultivation, and the broader spice-growing belt of the Western Ghats (Farmonaut, 2026). This structural feature distinguishes Kerala's agricultural productivity and input-use patterns markedly from states such as Punjab, Haryana and Uttar Pradesh, which the same national land-use literature identifies as having the highest cropping intensity in India, often achieving double or triple cropping on the same land parcel within a single year, a pattern that Kerala's perennial tree-crop-dominated agriculture, planted once and then harvested over a multi-decade productive lifespan, does not replicate (Farmonaut, 2026). The Kerala Agriculture Department's own annual planning documents reflect this structural reality directly, organising the state's principal crop-development schemes around rice development, vegetable development, coconut development, spice development, and the development of fruits, flowers and medicinal plants, alongside an explicit crop diversification component, rather than around the kind of cereal-intensification programming that dominates agricultural input-use policy in India's major grain belts (Directorate of Agriculture, 2024). The Department's Agro-Ecological Unit concept, emphasising scientific selection of crop components and agronomic management practices calibrated to Kerala's distinct micro-ecological zones, represents a deliberate methodological response to the considerable agro-climatic and geographic diversity packed within Kerala's narrow territorial extent, documented throughout Chapter 1's discussion of the state's three-zone highland, midland and lowland topography (Directorate of Agriculture, 2024).

Kerala's average agricultural landholding size, shaped by the historical land reform programme documented in Chapter 1's discussion of the state's distinctive social development trajectory, remains considerably smaller than the average landholding in major grain-belt states, a structural feature with direct implications for how productivity and input-use efficiency should be measured and interpreted across this chapter's discussion of Kerala's agricultural sector. Whereas Punjab and Haryana's larger, more consolidated landholdings support mechanised, capital-intensive cultivation of a small number of high-volume cereal crops, Kerala's smaller, more fragmented landholdings, frequently divided across successive generations within extended families, are better suited to the labour-intensive, diversified, multi-crop cultivation pattern that the Department's integrated horticulture, spice and tree-crop programming, discussed throughout this chapter, is specifically designed to support. This landholding-size constraint also explains, in significant part, why the cooperative aggregation model examined in Chapter 12's discussion of Milma dairy cooperatives, and the

Farmer Producer Organisation structures discussed in section 18.3's treatment of the Value Chain Modernisation Project, feature so prominently in Kerala's agricultural policy architecture relative to states where larger individual landholdings allow farmers greater independent bargaining power and processing capacity without requiring the same degree of collective organisation.

18.2 Irrigation and Water Use Efficiency in Agriculture

The irrigation infrastructure mismatch this report identified in Chapter 10, where Kerala's existing minor and medium irrigation infrastructure was built substantially for paddy cultivation even as the state's actual cropped area has shifted decisively towards rainfall-dependent plantation and tree crops, finds its clearest policy expression in the Kerala Agriculture Department's dedicated paddy-revival initiatives. The Department's Operation Double Kole scheme, allocated ₹50 lakh for the 2024-25 financial year specifically to encourage double cropping within the state's distinctive Kole wetland paddy areas, provides assistance for critical inputs and infrastructure development based on project proposals submitted by the programme's special officer (Directorate of Agriculture, 2024), representing a targeted attempt to reverse, at least within these specific wetland tracts, the broader paddy-land contraction trend documented in Chapter 10 and Chapter 13. This Kole-specific double-cropping initiative connects directly to the natural flood-attenuation function of paddy wetlands discussed in Chapter 13, since reviving active double cropping within these specific low-lying tracts simultaneously serves agricultural production objectives and the water-retention and flood-mitigation objectives examined in that chapter's discussion of the 2018 floods, illustrating a rare instance within this report's evidence base of a single, comparatively modest budgetary allocation, ₹50 lakh, addressing both an agricultural productivity objective and an environmental resilience objective simultaneously.

Beyond the Kole-specific intervention discussed above, the broader irrigation water-use efficiency question for Kerala's now-dominant plantation and tree-crop agriculture, rather than for the contracting paddy sector specifically, requires a fundamentally different policy and infrastructure response than conventional canal-irrigation efficiency improvement. Soil moisture conservation techniques, including mulching and contour-bunding on Kerala's characteristically sloped midland terrain, alongside targeted supplementary irrigation during the specific pre-monsoon dry-season water-stress period documented in Chapter 10, represent the more directly relevant water-management interventions for rubber, coconut and spice cultivation than the canal-irrigation-intensity metrics that dominate water-use efficiency assessment in India's major grain-producing states. The Agriculture Department's Agro-Ecological Unit framework, discussed in section 18.1, provides the institutional vehicle through which such crop-and-terrain-specific water management guidance could in principle be delivered systematically to Kerala's smallholder plantation-crop farmers, though the available sources reviewed for this chapter do not confirm the extent to which this framework has yet been operationalised specifically around water-use efficiency guidance, as distinct

from its broader crop-selection and agronomic management mandate discussed in section 18.1.

18.3 Agricultural Marketing, Price Realisation and Farmer Income

The Kerala Agriculture Department's Value Chain Modernisation Project, launched during the 2024-25 financial year, is explicitly designed to promote resilient commercialisation of Kerala's food and agriculture sector for smallholder farmers, agri-based micro, small and medium enterprises, Farmer Producer Organisations, and agricultural startups, with the stated objective of invigorating local economic development through value addition rather than relying solely on raw or minimally processed commodity sales (Directorate of Agriculture, 2024). The project's structured components, spanning climate resilience and mitigation in agriculture, enhanced smallholder commercialisation for local economic development through value addition, a dedicated project management unit, and a Contingent Emergency Response Component specifically designed to provide rapid-response capacity in the event of agricultural emergencies (Directorate of Agriculture, 2024), directly parallel the value-chain transformation priorities this report identified in Chapter 4's discussion of rubber, seafood and coconut value addition, extending that chapter's industrial-policy framing of agricultural value chains into the Agriculture Department's own dedicated programme architecture. This convergence between the Industries Department's value-chain ambitions documented in Chapter 4 and the Agriculture Department's own Value Chain Modernisation Project documented here illustrates a genuine instance of cross-departmental policy alignment around a shared strategic objective, value addition rather than raw commodity export, that stands in useful contrast to the more frequently documented coordination weaknesses this report identified in Chapter 15.

Price realisation for Kerala's principal commercial crops, rubber, coconut, pepper and other spices, remains substantially exposed to global commodity price cycles rather than to domestically administered minimum support price mechanisms of the kind that govern price realisation for the cereal crops dominant in northern Indian agricultural states, a structural feature already noted in Chapter 3's discussion of Kerala's plantation-crop-dominated agricultural structure. Rubber prices specifically, examined in Chapter 4's discussion of the rubber value-chain transformation opportunity, have historically exhibited considerable volatility tied to global synthetic rubber substitution dynamics, automotive sector demand cycles, and the pricing decisions of major rubber-producing competitor nations including Thailand, Indonesia and Vietnam, exposing Kerala's roughly ninety per cent national share of natural rubber production to price risk that domestic policy instruments alone cannot fully insulate against. The Rubber Board of India, operating as a central government statutory body with a regional office structure substantially concentrated in Kerala given the state's dominant rubber production share, provides price stabilisation support, replanting subsidies, and market intelligence specifically calibrated to this commodity price volatility, though the scale and adequacy of this support relative to the full extent of price risk Kerala's rubber-growing households face was not assessed in comparative detail within the sources reviewed for this

chapter. Spice price realisation follows a broadly similar pattern, with Kerala's pepper, cardamom and other spice exports subject to international commodity market price determination rather than domestic price administration, reinforcing the case, examined in Chapter 4, for accelerating value-added processing as a mechanism for capturing a larger and more stable share of final product value, since processed spice products typically command considerably more stable pricing than raw, unprocessed commodity exports subject to the full volatility of global agricultural commodity markets.

18.4 Food Processing Industry and Value Chain Development

Kerala's food processing capacity, examined from an industrial policy perspective in Chapter 4's discussion of rubber, seafood and coconut value addition, finds its agricultural-sector counterpart in the smallholder commercialisation component of the Value Chain Modernisation Project discussed in section 18.3, which is specifically structured to support agri-based MSMEs and Farmer Producer Organisations in developing processing and value-addition capacity at a scale appropriate to Kerala's predominantly small-landholding agricultural structure, discussed throughout this report in connection with the cooperative dairy model examined in Chapter 12. The Department's coconut development scheme, one of the principal crop-development programmes catalogued in section 18.1, connects directly to the coconut value-chain opportunity identified in Chapter 4, where virgin coconut oil, coconut water and coir-based products were identified as carrying margins considerably above those available from raw copra or unprocessed coconut sale, and the scheme's explicit inclusion within the Department's annual planning architecture indicates institutional recognition, at the agricultural production level, of the same value-addition imperative this report has documented from the industrial and export-promotion perspective in Chapter 4.

Cold chain and post-harvest storage infrastructure represents a further specific constraint on Kerala's food processing and value-chain development potential that intersects directly with the logistics and multimodal freight infrastructure discussed in Chapter 8. Perishable agricultural and fisheries products, the seafood export trade discussed in Chapter 4 and section 18.6, and Kerala's horticultural and floricultural output discussed in section 18.7, depend on reliable cold chain infrastructure linking farm and harbour-level collection points through processing facilities to the airports and ports discussed in Chapter 8 for both domestic and export market access. The eight-track freight rail proposal's planned inland container depots and multimodal freight terminals, discussed in Chapter 8, explicitly identify seafood and agricultural produce as priority freight categories, indicating that Kerala's broader infrastructure planning, examined in that chapter, has incorporated agricultural and fisheries value-chain logistics requirements directly into its freight infrastructure design rather than treating agricultural logistics as a separate, lower-priority planning consideration. The practical adequacy of Kerala's current cold chain infrastructure, prior to the full realisation of this still partly proposed freight rail network, relative to the volume of perishable agricultural and marine product output this chapter and Chapter 4 have documented, was not separately quantified within the sources reviewed for this chapter,

representing a further specific data and capacity gap this report flags for the statistical strengthening agenda developed in Chapter 20.

18.5 Animal Husbandry, Dairy and Poultry: Economic Contribution

Kerala's dairy sector, examined in Chapter 12's discussion of the Milma cooperative model, continues to provide an important livelihood and income diversification function for the state's predominantly smallholder agricultural households, complementing the plantation and tree-crop income discussed throughout this chapter with a more regular, less seasonally concentrated cash flow than tree-crop harvests, which for crops such as rubber and coconut are typically realised over longer collection cycles rather than the daily or near-daily milk collection schedule that dairy farming provides. Poultry farming, similarly organised substantially around smallholder production integrated with cooperative or contract-based procurement arrangements, provides a further diversification option within Kerala's mixed-farming household economy, though the specific scale and growth trajectory of Kerala's poultry sector relative to other Indian states was not detailed with sufficient granularity within the sources reviewed for this chapter, representing a further specific data gap consistent with the broader pattern this report has identified across multiple sectoral chapters.

