FUTURE PROOFING THRISSUR:
REGIONAL PLAN 2047

R E P O R T







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Master of Planning (Urban & Regional Planning) 2022-24

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Thrissur Management Association

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This report is prepared as part of the academic exercise of 2nd Semester Master of Planning, Urban and Regional Planning students. School of Planning and Architecture, Bhopal does not hold any accountability of the authenticity of the information furnished here.

ACKNOWLEDGEMENTS

We would like to express our sincere gratitude and appreciation to all individuals and organizations who have contributed to the development of the Future Proofing Thrissur: Regional Plan 2047. Without their valuable support, insights, and collaboration, this study would not have been possible. First and foremost, we extend our heartfelt thanks to the esteemed faculties of the school Planning and Architecture (SPA), Bhopal, namely Prof. Ashfaque Alam, Prof. Paulose N. Kuriakose, and Prof. Kshama Puntambekar. Their expertise, guidance, and mentorship have been instrumental in shaping the vision and objectives of this regional plan. Their dedication to the field of regional planning and their commitment to academic excellence have been a constant source of inspiration.

We would also like to extend our gratitude to Director General Dr. Joy Elamon, Dr. Ajith Kaliyath (Professor, Urban Chair) and the entire Kerala Institute of Local Administration (KILA) team , for their hospitality, valuable contributions, and support throughout the planning process. Their expertise in local governance and their commitment to sustainable development have significantly enriched the regional plan. We would like to acknowledge the support and collaboration of the Thrissur Management Association (TMA) and ESAF foundation for the invaluable input, logistics, accommodation, industry knowledge, and commitment to economic development which greatly influenced the proposals of the regional plan. We would like to extend our special thanks to Mr. Manoj Kumar (Secretary, TMA) Mr. Kadambelil Paul Thomas (President, TMA and Managing Director and CEO, ESAF Bank) for the constant support and their insights about the District. Assistance for the data collection for the block level research was supported by Department of Architecture Government Engineering College, which let their students is highly appreciated .This would not have been possible without the support of Head, School of Architecture and Planning, Prof. Bindu C.A.

A special word of thanks to Dr. Rajesh K, Dr. Jiju P. Alex (Member, Kerala State Planning Board), Dr. Abhilash S (Associate Professor, Department of Atmospheric Sciences, CUSAT), Mr. George M.P. (Manager, ESAF Foundation) Ar. Vinod Kumar M.M., Ar. Mohamed Ikbal, for sharing their understanding and comments that helped us get on the right path and stay inspired during the study.

We would also like to express our appreciation to the various stakeholders, including government officials at Collectorate, District Planning Office, community representatives, NGOs, and the general public, who actively participated in the consultation processes, and discussions. Their engagement, insights, and feedback have played a vital role in shaping the regional plan and ensuring its relevance and effectiveness.

Lastly, we extend our heartfelt thanks to Kudumbashree ladies for their hospitality at KILA, drivers who helped us in reaching the various locations conveniently and all the individuals who have contributed their time, expertise, and resources towards this endeavor. Their collective efforts have made this regional plan a comprehensive and impactful document, paving the way for a sustainable and prosperous future for Thrissur. We remain grateful for the immense support and encouragement received throughout this journey. The collective efforts and collaboration of all stakeholders have truly made a significant difference in shaping the Future Proofing Thrissur: Regional Plan 2047.