The institutional origins of Kerala's dairy cooperative model trace back to India's broader Operation Flood programme, the national dairy development initiative launched in the 1970s that transformed India from a milk-deficit nation into the world's largest milk producer through a three-tier cooperative structure subsequently adapted and implemented across multiple states, of which Kerala's Milma federation, discussed in Chapter 12, represents the state's own specific institutional implementation. Kerala's dairy sector has historically faced a structural production constraint relative to states with larger areas of pasture and fodder cultivation land, given the land scarcity documented throughout this report in Chapters 10, 11 and 18, meaning Kerala's milk production has not historically achieved full self-sufficiency relative to state-wide consumption demand, requiring continued supplementary milk and dairy product inflows from neighbouring states, a pattern broadly analogous to the cereal import dependence documented in section 18.8's discussion of Kerala's food security profile. This land-constrained dairy production ceiling means that further growth in Kerala's dairy sector is likely to depend more heavily on productivity improvement per animal, through improved breeding, feed quality and veterinary care, than on expansion of the total area devoted to fodder cultivation and pasture, a productivity-intensification rather than area-expansion growth strategy that mirrors the broader land-constrained agricultural intensification pattern this chapter has documented across Kerala's tree crop and horticultural sectors alike.

Kerala's poultry sector, while smaller in aggregate economic contribution than the dairy sector discussed above, has historically grown at a pace broadly comparable to national poultry sector growth trends, driven substantially by rising household protein consumption

associated with the income growth documented throughout Chapter 3, including the remittance-financed consumption increases discussed in that chapter. The Kerala Chicken initiative, examined in Chapter 3's discussion of Kudumbashree's allied livelihood enterprises, represents a specific institutional intervention extending the broader Kudumbashree livelihood model, already documented across Chapters 3, 6, 7 and 12, into organised poultry production and marketing, providing smallholder and landless households with a livestock-based livelihood option that requires considerably less land than either dairy farming or tree-crop cultivation, making poultry production a particularly accessible income-diversification option for Kerala's land-constrained rural households relative to the land-intensive cultivation options that dominate the rest of this chapter's discussion.

18.6 Fisheries: Inland, Marine and Aquaculture

Kerala's fisheries sector, examined extensively in Chapter 3's discussion of the primary sector's strong 2024-25 rebound, growing 10.55 per cent in real terms after the previous year's contraction, and in Chapter 4's discussion of the seafood value-chain transformation opportunity, connects directly to the Marine Products Export Development Authority registration and certification framework discussed in that chapter and to the coastal and marine resource management priorities examined in Chapter 13. The fisheries sector's distinctive vulnerability profile, spanning the coastal erosion and storm surge exposure documented in Chapter 11's treatment of traditional fisherfolk housing, the Cyclone Ockhi impact on the marine fishing community documented in Chapter 14, and the broader marine ecosystem health concerns examined in Chapter 13's coastal resource management discussion, means that fisheries sector growth in Kerala cannot be assessed purely as an agricultural productivity question but must be understood as inherently bound up with the climate vulnerability, coastal infrastructure, and marine environmental governance themes this report has documented across multiple preceding chapters. Inland aquaculture, a smaller but growing component of Kerala's overall fisheries output relative to marine capture fisheries, benefits from the state's extensive backwater and freshwater pond infrastructure discussed in Chapter 8's treatment of the backwater transport network, though the available sources reviewed for this chapter do not provide a detailed quantitative breakdown between marine and inland aquaculture contribution to the sector's overall 2024-25 growth.

Kerala's marine fisheries sector operates within a defined institutional framework spanning the state Fisheries Department, the central Marine Products Export Development Authority discussed in Chapter 4, and the traditional, community-organised fishing cooperative structures that have historically governed access to specific coastal fishing grounds across the state's traditional fisherfolk settlements. This multi-layered institutional architecture, state regulatory oversight, national export certification, and traditional community governance operating simultaneously, mirrors the broader institutional layering pattern this report has identified throughout, in Kerala's agricultural cooperative structures discussed in Chapter 12, in its decentralised panchayat governance discussed in the same chapter, and in its multi-tier industrial policy architecture discussed in Chapter 4. Sustainable harvest practices, a

precondition for maintaining the MPEDA export certification on which Kerala's seafood value-chain transformation ambitions depend, require ongoing coordination between these traditional community fishing governance structures and the more formal regulatory and export certification systems, a coordination challenge that, consistent with the broader inter-agency coordination weaknesses this report identified in Chapter 13's discussion of mining enforcement and Chapter 15's discussion of administrative governance, has not been comprehensively assessed within the sources available for this chapter, representing a further specific area where dedicated institutional research would strengthen this report's otherwise favourable assessment of Kerala's fisheries sector trajectory.

18.7 Horticulture, Floriculture and Medicinal Plants

The Kerala Agriculture Department's crop-development scheme architecture, discussed in section 18.1, explicitly groups the development of fruits, flowers and medicinal plants together as a single integrated programme category, reflecting both the comparatively smaller individual scale of each of these three sub-sectors relative to the dominant coconut, rubber and rice categories, and a shared institutional logic in which horticultural diversification, floriculture for both domestic ornamental markets and export, and medicinal plant cultivation are together positioned as complementary income-diversification opportunities for Kerala's smallholder farming households rather than as separate, independently administered agricultural sub-sectors (Directorate of Agriculture, 2024). Kerala's medicinal plant cultivation carries particular significance given the state's well-established Ayurvedic medicine tradition, examined further in Chapter 19's treatment of wellness tourism, where Kerala's distinctive position as a global centre for authentic Ayurvedic treatment depends directly on a reliable, high-quality domestic supply chain for the medicinal plant raw materials that Ayurvedic formulations require, connecting this section's agricultural diversification discussion directly to the wellness tourism economic driver examined in that later chapter.

Kerala's Ayurvedic medicine and wellness industry represents a globally distinctive economic sector built substantially on the state's traditional medicinal plant cultivation knowledge, with Kerala recognised internationally as a centre of authentic Ayurvedic practice in a manner few other Indian states or global destinations can credibly claim, given the depth of institutional and practitioner knowledge accumulated across generations of Kerala's traditional Ayurvedic medical lineages. This wellness industry's continued growth, examined further in Chapter 19's treatment of tourism, depends on a reliable domestic supply chain for specific medicinal plant species, many of which require particular soil, altitude and microclimate conditions found specifically within Kerala's Western Ghats foothill and midland zones, the same ecologically significant terrain examined extensively in Chapter 13's discussion of forest cover and biodiversity. This creates a direct, currently underexamined linkage between the medicinal plant cultivation programming discussed in this section and the conservation and biodiversity priorities examined in Chapter 13, since sustainable, conservation-compatible cultivation of medicinal plant species within or adjacent to ecologically sensitive zones

requires careful agronomic management to avoid the kind of habitat degradation associated with less ecologically sensitive forms of agricultural expansion documented elsewhere in this report, particularly the plantation forestry and quarrying pressures examined in Chapter 13.

18.8 Agricultural Credit, Insurance and Risk Management

Kerala's agricultural risk profile is explicitly characterised in the academic risk and insurance literature as diverse and comparatively elevated relative to many other Indian agricultural regions, a consequence of the state's particular agro-climatic and geographic peculiarities combined with the increasing production instability associated with shifting climatic patterns, with insurance interventions identified as the principal risk-mitigation tool currently available to support Kerala's rural farming population against these compounding vulnerabilities (ResearchGate, 2024). Kerala's State Crop Insurance Policy, administered through the Department of Agriculture Development and Farmers' Welfare, extends coverage to 27 major crops across the state, including specific compensation provisions for crop loss due to pest and disease attack in rice, with applications submitted individually by farmers through the dedicated AIMS portal (Directorate of Agriculture, 2025). This state-administered scheme operates alongside the national Pradhan Mantri Fasal Bima Yojana, with the Union and State governments jointly bearing seventy-five per cent of the insurance premium for paddy farmers and fifty per cent of the premium for other covered crops, and with coverage extending specifically to tapioca and banana crop losses from pest attack and natural calamities across all districts, second-crop punja paddy in Alappuzha, Pathanamthitta and Kottayam, second and third crop paddy across eleven named districts, sugarcane in Idukki and Palakkad, cashew across five Malabar-region districts, and mango in Palakkad (AgriInsurance, 2024).

A significant recent extension of this insurance architecture specifically addresses the plantation crops that this chapter has identified as structurally central to Kerala's agricultural economy: weather-based crop insurance has been extended specifically to rubber and coconut, a development Kerala farmers have welcomed while simultaneously calling for further expansion of coverage scope, with the extended scheme covering crop damage attributable to climate change, including yield reductions caused by weather conditions even where the crop is not entirely destroyed, complementing the more conventional total-loss-triggered compensation that has historically characterised Indian crop insurance design (The South First, 2023). Kerala's state government insurance specifically covers crops completely damaged under extremely severe weather conditions, while the central scheme's expanded coverage addresses the more gradual, partial-yield-reduction losses associated with climate variability that a total-loss-only insurance design would not capture (Ashok, as cited in The South First, 2023). Notably, while small grains and legumes have technically been included within this insurance coverage architecture, Agricultural Department sources indicate that very few Kerala farmers actually cultivate these crops, since the state remains structurally dependent on other states for its cereal and pulse supply, a finding directly consistent with the food security vulnerability this report identified in Chapter 3's discussion

of Kerala's plantation-crop-dominated agricultural structure and the state's resulting reliance on inter-state cereal inflows to meet domestic food consumption needs (The South First, 2023).

The broader insurance penetration question this report raised in Chapter 14's discussion of post-disaster recovery financing applies directly to the agricultural risk management context examined in this section: notwithstanding the genuinely comprehensive crop coverage architecture documented above, spanning 27 major crops under the state scheme alongside the national PMFBY framework's premium subsidy structure, the actual farmer enrolment rate within this insurance architecture, as distinct from the formal availability of coverage, was not separately quantified within the sources reviewed for this chapter. This distinction between coverage availability and actual enrolment matters considerably for assessing the real-world risk protection Kerala's smallholder farming households experience, since insurance schemes with comprehensive formal coverage architecture but low actual farmer enrolment, whether due to premium affordability constraints even after the seventy-five and fifty per cent government premium subsidies, administrative complexity in the AIMS portal application process, or simple lack of awareness among Kerala's more remote and economically disadvantaged farming households, would deliver considerably less effective risk protection than the formal scheme design alone would suggest. Given the elevated agricultural risk profile this section's academic source material explicitly identifies as characteristic of Kerala's agro-climatic and geographic circumstances, closing this potential gap between formal insurance coverage availability and actual farmer enrolment represents a priority area this report identifies for further investigation, connecting directly to the broader pattern of formally well-designed policy architecture facing implementation and uptake gaps that this report has documented repeatedly across Chapters 13, 15 and now 18.

The cumulative evidence assembled across this chapter demonstrates that Kerala's agricultural policy architecture has been deliberately adapted to the state's distinctive plantation-crop-dominated, climate-exposed agricultural structure, rather than applying a generic national agricultural policy template calibrated to the cereal-intensive farming systems that dominate most of India's major agricultural states. The weather-based rubber and coconut insurance extension, the Kole wetland double-cropping revival, the integrated horticulture-floriculture-medicinal plant programming, and the Value Chain Modernisation Project's smallholder commercialisation focus together constitute a coherent, structurally adapted agricultural policy framework that, while facing the same persistent food security dependency and climate vulnerability challenges this report has documented throughout Chapters 3, 10, 13 and 14, nonetheless demonstrates a genuine institutional capacity for designing agricultural policy instruments specifically calibrated to Kerala's actual cropping reality rather than to a generic, nationally uniform agricultural policy model, a finding that connects this chapter's agricultural assessment to the broader pattern of context-sensitive institutional adaptation this report has identified as one of Kerala's recurring governance strengths.

Drawing these findings together with the broader food security and economic context examined throughout this report, Kerala's agricultural sector occupies a distinctive structural position within both the state's own economy and within India's broader agricultural landscape: a comparatively small contributor to overall GSDP, documented in Chapter 3 at roughly 8 per cent of real GSVA, yet one whose specific crops, rubber, pepper, natural rubber and coconut, carry outsized national and even global significance given Kerala's dominant production share in each. This combination of modest aggregate economic weight alongside concentrated commodity-specific significance means that agricultural policy success in Kerala should be measured less by conventional metrics such as overall sectoral GSDP growth, which this chapter's evidence suggests is structurally capped by the state's limited cultivable land area, and more by the value-addition, climate resilience, and farmer income stability metrics this chapter has examined throughout, the rubber and coconut weather-based insurance extension, the Value Chain Modernisation Project's smallholder commercialisation focus, and the Kole wetland double-cropping revival among them. This reframing of agricultural policy success criteria, from aggregate sectoral growth towards value-addition and resilience-focused metrics, represents this chapter's central analytical contribution to the report's broader Vision 2047 roadmap developed in Chapter 21, and is consistent with the value-chain transformation framing already established in Chapter 4's treatment of Kerala's rubber, seafood and coconut export ambitions.

Chapter 19: Tourism, Culture and Creative Economy

19.1 Tourism Asset Inventory: Natural, Heritage, Religious and Adventure

Kerala's tourism asset base, marketed internationally under the "God's Own Country" slogan adopted in the 1990s, spans backwaters, hill stations, beaches, wildlife sanctuaries and a dense concentration of heritage and religious sites, with destination anchors including the Alappuzha and Kumarakom backwater houseboat circuit, the Munnar tea plantation hill station, the Kovalam and Varkala beach destinations, the Periyar National Park wildlife reserve, and Kochi's colonial heritage precinct discussed in Chapter 11 (Connolly Cove, 2025; IBEF, 2025). The Western Ghats biodiversity hotspot examined extensively in Chapter 13 provides the ecological foundation for Kerala's wildlife and adventure tourism segment, with the Wayanad Wildlife Sanctuary alone drawing more than 344,000 annual visitors for jeep safaris and nature camps prior to the July 2024 landslide disruption discussed in Chapter 14, supporting habitats hosting over 200 bird species and mammals including bison, while the Eravikulam National Park's population of 1,365 Nilgiri tahr, as recorded in the 2025 census, anchors Kerala's distinctive endemic-species wildlife tourism offering (Grokikipedia, 2026). Kerala's tourism strategy has deliberately expanded beyond these established anchor destinations through a "destination circuits" approach, coordinated travel routes linking natural attractions, heritage sites, hill stations, backwaters and cultural hubs specifically designed to de-congest overcrowded hotspots by distributing visitor flow more evenly across the state rather than concentrating tourism pressure within a small number of already-saturated locations (Travel and Tour World, 2026).

Religious tourism constitutes a further substantial and historically under-emphasised component of Kerala's tourism asset base, reflecting the religious plurality documented extensively in Chapter 1: the Sabarimala Ayyappa Temple draws millions of pilgrims annually during its primary pilgrimage season, representing one of the largest annual pilgrimage gatherings in India, while Thiruvananthapuram's Padmanabhaswamy Temple, Guruvayur's Krishna temple in Thrissur district, and numerous Christian pilgrimage sites including the Malayattoor church associated with the apostle Thomas tradition, alongside significant mosque and dargah pilgrimage destinations, together constitute a religious tourism circuit whose scale, in terms of total annual visitor numbers, plausibly rivals or exceeds the more internationally marketed backwater and hill-station tourism segments discussed throughout this section, even though religious tourism receives comparatively less emphasis within Kerala's international tourism marketing materials relative to its likely actual visitor volume. This asymmetry between religious tourism's probable scale and its comparatively modest position within Kerala's international marketing strategy represents a further specific area where this report's evidence base remains incomplete, since the sources reviewed for this chapter did not provide a quantified, disaggregated estimate of religious tourism's contribution to Kerala's overall visitor numbers and tourism revenue relative to the more thoroughly documented natural-heritage and wellness tourism segments examined throughout the remainder of this chapter.

19.2 Tourism Infrastructure: Hotels, Connectivity and Facilitation

Kerala's tourism infrastructure benefits directly from the aviation network examined in Chapter 8, with four operational international airports providing visitor access well beyond what a state of Kerala's size would typically support, and the planned fifth airport at Kottayam extending this connectivity further into central Kerala's tourism circuit. The 2025-26 state budget introduced the K-Homes project, specifically designed to increase accommodation availability by leveraging unoccupied homes near major tourist destinations including Kovalam, Kumarakom, Munnar and Fort Kochi, supported by dedicated online booking infrastructure to streamline reservations for these home-stay arrangements (Kerala Tourism Newsletter, 2025). This home-stay accommodation model directly extends the in-situ, community-embedded development approach this report has identified throughout multiple chapters, including the housing and urban development discussion in Chapter 11, rather than relying solely on conventional hotel construction, which would compete for the same scarce land resources this report has documented as a persistent constraint across Kerala's infrastructure landscape. Cruise tourism represents an emerging infrastructure category directly connected to the Vizhinjam International Seaport discussed extensively in Chapter 8: the port's partial operations, commenced in late 2023, had accommodated more than 20 vessels carrying over 3,350 passengers by March 2024, supported by a dedicated terminal capable of handling ships carrying up to 1,000 passengers, with projections anticipating 50,000 annual cruise tourists by 2028, contingent on global shipping trends and the development of ancillary inland excursion services (Grokikipedia, 2026).

Kerala's accommodation sector spans a wide quality and price spectrum, from internationally branded five-star resort properties concentrated in the major tourism circuits discussed in section 19.1, through the heritage and boutique hotel segment particularly prominent in Fort Kochi's adaptively reused colonial-era buildings discussed in Chapter 11, to the homestay and budget accommodation segment that the K-Homes initiative discussed above is specifically designed to expand. This accommodation diversity is significant for the destination-circuit diversification strategy discussed in section 19.1, since extending tourism benefit into less established destinations requires a correspondingly diverse accommodation base capable of serving visitors with varying budget levels and experience preferences, rather than relying solely on the high-end resort model that dominates Kerala's most internationally marketed destinations. The connectivity infrastructure underpinning this accommodation diversification, the road network discussed in Chapter 8, the proposed Coastal Highway specifically designed to improve access along Kerala's full coastal tourism corridor, and the planned Kottayam international airport extending aviation access to central Kerala's tourism circuit, together represent a coordinated infrastructure investment programme directly supporting the tourism sector's stated diversification ambitions, illustrating a further instance of the cross-sectoral infrastructure alignment this report has identified at several points throughout preceding chapters.

Tourism facilitation infrastructure extends beyond physical accommodation and connectivity into the digital and visitor-information domain examined in Chapter 16's broader discussion of citizen and visitor-facing digital services, with Kerala's tourism authorities maintaining a dedicated digital travel hub platform offering detailed information on destinations, activities, accommodations and local experiences, intended to function as a comprehensive one-stop resource for trip planning regardless of whether the prospective visitor is seeking adventure tourism, cultural experiences, or relaxation-focused travel (Connolly Cove, 2025). This digital facilitation layer mirrors the broader e-governance and citizen service delivery infrastructure documented throughout Chapter 16, extending Kerala's demonstrated institutional capacity for digital public service delivery into the visitor-facing tourism domain specifically, even though the precise integration, if any, between this tourism-specific digital platform and the broader KFON and e-governance infrastructure discussed in Chapter 16 was not detailed within the sources reviewed for this chapter.

19.3 Domestic and International Tourist Flows: Trends and Targets

Kerala's tourism sector recorded an unprecedented 2,58,80,365 total arrivals in 2025, the highest figure since the state's formation, representing an increase of 28,95,002 visitors over 2024, itself a record year that attracted 2,22,46,989 tourists, a 21 per cent increase over pre-pandemic levels (TMV, 2026; Kerala Tourism Newsletter, 2025). Of the 2025 total, approximately seventy per cent were domestic tourists and roughly thirty per cent international visitors, with domestic arrivals rising 12.64 per cent year-on-year and standing 36.03 per cent above pre-Covid levels (TMV, 2026). District-level domestic visitor distribution reveals a striking pattern: Idukki led all districts with 46,79,800 domestic tourists, followed by Ernakulam (44,29,899), Thiruvananthapuram (43,75,846) and Thrissur (31,24,696) (TMV, 2026), with Idukki's leading position reflecting the continued strong draw of Munnar and the broader hill-station and wildlife tourism segment discussed in section 19.1, notwithstanding that district's status, documented in Chapter 14, as one of Kerala's nine highest climate-vulnerability districts and a site of documented landslide and quarrying risk examined in Chapter 13. North Kerala's tourism contribution has grown steadily from a historical baseline of just six per cent of the state's total tourism activity, according to the state's Tourism Minister, reflecting deliberate destination-circuit diversification efforts discussed in section 19.1 extending tourism benefit beyond the traditionally dominant southern and central Kerala corridor (TMV, 2026).

This North Kerala diversification finding carries direct relevance for the intra-state disparity analysis developed in Chapter 1, since the Malabar region districts historically lagging the erstwhile Travancore-Cochin core on social development indicators, discussed in that chapter, stand to benefit economically from the tourism revenue and employment diversification this section documents, provided the destination-circuit infrastructure investment discussed in section 19.2 is genuinely extended to these districts rather than remaining concentrated within the already well-established southern and central tourism corridor. Kasaragod and Kannur, both identified in Chapter 14 among Kerala's high climate-vulnerability districts, illustrate the

same dual-edged pattern this report has documented throughout Chapter 19's broader sustainability discussion: tourism growth in these northern districts offers a genuine economic diversification opportunity, but one that, absent the kind of careful environmental and construction-licensing oversight this chapter has shown to be inconsistently applied in Wayanad, risks replicating the same ecological and regulatory compliance failures already documented in Kerala's more established tourism destinations.

International arrivals tell a more complicated recovery story than the domestic figures: Kerala welcomed approximately 1.2 million international tourists in 2019, a figure that collapsed during the pandemic and had recovered to only 650,000 by 2023, less than 55 per cent of the pre-pandemic baseline, even as domestic tourism not only recovered but substantially exceeded pre-pandemic levels over the same period (TTG Asia, 2025). This divergence between domestic recovery, which exceeded the pre-pandemic baseline, and international recovery, which remained well below it, reflects the differential impact of pandemic-era international travel restrictions and the subsequent, more gradual restoration of international flight connectivity relative to the comparatively faster recovery of India's domestic travel market. The United Kingdom remains Kerala's leading source market for foreign tourist arrivals, with the United States ranking second, contributing 13.33 per cent of total foreign arrivals, and the top eleven source countries together accounting for approximately 69.13 per cent of total foreign tourist visits in 2024 (Curly Tales, 2025). Kerala's tourism authorities have responded to the international arrivals gap with deliberate market diversification, actively courting visitors from Russia, Uzbekistan, Belarus, Kazakhstan, Norway and Denmark as new source markets, alongside expanded helicopter, adventure and caravan tourism segments developed through public-private partnerships, including heliport establishment in key destinations and dedicated caravan parks in Palakkad and Munnar (Curly Tales, 2025; TTG Asia, 2025).

Kerala's tourism arrivals figures, when placed within the broader national context, position the state among India's leading tourism destinations by volume, though precise comparative ranking against other major Indian tourism states, Rajasthan, Goa, Tamil Nadu and Himachal Pradesh among the most significant comparators, was not available with sufficient currency within the sources reviewed for this chapter. Seasonal concentration represents a further structural feature of Kerala's tourist flow pattern: the state's tourism marketing strategy explicitly seeks to address the historical concentration of visitor arrivals within Kerala's cooler, drier winter season by promoting monsoon tourism, wellness retreats, and extended-stay options designed to generate visitor demand across a fuller annual cycle rather than concentrating tourism revenue, employment and environmental pressure within a narrow seasonal window, an objective directly relevant to managing the carrying-capacity concerns documented in section 19.6, since spreading visitor flow across a longer annual period reduces peak-period pressure on ecologically sensitive sites such as Vembanad Lake and the Wayanad hill region even where total annual visitor numbers continue to grow.

19.4 Cultural Heritage Preservation and Institutional Framework

Kerala's cultural heritage preservation framework, examined from an urban-development perspective in Chapter 11's discussion of Fort Kochi and the Kochi-Muziris Biennale, extends through the state's broader event and festival calendar into a deliberate cultural tourism strategy. The Kochi-Muziris Biennale's most recent edition, scheduled from 12 December through 31 March 2026, continues to function as India's most significant new-age art event, leveraging the adaptive heritage reuse model discussed in Chapter 11 to draw both domestic and international cultural tourism audiences (Curly Tales, 2025). The Champions Boat League, an ongoing competitive event centred in Alappuzha, extends Kerala's traditional snake-boat racing heritage, examined in connection with the backwater ecosystem discussed in Chapter 8 and Chapter 13, into a structured, internationally promotable sporting and cultural attraction, while Yaanam 2025, billed as India's first travel literary festival, held at Ranga Kala Kendram in Varkala from 17 through 19 October 2025, illustrates a further dimension of Kerala's cultural tourism diversification strategy extending beyond conventional heritage-site visitation into literary and creative-industry programming (Curly Tales, 2025).

These cultural and event-based tourism initiatives carry an institutional advantage relative to the more capital-intensive heritage-site preservation discussed elsewhere in this section: events such as the Biennale, the Champions Boat League and Yaanam operate on substantially lower capital cost bases than physical heritage conservation infrastructure, since they leverage existing built and natural environments, Fort Kochi's already-adapted heritage warehouses, Alappuzha's existing backwater geography, and Varkala's existing cultural venue, rather than requiring the kind of sustained, large-scale capital investment that systematic heritage building conservation across Kerala's full inventory of historically significant structures would demand. This lower capital intensity makes event-based cultural tourism programming a particularly cost-effective strategy for a Tourism Department operating, as documented above, with a comparatively modest annual budget, allowing Kerala to generate substantial cultural tourism visibility and revenue through a relatively small number of well-curated flagship events rather than requiring proportionately larger capital investment across the full breadth of the state's heritage asset inventory, even though this event-centred approach, by its nature, leaves the broader, more diffuse heritage conservation challenge, the maintenance and preservation of Kerala's full inventory of historic temples, churches, mosques and traditional tharavadu residences beyond the small number of flagship event venues, comparatively under-addressed relative to the more concentrated investment these flagship cultural events receive. Kerala's Tourism Department's institutional budget for these cultural and heritage tourism programmes, channelled substantially through the Kerala Tourism Development Corporation's management of hotels, restaurants and transport services, has historically operated at a comparatively modest scale, with total tourism outlays running around ₹40 to 50 crore annually in recent years, a budget scale that independent assessment characterises as constraining the sector's institutional efficacy relative to the scale of need across Kerala's tourism infrastructure and heritage preservation requirements (Grokikipedia, 2026).

This modest tourism budget scale, ₹40 to 50 crore annually, stands in striking contrast to the scale of revenue the tourism sector generates for the state economy, with the wellness and Ayurveda segment alone earning approximately ₹13,500 crore in 2024 as documented in section 19.6, and the broader tourism sector's contribution to Kerala's overall GSDP, examined in Chapter 3's discussion of the tertiary sector's dominant economic role, running to a multiple of the Tourism Department's own direct budgetary allocation. This disproportion between tourism's revenue-generation scale and its direct public investment allocation is consistent with the broader capital expenditure constraint this report has documented throughout Chapter 2, where the state's narrow fiscal margin for discretionary and developmental spending was shown to fall disproportionately on capital and infrastructure investment relative to committed expenditure. The practical consequence for tourism specifically, illustrated by the heritage preservation and Kerala Tourism Development Corporation hotel-management funding constraints discussed above, is that Kerala's tourism sector has historically grown substantially through private investment and informal, community-led initiatives such as the homestay and Responsible Tourism models discussed in sections 19.2 and 19.5, rather than through large-scale direct public capital investment of the kind examined in this report's infrastructure chapters, a funding pattern that may partly explain the regulatory enforcement gaps documented in section 19.6, since a tourism sector growing substantially through dispersed private investment, rather than centrally planned public development, is correspondingly harder for state regulatory authorities to monitor and bring into consistent compliance.

19.5 Creative Industries: Handicrafts, Performing Arts and Cultural Economy

Kerala's cultural heritage extends into a substantial living creative economy spanning traditional dance forms including Kathakali, distinctive festivals such as Thrissur Pooram, handicrafts, and the coir and traditional craft manufacturing sector discussed in Chapter 3, which together provide Kerala with what tourism economists characterise as a comprehensive cultural heritage proposition combining traditional dance forms, festivals, handicrafts, traditional arts and unique culinary experiences (IBEF, 2025). Kerala's Responsible Tourism mission, discussed further in section 19.6's treatment of sustainability tensions, has achieved particular global recognition specifically for its integration of creative-economy and craft-based livelihood generation with tourism revenue, operating more than 26,000 units that collectively benefit 1.5 lakh families, with approximately 80 per cent of these units women-led, directly extending the Kudumbashree livelihood model documented throughout Chapters 3, 6, 7, 12 and 18 into the tourism and creative-economy sector specifically (TMV, 2026). This women-led, locally embedded craft and creative-economy tourism model aligns explicitly with international gender-inclusive development goals and represents, in this report's assessment, one of the more globally distinctive applications of Kerala's broader decentralised, community-embedded delivery architecture, extending a model this report has documented across health, nutrition, livelihood and welfare domains into the tourism sector with comparable institutional depth.

Kerala's Malayalam-language film industry, one of India's most critically acclaimed regional cinema traditions, contributes a further significant dimension to the state's creative economy that connects directly to the tourism sector examined throughout this chapter, since film tourism, visitors travelling specifically to locations featured in popular Malayalam cinema, has grown into a recognised niche tourism segment building on Kerala's natural scenic backdrop already marketed extensively through the destination assets discussed in section 19.1. Kerala's film industry has historically operated with a distinctive aesthetic and narrative tradition that has earned it disproportionate critical recognition relative to its budget scale compared with India's larger Hindi-language film industry, producing internationally recognised auteur directors and award-winning films that have screened at major international film festivals, building a form of cultural soft power for Kerala that extends the state's international visibility well beyond what its tourism marketing budget alone, discussed in section 19.4, could achieve independently. The state's broader media and content industry, including its television and digital streaming content production base, has similarly expanded considerably in recent years, paralleling the broader digital infrastructure and creative technology growth documented in Chapters 4, 16 and 17, with Kerala-based content increasingly distributed through national and international streaming platforms rather than solely through traditional regional television and theatrical release channels.

19.6 Film, Media and Content Industries as Economic Drivers

Kerala's wellness and medical tourism segment, building directly on the medicinal plant cultivation and Ayurvedic medicine tradition discussed in Chapter 18, has emerged as a particularly high-value tourism category: the wellness and Ayurveda segment specifically earned approximately ₹13,500 crore in 2024, attracting international travellers seeking holistic healing experiences from source markets including Oman and the Maldives (TMV, 2026). Kerala's 2026-27 tourism strategy explicitly prioritises further development of medical tourism and wellness travel as a high-value segment, aligning with national-level support for medical tourism hubs, including federal scheme proposals in the 2026-27 Union budget to support state-level medical tourism hub development in partnership with private sector players, and benefiting from visa facilitation reforms in India's 2025 budget that expanded e-medical visa eligibility to six months alongside a dedicated AYUSH visa category specifically for wellness treatment travellers (Grokikipedia, 2026; Travel and Tour World, 2026). This combination of traditional healing system depth, scenic natural surroundings, and increasingly supportive national visa policy positions Kerala favourably within the rapidly growing international wellness tourism market, a positioning this report's evidence suggests is genuinely differentiated rather than merely promotional, given the medicinal plant supply-chain depth documented in Chapter 18 and the practitioner knowledge tradition underlying Kerala's Ayurvedic reputation.

The sustainability tension this chapter has flagged throughout, between tourism growth ambition and ecological carrying capacity, finds its starkest expression in Kerala's backwater houseboat sector, examined from an environmental perspective in Chapter 13: in 2025, 926

houseboats operated on Vembanad Lake alone, surpassing the lake's recreational carrying capacity by approximately 200 per cent, with this overcapacity generating roughly 1,600 tonnes of food waste and 410 tonnes of plastic waste annually, alongside 846 kilolitres of daily sewage discharge that fosters eutrophication through nutrient overloading, triggering algal blooms and diminishing aquatic biodiversity (Grokikipedia, 2026). This finding directly corroborates and extends the wetland and water-body degradation concerns this report documented in Chapter 13's treatment of river ecosystem health, demonstrating that tourism activity itself, rather than only the agricultural, industrial and urban pollution sources examined in that chapter, constitutes a significant and currently under-managed contributor to Kerala's backwater ecological stress. High visitor density in ecologically sensitive hill regions, particularly Wayanad, has similarly eroded trails and destabilised slopes, a finding independent assessment explicitly links to the severity of the July 2024 landslides examined extensively in Chapter 14, with tourism-driven resort and access-infrastructure development identified as having fragmented habitats and heightened vulnerability to monsoon-induced erosion in already steep, ecologically fragile terrain (Grokikipedia, 2026). This finding adds tourism development to the list of contributing factors this report has documented in connection with the 2024 Wayanad landslide, alongside the illegal mining and ESA-zone quarrying activity discussed in Chapter 13, reinforcing the multi-causal, cumulative pattern of land-use pressure this report has identified as characteristic of Kerala's most environmentally stressed districts.

A specific governance failure documented within this same sustainability assessment compounds these ecological concerns: a government study found that nearly half of all tourism-related construction in Wayanad lacked proper licensing and environmental clearance, raising direct safety and sustainability concerns that connect this chapter's tourism infrastructure discussion to the regulatory enforcement weaknesses this report identified throughout Chapter 13 and Chapter 15 (TMV, 2026). This finding is among the most concrete and consequential illustrations in this entire report of the recurring pattern this report has documented across multiple chapters, formally well-designed regulatory frameworks, in this instance Kerala's tourism construction licensing and environmental clearance requirements, facing substantial, documented non-compliance precisely in the district facing the highest combined climate, landslide and ecological vulnerability examined throughout Chapters 13 and 14.

The Vembanad Lake houseboat overcapacity crisis documented above warrants particular attention as a case study in the specific institutional dynamics that allow such regulatory gaps to persist despite their well-documented and quantified environmental consequences. Houseboat licensing in Kerala falls under a combination of state Tourism Department, Inland Navigation, and local self-government body jurisdiction, a multi-agency regulatory structure that, consistent with the cross-departmental coordination weaknesses this report identified as a central, recurring institutional finding throughout Chapter 15, creates exactly the kind of diffuse accountability structure within which a 200 per cent carrying-capacity overshoot can develop and persist without any single agency bearing clear, sole responsibility for

enforcement. The economic incentive structure compounds this regulatory fragmentation: houseboat tourism generates substantial direct revenue for vessel operators and the local hospitality and food-supply businesses that service the houseboat trade, creating a powerful constituency with strong economic incentive to resist capacity restrictions, even as the environmental degradation this continued expansion generates threatens the long-term ecological integrity of Vembanad Lake itself, the very natural asset on which the houseboat tourism segment's continued commercial viability ultimately depends. This tension, between short-term operator revenue incentives and long-term ecological asset preservation, mirrors precisely the construction-industry-versus-Western-Ghats-conservation tension this report documented extensively in Chapter 13's treatment of the sand-mining-to-quarrying regulatory displacement, reinforcing this report's broader finding that Kerala's environmental governance challenges, across mining, tourism and water-body management alike, share a common underlying political-economy structure that piecemeal, sector-specific regulation has so far proven insufficient to resolve durably.

Adventure tourism safety represents a further, more acute manifestation of this same enforcement gap: a fatal ride-malfunction incident at an adventure tourism site on 1 July 2025 prompted temporary operational halts and new compliance mandates under Kerala's tourism regulations, highlighting persistent risks from substandard equipment maintenance and operator training deficiencies that independent assessment characterises as prevalent across India's broader adventure tourism sector, not Kerala's specifically, even though the specific incident occurred within Kerala's jurisdiction (Groklopedia, 2026).

Kerala's policy response to these documented sustainability and safety failures, articulated through the state's most recent tourism strategy, explicitly frames a decisive departure from traditional mass-tourism models that prioritise visitor volume over value, instead targeting long-term economic sustainability, ecological balance and cultural preservation through a holistic development approach combining infrastructure strengthening, medical and wellness travel elevation, expanded eco-tourism, and the destination-circuit diversification strategy discussed in section 19.1 (Travel and Tour World, 2026). Whether this stated strategic reorientation, from volume-maximisation towards value-and-sustainability-maximisation, will succeed in resolving the specific, documented failures this section has catalogued, the Vembanad houseboat overcapacity, the Wayanad construction licensing non-compliance, and the adventure tourism safety enforcement gap, represents, on the evidence available to this report, a critical test of whether Kerala's tourism governance can match the institutional rigour this report has documented in other domains, including the health and welfare delivery architecture examined in Chapters 6 and 7, or whether tourism will instead continue to exhibit the pattern of strong policy design alongside weak enforcement consistency that this report has identified as a persistent institutional vulnerability across Chapters 13, 15 and now 19. This finding carries direct relevance for the State Vision 2047 roadmap developed in Chapter 21, where tourism sustainability governance, rather than tourism growth promotion alone, should be treated as a co-equal policy priority given the demonstrated, material

connection this chapter has documented between unmanaged tourism growth and the climate, landslide and ecological vulnerabilities examined throughout Chapters 13 and 14.

This chapter's findings, taken together with the recurring institutional pattern this report has now documented across mining, solid waste, climate adaptation and tourism alike, in Chapters 13, 14, and now 19, suggest that Kerala's environmental and resource governance challenge extends well beyond any single sector and instead reflects a systemic capacity gap in cross-departmental enforcement coordination that the administrative governance reforms proposed in Chapter 15 are specifically designed to address.

Chapter 20: Cross-Cutting Themes and Integrated Policy Imperatives

20.1 Sustainable Development Goals of the State

Kerala's overall development performance receives its clearest, most authoritative external validation through NITI Aayog's SDG India Index, the country's principal tool for measuring national and sub-national progress against the United Nations Sustainable Development Goals across 113 indicators spanning 16 of the 17 SDGs. In the 2023-24 edition, the fourth released since the index's 2018 launch, Kerala emerged jointly with Uttarakhand as India's top-performing state, both recording a composite score of 79 out of 100, while Bihar recorded the lowest national score at 57, followed by Jharkhand at 62 (NITI Aayog, 2024; Drishti IAS, 2024). This top ranking is not a new or isolated achievement: Kerala has consistently led or near-led this index since its inception, a sustained performance that corroborates, through an independent, methodologically standardised national measurement framework, the sector-by-sector findings this report has assembled across the preceding nineteen chapters. India's own overall SDG composite score rose to 71 in 2023-24, a five-point increase from 66 in 2020-21 and fourteen points above the 2018 baseline, with thirty-two of India's thirty-six states and union territories now classified in the Front Runner category, scoring between 65 and 99 (GFST, 2025; Lukmaan IAS, 2024). Within this broadly improving national context, Kerala's position at the very top of the index, alongside Uttarakhand, Tamil Nadu at 78, Goa at 77 and Himachal Pradesh at 77, confirms that Kerala's lead over the national average, while narrowing somewhat as other states improve, remains genuine and substantial (GFST, 2025).

The specific goal-level detail underlying this composite score offers a useful synthesis lens for the sectoral findings developed throughout this report. India's national trajectory projects three goals, SDG 7 on affordable and clean energy, SDG 11 on sustainable cities and communities, and SDG 12 on sustainable consumption and production, as achievable nationally by 2025-26, with SDG 3 on good health and well-being targeted for 2026-27 and SDG 2 on no poverty and SDG 5 on zero hunger targeted for 2027-28, while SDG 5 on gender equality is projected only for 2030-31, and eight SDGs nationally remain unlikely to be achieved by 2030 absent significantly accelerated effort (GFST, 2025). Mapped against this report's own chapter-by-chapter findings, Kerala's performance on the health-related SDG 3 target is corroborated directly by the maternal and child health achievements documented in Chapter 6, where Kerala was shown to have already met 2030 global targets for neonatal, infant and maternal mortality years ahead of the national 2026-27 projected achievement date. Kerala's performance on SDG 7, energy, is more equivocal given the roughly seventy per cent power import dependence documented in Chapter 9, even as the state's renewable generation mix and ambitious 2040 full-renewable target suggest a trajectory consistent with eventual national-level achievement. SDG 5, gender equality, is the goal where this report's own evidence base most directly corroborates the national index's comparatively pessimistic 2030-31 timeline: the severe youth gender employment gap documented in Chapter 3 and Chapter 7, where young women's unemployment reached 47.1

per cent against 19.3 per cent for young men, stands as a stark illustration of why gender equality remains, even in India's top-ranked SDG performer state, the most distant of the major goals from full achievement.

Government interventions cited in the national SDG India Index assessment as drivers of overall national progress, the Pradhan Mantri Awas Yojana's more than four crore houses built nationally, the Swachh Bharat Mission's eleven crore toilets and 2.23 lakh community sanitary complexes, the Ujjwala Yojana's ten crore LPG connections, the Jal Jeevan Mission's tap water connections to over 14.9 crore households, and Ayushman Bharat-PMJAY's more than thirty crore beneficiaries (NITI Aayog, 2024; Lukmaan IAS, 2024), each have direct Kerala-specific counterparts examined throughout this report: the LIFE Mission and PMAY-Gramin coordination discussed in Chapter 11 and Chapter 12, the ODF Plus sanitation transition discussed in Chapter 10, and the KASP-PMJAY convergence model discussed in Chapter 6. Kerala's consistently strong SDG performance, this report's evidence suggests, reflects not merely passive benefit from these national schemes but the same active, state-specific adaptation and integration this report has documented repeatedly, layering state programmes onto national frameworks through the decentralised, panchayat-engaged delivery architecture examined throughout Chapters 6, 7, 10, 11 and 12, rather than simply implementing national schemes as designed without local customisation.

Kerala's lead over the next-ranked states, narrowing from a historically wider gap to the current one-point margin over Uttarakhand and two-point margin over Tamil Nadu, signals a broader national convergence trend worth noting within this cross-cutting synthesis: India's overall SDG performance has improved substantially across virtually all states over the period this index has tracked, with ten states advancing from the Performer to Front Runner category in the most recent assessment alone and several states, Assam, Manipur, Punjab, West Bengal and Jammu and Kashmir among them, each gaining eight points since 2020-21 (Ensure IAS, 2025). This convergence pattern means Kerala's relative advantage, while still real and substantial, can no longer be assumed to widen automatically over time, and the state's continued top-ranking position will increasingly depend on sustained, accelerating improvement rather than on the kind of structural head-start that explained Kerala's dominant SDG position in earlier index editions. This finding reinforces, from the SDG measurement perspective specifically, the broader urgency this report has identified throughout its sectoral chapters: Kerala's historical social development advantages, while genuine and durable in many respects, are not by themselves sufficient to guarantee the state's continued national leadership without the kind of accelerated, well-sequenced reform across fiscal, economic, infrastructure and governance domains that this report's preceding chapters have detailed extensively.

20.2 Gender Mainstreaming Across Sectors

The gender employment paradox this report has documented repeatedly, near-parity or female-favourable indicators in education, health and demographic structure (Chapters 1, 5

and 6) alongside a severe and persistent gap in economic participation (Chapters 3 and 7), represents the single most consistent cross-cutting finding across this entire report. Kerala's sex ratio of 1,084 females per 1,000 males, documented in Chapter 1, the gender parity or female advantage in secondary and higher education enrolment documented in Chapter 5, and the exceptionally low maternal mortality ratio documented in Chapter 6, collectively demonstrate that Kerala's social investment in women's education, health and basic rights protection has succeeded comprehensively by any standard comparative measure. Yet this same report has shown, in Chapter 3's labour market analysis and Chapter 7's gender equity discussion, that this investment has not translated into commensurate female labour force participation or economic empowerment, with the Kudumbashree network examined throughout Chapters 3, 6, 7, 12, 18 and 19 functioning as a partial, geographically uneven compensating mechanism rather than a comprehensive solution to this underlying structural gap.

Gender mainstreaming across the specific sectors examined in this report reveals a consistent secondary pattern: women's participation is strongest precisely where Kerala's decentralised, panchayat-embedded institutional model, documented throughout Chapters 6, 7, 12 and 19, has been most deliberately and systematically applied, Kudumbashree's 4.2 million women members documented in Chapter 12, the ninety per cent female share of MGNREGS beneficiaries documented in Chapter 7, and the eighty per cent women-led tourism units documented in Chapter 19's Responsible Tourism discussion. Conversely, women's participation remains comparatively weaker precisely where Kerala's economy has shifted towards more conventional, less locally embedded growth sectors, the IT services and GCC expansion documented in Chapter 4, where this report's evidence does not establish gender parity in either employment or leadership representation, and the broader formal private sector labour market documented in Chapter 3, where the headline unemployment gender gap is most acute. This pattern suggests that Kerala's most effective gender mainstreaming mechanism, the decentralised, community-organised livelihood model, has not yet been extended with comparable institutional intensity into the state's fastest-growing, most economically significant emerging sectors, a gap this report identifies as a priority area for the gender equity component of the Vision 2047 roadmap developed in Chapter 21.

The political representation dimension of gender mainstreaming, examined briefly in Chapter 12's discussion of the Sarpanch Pati phenomenon documented elsewhere in India, deserves further attention within this cross-cutting synthesis. Kerala's constitutionally mandated reservation of panchayat seats for women, applied uniformly under the 73rd and 74th Constitutional Amendments discussed in Chapter 12, has formally guaranteed women's representation in local governance across the state for three decades, yet this report's evidence could not establish, with the specificity this cross-cutting theme requires, whether this formal representation has consistently translated into substantive decision-making authority, as distinct from nominal office-holding, across Kerala's nearly 900 Gram Panchayats. The strong, independently documented effectiveness of Kerala's Kudumbashree-organised women's collectives, in contrast to this more uncertain panchayat political representation

picture, suggests that economic and livelihood-based women's organisation may have achieved more substantive empowerment outcomes in Kerala than formal political representation alone has delivered, a finding with direct implications for how future gender mainstreaming investment should be prioritised: continuing to deepen and extend the economically grounded Kudumbashree model, which this report's evidence indicates has a demonstrated track record of substantive impact, rather than relying primarily on formal political representation requirements whose substantive impact this report cannot confirm with comparable confidence.

20.3 Youth Policy and Demographic Dividend Realisation

Kerala's demographic structure, examined extensively in Chapter 1 and Chapter 6, places the state in a fundamentally different position from most of India regarding the conventional demographic dividend framework: with a total fertility rate below replacement level for an extended period and an already advanced population ageing trajectory, Kerala's working-age population window, the period during which a state's demographic structure favours economic growth through a high ratio of working-age to dependent population, is considerably more advanced, and closer to closing, than in most other Indian states still in earlier stages of demographic transition. This timing mismatch creates a particular urgency that recurs throughout this report's youth-focused findings: the youth unemployment crisis documented in Chapter 3, the NEET incidence and higher-education-to-employment gap documented in Chapter 5, and the innovation ecosystem's not-yet-sufficient employment-generation scale documented in Chapter 17, must each be resolved within a comparatively compressed remaining window before Kerala's demographic structure shifts decisively from dividend to burden, a transition several other Indian states with later-stage demographic transitions have not yet begun to confront with the same immediacy.

Kerala's youth policy response, distributed across the multiple sectoral initiatives this report has documented rather than consolidated within a single comprehensive youth policy framework, spans the Knowledge Economy Mission's Coursera partnership and Additional Skill Acquisition Programme discussed in Chapter 5, the Kerala Startup Mission's youth innovation infrastructure discussed in Chapter 17, and the broader GCC and value-chain employment opportunities discussed in Chapter 4. The dispersed nature of this youth policy architecture, spanning at minimum the Education, Industries, IT, Labour and Skills Development departments, represents a further specific manifestation of the cross-departmental coordination challenge this report identified as a central, recurring institutional finding in Chapter 15, and one with particular urgency given the narrowing demographic dividend window discussed above: unlike several of the other coordination gaps this report has documented, where delayed resolution primarily affects project completion timelines, delayed resolution of Kerala's youth employment coordination gap risks the state missing its demographic dividend window entirely, converting what remains, for now, a solvable structural challenge into a permanent feature of Kerala's economic trajectory.

Kerala's demographic trajectory invites useful comparison with East Asian economies that experienced a comparably early and rapid demographic transition, South Korea and Taiwan among the most relevant comparators, both of which confronted a similarly compressed working-age population window and similarly elevated youth education levels relative to domestic employment absorption capacity during their own economic transition decades. These East Asian comparators resolved their own youth employment and demographic dividend challenges substantially through aggressive, state-coordinated investment in export-oriented manufacturing and, subsequently, knowledge-intensive technology sectors, a sequencing broadly analogous to the manufacturing-then-technology trajectory this report has identified as Kerala's own emerging, though as yet incomplete, development strategy across Chapters 4 and 17. The critical difference distinguishing Kerala's circumstances from these East Asian precedents, on the evidence assembled throughout this report, is scale and timing: South Korea and Taiwan pursued their manufacturing and technology transitions as sovereign states with full control over trade, currency and industrial policy instruments, whereas Kerala, as an Indian state operating within national trade, currency and major industrial policy frameworks set substantially at the central government level, must pursue an analogous development trajectory using the comparatively narrower set of policy instruments, state industrial incentives, land and infrastructure provision, and targeted skilling investment, available to a sub-national government, a constraint that does not invalidate the comparison but does suggest Kerala's path to resolving its own demographic dividend challenge will necessarily proceed more gradually and with greater dependence on coordinated central government partnership than the East Asian comparator cases required.

20.4 Migration: Internal, Inter-State and International Dimensions

Migration constitutes perhaps the single most pervasive cross-cutting theme in this entire report, appearing as a significant explanatory or contextual factor in no fewer than twelve of the preceding nineteen chapters. International outward migration to the Gulf Cooperation Council states, documented extensively in Chapter 3, drives the remittance economy that this report has shown to underpin Kerala's per capita income figures, its construction and real estate boom, its banking sector depth, and a substantial share of its consumption-driven retail growth. This same migration pattern generates the transnational family structures examined in Chapter 6's mental health discussion, the gendered migration diversification into nursing documented in Chapter 3's labour market analysis, and the household-level housing investment patterns documented in Chapter 11. Internal migration into Kerala, while less extensively documented within the sources reviewed for this report than the state's outward international migration, encompasses interstate labour migration into Kerala's construction, agriculture and service sectors, a workforce whose scale and welfare needs this report's evidence base has not been able to assess with the same granularity available for Kerala's own outward-migrant population, representing a further specific data gap this chapter flags for the statistical strengthening agenda developed in section 20.6.

Migration's fiscal and economic significance extends directly into the food security vulnerability documented in Chapter 18, since Kerala's structural dependence on inter-state cereal inflows reflects, at the aggregate level, the same logic of comparative advantage and specialisation that drives individual household migration decisions: Kerala's households and the Kerala economy as a whole have each, in their own way, substituted imported resources, remittance income at the household level, cereal imports at the state level, for domestically generated equivalents, allowing concentration of local resources and labour within higher-value activities, plantation crop cultivation, IT services, tourism, that the state's land and labour market comparative advantage favours. This migration-and-specialisation framing, applied consistently across this report's economic, social and food security findings, suggests that Kerala's migration dependence should be understood not as an isolated demographic phenomenon but as the structural foundation underlying much of the state's broader economic model, a foundation whose continued stability, given the Gulf labour market policy risks and global oil-price exposure documented in Chapter 3, represents one of the most consequential external vulnerabilities examined throughout this entire report.

A further dimension of migration's cross-cutting significance, only partially examined within the sectoral chapters of this report, concerns the second-generation effects of Kerala's multi-decade migration economy on the state's demographic and social structure discussed in Chapter 1 and Chapter 20.3. Children and young adults who have grown up in households sustained substantially by remittance income, rather than by locally generated wages, develop economic expectations and career aspirations shaped by that household experience, a pattern plausibly contributing to the documented preference among Kerala's educated population for white-collar and government employment, and the corresponding reluctance to take up semi-skilled or low-skilled work, that Chapter 3 identified as part of the explanation for Kerala's paradoxical combination of high education and high youth unemployment. If this intergenerational migration-expectation effect is genuinely significant, a hypothesis this report's available evidence can identify but cannot conclusively confirm without dedicated household-level survey data, it would suggest that resolving Kerala's youth employment crisis requires not only the labour-demand-side interventions examined throughout Chapters 4 and 17, but also a deliberate, sustained effort to recalibrate career expectations and the social status associated with different forms of work among a generation whose household economic experience has been shaped disproportionately by migration and remittance income rather than by domestic wage employment.

This dynamic connects directly to the inter-state labour migration pattern noted earlier in this section, since the semi-skilled and low-skilled construction, agricultural and service-sector positions that Kerala's own educated youth population has shown documented reluctance to take up are, in practice, increasingly filled by interstate migrant workers from states including West Bengal, Odisha, Bihar and Assam, a workforce substitution pattern visible across Kerala's construction industry discussed in Chapter 3 and its agricultural and fisheries sectors discussed in Chapter 18. This pattern, domestic youth aspiring towards white-collar and government employment while interstate migrants fill the resulting gap in semi-skilled and

manual labour, represents a distinctive and largely unexamined dimension of Kerala's labour market that this report's available evidence could document only in outline, given the absence of comprehensive, current data on interstate migrant worker numbers, sectoral distribution, and welfare conditions within Kerala specifically, a further specific gap this chapter adds to the statistical strengthening agenda developed in section 20.6.

20.5 Science, Technology and Innovation for Development

The technology and innovation themes examined separately throughout Chapters 4, 16 and 17, GCC expansion, AI policy, the startup ecosystem, and frontier research in semiconductors and quantum computing, converge in this section as a single, cross-cutting development strategy whose common thread this report has identified throughout: Kerala's technology and innovation policy consistently seeks to leverage the state's distinctive comparative advantages, high literacy and education levels documented in Chapter 5, a multi-decade digital infrastructure investment documented in Chapter 16, and a research institution density documented in Chapter 17, rather than competing directly on the conventional industrial scale advantages that larger, more populous Indian states possess. This differentiated positioning strategy, examined explicitly in Chapter 17's discussion of Kerala's frontier-technology niche strategy relative to the established IT hubs of Bengaluru, Hyderabad and Chennai, represents this report's clearest example of a coherent, deliberately sequenced state development strategy operating consistently across multiple sectoral domains simultaneously.

The institutional mechanism through which this consistent strategic positioning has been sustained across multiple government administrations and policy cycles, examined across Chapters 4, 16 and 17 but not previously analysed as a unified cross-cutting phenomenon, appears to rest substantially on Kerala's distinctive density of technocratic and academic expertise embedded directly within state policymaking institutions, the State Planning Board discussed in Chapter 12, the Kerala Startup Mission and Digital University leadership discussed in Chapters 4, 16 and 17, and the various sector-specific expert committees this report has documented throughout, the CSTEP energy transition roadmap discussed in Chapter 9, the World Bank-supported climate resilience programming discussed in Chapter 14, among others. This technocratic policy infrastructure, sustained and reinforced across successive changes of governing coalition in a manner this report has already noted in Chapter 12's discussion of the durability of Kerala's fiscal devolution commitment, provides a degree of policy continuity that more political-appointee-dependent state administrations elsewhere in India have, in many documented instances, struggled to sustain across electoral cycles, and represents, in this report's final cross-cutting assessment, as significant a contributor to Kerala's science, technology and innovation development trajectory as any single specific policy instrument or funding programme examined throughout the preceding chapters.

20.6 Statistical System Strengthening and Evidence-Based Policymaking

This report has identified a specific and recurring data limitation across nearly every chapter: Kerala-specific, disaggregated outcome data, distinguishing the state's performance from national aggregates with the granularity needed to evaluate specific programmes and institutions, has been repeatedly unavailable within the sources consulted, even where Kerala's general institutional and policy architecture is well documented. This gap recurred in Chapter 5's discussion of teacher workforce and disability-inclusion statistics, Chapter 6's discussion of nutrition outcome data, Chapter 12's discussion of the Sarpanch Pati phenomenon's prevalence within Kerala specifically, Chapter 15's discussion of judicial pendency and civil service vacancy figures, Chapter 17's discussion of research and development intensity, and Chapter 18's discussion of crop insurance enrolment rates, among numerous other instances catalogued throughout this report. The cumulative pattern this recurring gap reveals is significant in its own right: Kerala possesses genuinely sophisticated institutional and policy design across virtually every sector examined in this report, yet the state's own statistical infrastructure for measuring and publishing the outcomes of that institutional design has not kept comparable pace, leaving external assessment, including this report's own analysis, frequently reliant on national-level data, academic case studies of specific localities, or institutional self-reporting rather than comprehensive, routinely published, disaggregated state performance statistics.

Strengthening Kerala's statistical system, building on the State Planning Board's existing data infrastructure documented in Chapter 12 and the digital governance architecture documented in Chapter 16, represents this report's single most consistently recurring and most directly actionable cross-cutting recommendation. A consolidated, publicly accessible state statistical dashboard, drawing together education, health, judicial, civil service, agricultural and environmental outcome data currently dispersed across multiple departmental reporting systems of uneven quality and accessibility, would directly address the evidence gap this report has documented across nearly every preceding chapter, while simultaneously supporting the cross-departmental coordination function this report identified in Chapter 15 as Kerala's central administrative governance reform priority, since shared, transparent outcome data is itself a foundational precondition for effective cross-departmental coordination.

The specific institutional model for this proposed statistical strengthening agenda need not be built entirely from scratch: NITI Aayog's own SDG India Index methodology, discussed in section 20.1, already demonstrates that a standardised, multi-indicator state performance measurement framework can be constructed and sustained at the national level across 113 indicators and sixteen goals, and Kerala's State Planning Board, with its multi-decade institutional experience in decentralised data collection through the People's Plan Campaign documented in Chapter 12, possesses considerable existing capacity to adapt this kind of standardised, multi-indicator framework specifically to the more granular, sub-state level required to close the data gaps this report has documented throughout. A Kerala-specific

district and sector dashboard, modelled methodologically on the SDG India Index but extended to the considerably more granular level of teacher vacancy rates, judicial pendency by district, crop insurance enrolment by crop and district, and disability-inclusion outcomes in schooling, the specific gaps this report has identified throughout Chapters 5, 6, 7, 15 and 18, would represent a natural and methodologically well-precedented extension of data infrastructure Kerala has already demonstrated institutional capacity to build and sustain at the state-aggregate level.

20.7 Public Participation: Behavioural Change and Citizen Engagement

Kerala's tradition of public participation, anchored institutionally in the decentralised Panchayati Raj architecture and People's Plan Campaign documented extensively in Chapter 12, extends throughout this report into behavioural-change-dependent policy domains where citizen cooperation, rather than government action alone, determines policy success: the source segregation and decentralised waste management transition discussed in Chapter 10, the water conservation awareness campaigns discussed in Chapter 11's treatment of AMRUT 2.0's Jalam Jeevitham programme, and the community-based disease surveillance and screening models discussed in Chapter 6. This report's evidence indicates that Kerala's public participation tradition, while genuinely deep and historically significant, has not uniformly translated into behavioural compliance across every policy domain requiring it, the persistent informal sector and tax compliance gaps implicit in Chapter 2's revenue mobilisation discussion, and the Wayanad tourism construction licensing non-compliance documented in Chapter 19, both illustrate that formal citizen participation in planning processes does not automatically guarantee citizen compliance with the resulting regulations, a distinction this report identifies as analytically important for designing future participation-dependent policy interventions: genuine public participation in policy design, Kerala's clear strength, and sustained public compliance with the resulting regulations, a less consistently demonstrated outcome across the evidence this report has assembled, are related but distinct policy objectives that require correspondingly distinct institutional strategies to achieve reliably. This distinction, between participatory policy design and sustained regulatory compliance, represents the final cross-cutting synthesis finding this report carries forward into the State Vision 2047 roadmap developed in the chapter that follows.

This distinction between participatory design and sustained compliance, considered alongside the six other cross-cutting themes examined throughout this chapter, the SDG performance synthesis, the gender mainstreaming pattern, the demographic dividend timing constraint, migration's structural centrality, the differentiated technology and innovation strategy, and the statistical system gap, together constitute the integrated diagnostic foundation on which this report's concluding chapter builds. Each of these seven cross-cutting themes recurs, in some form, across at minimum half of the nineteen preceding sectoral chapters, confirming that Kerala's development challenges and achievements alike are rarely confined neatly within single departmental or sectoral boundaries, but instead emerge from, and must be addressed through, the kind of genuinely integrated, cross-departmental policy thinking this report has

argued for consistently since Chapter 15's administrative governance discussion first identified cross-departmental coordination as Kerala's single most consequential, generalisable institutional reform priority. The Vision 2047 roadmap developed in Chapter 21 is accordingly structured not as a further list of sector-specific recommendations, of which this report has already generated a considerable number across the preceding twenty chapters, but as an integrated sequencing and prioritisation framework explicitly designed around the cross-cutting themes this chapter has identified.

Chapter 21: State Vision 2047 - Strategic Priorities and Development Roadmap

21.1 Long-Term Vision and Flagship Missions

The diagnostic evidence assembled across the preceding twenty chapters of this report converges on a single, recurring structural finding: Kerala combines genuinely exceptional social development achievement, the highest SDG India Index score nationally, the lowest infant and maternal mortality rates, near-universal literacy and school retention, with a narrower and less consistently realised set of economic, fiscal and institutional capabilities. The state's long-term vision for 2047, the centenary of Indian independence, must accordingly be built around closing this specific gap rather than around further deepening the social development achievements that this report has shown, in Chapters 5 and 6 particularly, to already approach the practical ceiling of what further incremental investment in access and coverage alone can deliver. Three flagship missions emerge directly from this report's cumulative evidence as the organising priorities for Kerala's Vision 2047: first, a Fiscal and Economic Resilience Mission addressing the revenue mobilisation, capital expenditure and economic diversification findings documented in Chapters 2, 3 and 4; second, an Employment and Demographic Dividend Mission addressing the youth unemployment, gender employment gap and narrowing demographic window documented in Chapters 3, 5, 7, 17 and 20; and third, an Integrated Governance and Climate Resilience Mission addressing the cross-departmental coordination weakness and environmental enforcement gap documented across Chapters 8, 9, 13, 14, 15 and 19. These three missions are not independent of one another; this report's evidence demonstrates repeatedly that fiscal constraint limits employment-generating infrastructure investment, that employment generation depends on resolving the same coordination weaknesses that constrain environmental governance, and that climate resilience investment itself carries direct fiscal and employment implications, meaning the three missions must be pursued as a single integrated programme rather than as three separately sequenced initiatives.

21.2 Medium-Term Priority Action Plan (2025-2030)

Within this twenty-two-year vision horizon, the immediate five-year period demands the most concrete and time-bound prioritisation, since this report's evidence indicates that several of the structural vulnerabilities documented throughout, the narrowing demographic dividend window discussed in Chapter 20, the off-budget liability accumulation discussed in Chapter 2, and the accelerating climate vulnerability discussed in Chapter 14, carry genuine time sensitivity that delayed action would materially worsen. Five specific, measurable priorities define this medium-term action plan. First, raising own tax revenue from the current 6.5 per cent of GSDP towards the 8 per cent target referenced throughout Chapter 2, achieved through the SGST administrative reforms, property tax modernisation, and KIIFB transparency measures this report identified in Chapters 2 and 11. Second, establishing the binding capital expenditure floor and cross-departmental infrastructure delivery coordination

mechanism this report identified as its single most consequential and actionable administrative governance recommendation in Chapter 15, directly addressing the Vizhinjam rail-link sequencing gap, the Silver Line contestation, and the broader pattern of strong individual project design alongside weak inter-agency delivery coordination documented in Chapter 8. Third, scaling the TVET-to-GCC and Industry-on-Campus skilling pipeline documented in Chapter 5 and Chapter 17 to a materially larger absolute scale, closing the gap this report identified in Chapter 17 between the innovation ecosystem's genuine but still modest job-creation numbers and the much larger scale of youth unemployment documented in Chapter 3. Fourth, closing the urban sewerage and liquid waste management gap documented in Chapter 10, given this report's finding that this comparatively unglamorous infrastructure category delivers a disproportionately high public health and environmental return relative to its capital cost. Fifth, completing the renewable energy capacity expansion and storage investment documented in Chapter 9, directly addressing the roughly seventy per cent power import dependence this report identified as Kerala's single most consequential energy security vulnerability.

21.3 Financing Strategy: Resource Mobilisation, Revenue Enhancement and Expenditure Rationalisation

The financing strategy underpinning this medium-term action plan must confront directly the fiscal architecture findings documented in Chapter 2: a committed-expenditure burden consuming roughly seventy-one per cent of revenue receipts, a rising debt-to-GSDP ratio, and a capital expenditure base that this report showed in Chapter 2 to be squeezed disproportionately whenever revenue shortfalls occur. Three financing instruments, each examined in earlier chapters of this report, together offer a credible path through this constraint without requiring an unrealistic, immediate resolution of the underlying structural fiscal pressures. The KIIFB transparency and sustainability reform discussed in Chapter 2, bringing off-budget infrastructure financing under consolidated, publicly disclosed accounting consistent with the CAG's documented findings, would restore the credibility this report's evidence suggests is currently constraining KIIFB's own borrowing capacity and cost of capital. The diaspora development bond instrument, referenced in Chapter 2 and connected throughout this report to Kerala's distinctive remittance economy documented in Chapter 3, offers a financing channel specifically calibrated to Kerala's unique NRI investor base, converting a portion of the household-level remittance flows this report has shown drive consumption and property investment into productive infrastructure capital instead. The public-private partnership model demonstrated at Vizhinjam, examined in Chapter 4 and Chapter 8, and the build-own-operate-transfer renewable energy financing model discussed in Chapter 9, together provide a template for extending private capital mobilisation beyond these two flagship projects into the broader infrastructure investment programme this report has catalogued across Chapters 8 through 11.

21.4 Centre-State Partnership: Centrally Sponsored Schemes and Special Grants

Kerala's relationship with centrally sponsored schemes, examined throughout this report in connection with AMRUT and AMRUT 2.0 (Chapter 11), PMGSY (Chapter 12), PMAY-Gramin and PMAY-Urban (Chapter 11 and Chapter 12), the Jal Jeevan Mission (Chapter 10), and PM-KUSUM and the National Quantum Mission (Chapters 9 and 17), demonstrates a consistent pattern this report identifies as a genuine state capability: Kerala's institutional capacity to draw down and effectively implement centrally sponsored scheme funding, layering state-specific complementary programmes on top of national frameworks rather than relying on either in isolation. This demonstrated capability provides the foundation for Kerala's Centre-state partnership strategy through 2030: rather than treating the national policy shift away from direct urban mission grant funding, documented in Chapter 11, as purely a constraint, Kerala's evidence-based track record of effective scheme implementation, the AMRUT 1.0 completion rate of roughly ninety-four per cent against a national rate of around sixty per cent documented in Chapter 11, positions the state to credibly advocate for continued and expanded special grant allocation, including the urban flood management funding gap identified in Chapter 11 despite Kerala's documented flooding impact in Palakkad, Thrissur, Cochin and Malappuram, and the revenue deficit grant continuation discussed in Chapter 2 as the Fifteenth Finance Commission's protection period concludes.

21.5 Inter-State Cooperation: Regional Development Councils and River Boards

Kerala's most consequential inter-state cooperation requirements, documented throughout this report, span the Kochi-Bengaluru Industrial Corridor's integration with Karnataka's technology and manufacturing ecosystem discussed in Chapter 4, the Mullaperiyar dam's interstate water-sharing arrangement with Tamil Nadu discussed in Chapter 14, and the broader Western Ghats ecological governance framework spanning six states discussed in Chapter 13. Each of these cooperation requirements carries distinct institutional demands: the industrial corridor cooperation is fundamentally economic and infrastructure-focused, requiring coordinated investment planning and logistics integration; the Mullaperiyar cooperation is fundamentally a water-security and disaster-risk-management partnership requiring the kind of real-time, technically sophisticated inter-agency coordination this report identified in Chapter 14 as having been inadequate during the 2018 floods; and the Western Ghats cooperation is fundamentally a conservation governance partnership requiring resolution of the ESA delineation dispute examined extensively in Chapter 13. Kerala's approach to each of these three distinct cooperation domains should, on this report's evidence, be calibrated to its specific institutional character rather than treated as a single, undifferentiated category of interstate relations, since the economic, water-security and conservation cooperation challenges this report has documented each require different counterpart institutions, different negotiating postures, and different timelines for resolution.

21.6 International Collaboration: Common Development Agenda and Global Partnership

Kerala's international engagement, examined throughout this report in the World Bank's Resilient Kerala programme and Rebuild Kerala Initiative (Chapter 14), the German KfW Development Bank's Kochi Water Metro Extension financing (Chapter 8), and the Invest Kerala Global Summit's international investor courtship (Chapter 4), demonstrates a state with genuine, multi-channel international development partnership capacity extending well beyond the conventional diaspora and remittance linkages examined throughout Chapters 3 and 20. This existing international partnership infrastructure provides a strong foundation for the Vision 2047 horizon's international collaboration agenda, particularly given the global relevance of several of Kerala's specific development challenges, the climate adaptation and disaster resilience model documented in Chapter 14 offers genuinely exportable lessons for other small, densely populated, climate-vulnerable coastal regions globally, while Kerala's distinctive social-development-first development model, examined throughout this report's social welfare chapters, continues to attract international academic and policy interest as a comparative case study in achieving strong human development outcomes at moderate income levels. Kerala's stated AI strategy alignment with the national India AI Mission, discussed in Chapter 16, and the state's positioning as a national implementation hub ahead of the India AI Summit 2026, similarly offer a concrete near-term international and national visibility opportunity that builds directly on the digital governance and innovation ecosystem strengths documented throughout Chapters 16 and 17.

21.7 Monitoring, Evaluation and Results Framework

The statistical system strengthening priority identified as this report's most consistently recurring cross-cutting recommendation in Chapter 20 finds its direct operational expression in this section's monitoring and evaluation framework requirement. This report's own analytical process, requiring extensive reliance on academic case studies, institutional self-reporting, and national-aggregate data disaggregated only imperfectly to the Kerala-specific level, has itself demonstrated the practical cost of the data gap documented throughout Chapters 5, 6, 7, 12, 15, 17 and 18: even a comprehensive, good-faith assessment of Kerala's development trajectory, of the kind this report has attempted, is materially constrained by the absence of routinely published, disaggregated state performance data across several of the sectors this report has examined. The Vision 2047 results framework should accordingly be built around the consolidated state statistical dashboard proposed in Chapter 20, modelled methodologically on the NITI Aayog SDG India Index discussed in that chapter but extended to the granular district, sector and institution level required to track the specific medium-term priorities identified in section 21.2, own tax revenue as a share of GSDP, capital expenditure execution rates, TVET-to-employment placement statistics, urban sewerage coverage by city, and renewable energy capacity addition against the 10,000 MW by 2030 target documented in Chapter 9.

21.8 Accountability Architecture: Legislature, Civil Society and Citizens

The accountability architecture through which this Vision 2047 roadmap should be implemented and monitored draws directly on the institutional strengths and weaknesses this report has documented throughout. Kerala's Legislative Assembly, operating within the broader administrative governance framework examined in Chapter 15, provides the formal legislative oversight mechanism through which the fiscal, infrastructure and welfare commitments examined throughout this report are authorised and reviewed, while the Lok Ayukta and Vigilance Bureau, also examined in Chapter 15, provide the formal anti-corruption enforcement mechanism this report identified as requiring strengthened, independently verified performance assessment. Civil society engagement, examined throughout this report in the Kudumbashree network's 4.2 million women members (Chapter 12), the participatory Gram Sabha tradition underpinning the People's Plan Campaign (Chapter 12), and the academic and research institution ecosystem documented in Chapter 17, provides Kerala with a civil society accountability infrastructure considerably more developed than in most other Indian states, a genuine comparative advantage this report's evidence suggests should be leveraged more deliberately as a direct accountability mechanism for the Vision 2047 roadmap's implementation, rather than treated solely as a service-delivery partner, the role civil society institutions have predominantly played across the sectoral chapters examined throughout this report.

Citizen-level accountability, the final and most direct layer of this accountability architecture, depends on the digital governance infrastructure examined extensively in Chapter 16, the RTI implementation discussed in Chapter 15, and the open data commitments discussed in Chapter 14's climate resilience programming, each of which this report has shown to be genuinely present in formal policy commitment but, consistent with the broader implementation-versus-design gap this report has documented repeatedly across Chapters 13, 15 and 19, not yet uniformly realised in operational practice. Closing this specific gap, ensuring that Kerala's genuinely strong formal commitment to transparency and citizen accountability translates into routinely accessible, genuinely usable public information across the fiscal, infrastructure, environmental and welfare domains examined throughout this report, represents the final and most foundational recommendation this report offers: not a new policy, programme or institution, since this report has shown Kerala already possesses a remarkably comprehensive architecture of policies, programmes and institutions across virtually every sector examined, but a sustained, systematic commitment to ensuring that architecture's outcomes are measured, published, and held accountable with the same rigour and consistency that has historically characterised Kerala's policy design itself. This single finding, that Kerala's challenge over the Vision 2047 horizon lies considerably more in implementation consistency, data transparency and cross-departmental coordination than in any deficiency of policy ambition or institutional design, is the central conclusion of this report, synthesised across twenty-one chapters and grounded in the specific, documented evidence assembled throughout this comprehensive assessment of the State of Kerala.

END NOTE

The presentation of The Comprehensive Development Framework Report of the State of Kerala marks a pivotal moment in our collective pursuit of a brighter and more sustainable future. What began as a determined and ambitious initiative by the Youth Peace and Development Forum has now materialized into a definitive, evidence based roadmap. This document is not merely a compilation of theoretical policy suggestions. It is a bold declaration of intent, capturing the aspirations of a generation that actively seeks to build a resilient, prosperous, and globally competitive state.

Kerala has historically been a trailblazer in human development and progressive governance. Our past achievements in public health, universal education, and social equity have rightfully earned international acclaim. However, the rapidly shifting global economic landscape dictates that we can no longer rely solely on the laurels of our traditional development model. We are currently facing acute second generation challenges. Educated youth are migrating in unprecedented numbers in search of better career opportunities, our traditional industries are facing systemic stagnation, and climate change poses a severe existential threat to our coastal and high range communities. This comprehensive framework was born out of the urgent need to address these exact vulnerabilities and pivot toward a completely new paradigm of growth.

The strategic pillars detailed within these chapters provide a clear and actionable trajectory for profound structural transformation. By prioritizing a transition to a knowledge economy, we aim to harness the true and untapped potential of our highly educated workforce. We envision a near future where Kerala becomes a central, thriving hub for artificial intelligence, biotechnology, advanced manufacturing, and space research. Simultaneously, our heavy focus on building climate resilient rapid infrastructure ensures that our economic expansion never compromises our environmental security. We must diligently protect our expanding cities, vulnerable villages, and eroding coastlines from extreme weather events through sustainable engineering and forward looking urban planning.

At the very heart of our vision is the ambitious goal of creating a one trillion dollar economic ecosystem. Achieving this massive scale requires a fundamental alignment between our higher education institutions and rapidly evolving global industry standards. We must cultivate specialized research clusters that not only retain our brilliant local talent but also attract substantial international investments and academic partnerships. Furthermore, by strategically harnessing the silver and blue economies, Kerala can tap into highly lucrative and socially impactful sectors. We can provide world class geriatric care and wellness tourism for our aging population while sustainably utilizing our vast marine resources to boost our overall economic growth.

We also recognize that true economic progress must be deeply inclusive. Modernizing agriculture and fisheries remains a top priority within this framework. By introducing precision farming techniques, promoting significant value addition in cash crops, and

adopting advanced deep sea fishing technologies, we can secure the livelihoods of our primary sector workers. This holistic approach guarantees that our ambitious leap into the modern technological era leaves absolutely no community behind.

To support these massive economic shifts, our framework places a heavy emphasis on governance and regulatory reforms. The ease of doing business in the state must be drastically improved to foster an environment where local startups and global enterprises can flourish equally. Bureaucratic hurdles must be systematically dismantled and replaced with transparent, digitally driven administrative processes. A proactive, responsive, and agile government apparatus is the fundamental prerequisite for realizing the ambitious targets outlined in this report.

The youth of Kerala have clearly demonstrated their readiness to lead this monumental transformation. Through the tireless and dedicated efforts of the Council for Comprehensive Development Frameworks, young researchers and professionals have laid down a meticulously researched blueprint. They have proven beyond doubt that young people are entirely capable of shaping complex public policies and driving administrative change. It is now the collective responsibility of our policymakers, legislators, and community leaders to take ownership of these ideas, refine them through continuous public discourse, and translate them into actionable legislation and grassroots projects.

As India advances confidently toward the centenary of its independence in 2047, Kerala possesses a historic and unparalleled opportunity to redefine its legacy on both the national and global stage. We can create an economic model that seamlessly blends high economic growth with uncompromising environmental stewardship and deep rooted social equity. Let this framework serve as the definitive starting point for a new era of constructive dialogue, bold innovation, and relentless progress.

We extend our deepest gratitude to every researcher, academician, industry expert, and citizen who contributed to this grand vision. We look forward to witnessing the ideas contained within these pages transform into the lived reality of a thriving, resilient, and future ready Keralam.

Council for Comprehensive Development Frameworks

Youth Peace and Development (YPD) Forum

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