-Master of Planning (Urban & Regional Planning) 2022-24

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List of Abbreviations

1. AI - Artificial Intelligence
2. APC - Agro Processing Cluster
3. ASI- Archaeological Survey of India
4. AVC- Agiculture Village Committee
5. BOT- Build-Operate-Transfer
6. CBIC- Chennai-Bengaluru Industrial Corridor
7. CBO- community-based organizations
8. CPC - Central Processing Centre
9. CRZ- Coastal Regulation Zone
10. CSA- Climate-smart Agriculture
11. CSIND- Coastal Shipping and Inland Navigation Department
12. CSR - Corporate Social Responsibility.
13. CSR - Corporate Social Responsibility.
14. CSR- Corporate social responsibility
15. CTTS- Comprehensive Traffic and Transportation Study
16. DDMA- District Disaster Management Authority
17. DIC - District Industrial Centre
18. DMO - District Medical Officer
19. DPR - Detailed Project Report
20. DTPC- District Tourism Promotion Councils
21. EDC – Eco development committees
22. EPT- Elephant proof trench
23. ERCMPU - Ernakulam Regional Cooperative Milk Producers' Union.
24. ESS - Entrepreneur Support Scheme
25. ESS - Entrepreneur Support Scheme
26. EV- Electric Vehicle
27. FFDA – Fish Farmers Development Agency
28. FPO - Farmer Producing Organization
29. GDVA - Gross district value added.
30. GFDRR- Global Facility for Disaster Reduction and Recovery
31. GSRTC- Gujarat State Road Transport Corporation
32. HSPF- Hanging Solar Power Fence
33. HWC- Human Wildlife Conflict
34. ICAR- Indian Council of Agricultural Research
35. INTACH- Indian National Trust for Art and Cultural Heritage
36. IPHS - Indian Public Health Standards
37. IPT- Intermediate Public transport
38. IRR- Internal Rate of return
39. IRSDC- Indian Railway Stations Development Corporation
40. ISM - Indian System of Medicine
41. ITS- Intelligent Transportation System
42. IWAI- Inland Waterway Authority of India
43. IWAI- Inland Waterways Authority of India
44. KFRI- Kerala Forest Research Institute
45. KIIFB- Kerala Infrastructure Investment Fund Board
46. KIIFB- Kerala Infrastructure Investment Fund Board
47. KINFRA - Kerala Industrial Infrastructure Development Corporation
48. KRZ- Kole Regulation Zone
49. KSCADC- Kerala State Coastal Area Development Corporation Limited
50. KSRTC- Kerala State Road Transport Corporation
51. KSWTD-Kerala State Water Transport Department
52. KWH- Kilowatt hour
53. MDR- Major District Road
54. MICE- Meetings, Incentives, Conferences and Exhibitions
55. MMTH- Multi-Modal transport Hub
56. MoHUA- Ministry of Housing and Urban Affairs
57. MoRTH- Ministry of Road Transport and Highways
58. MVD- Motor Vehicle Department
59. NABARD - National Bank for Agriculture And Rural Development.
60. NH- National Highway
61. NHAI- National Highway Authority of India
62. NICDP- National Industrial Corridor Development Programme
63. NRHM - National Rural Health Mission
64. NTFP – Non timber forest produce
65. O/o PSA- Office of the Principal Scientific Advisor
66. ODR- Other District Road

67. OECD- Organization for Economic Cooperation and Development
68. OWS- Oil Water Separator
69. PEA - Project Execution Agency
70. PHPDT- Pick Hour Pick Direction Traffic
71. PM FME Scheme - PM Formalisation of micro food processing Enterprises Scheme
72. PMEGP - PM Employment Generation Programme
73. PMMY- Pradhan Mantri Mudra Yojana
74. PPC - Primary Processing Centre
75. PPP- Public-Private Partnership
76. PWD- Public Work Department
77. R&D- Research & Development
78. RIDF- Rural Infrastructure Development Fund RKI- the Rebuild Kerala Initiative
79. RRZ- River Regulation Zone
80. RTO- Regional Transport Office
81. S & T- Science and Technology
82. SAF – Society for Assistance to Fisher Women
83. SAV- Smart Agri Villages
84. SDG- Sustainable Developemnt Goals
85. SDMA- State Disaster Management Authority
86. SH- State Highway
87. SHG - Shelf Help Groups
88. SITCO- Surat Integrated Transportation Development Corporation
89. SMC- Surat Municipal Corporation
90. SPF- Solar Power Fence
91. SPV- Special Purpose Vehicle
92. SRTO- Sub-Regional Transport Office
93. SWOC- Strengths, Weaknesses, Opportunities, and Threats
94. SWTD- State Water Transport Department
95. Thrissur M.Corp- Thrissur Municipal Corporation
96. UNESCO- United Nations Educational, Scientific and Cultural Organization
97. URDPFI - Urban Development Plans Formulation and Implementation
98. VSS – Vana Samrakshana Samithi
99. WHO - World Health Organization
100. WRD- Water Resource Department

Executive Summary

Thrissur district, a significant economic and cultural hub in the southern region

Thrissur district is one of the 14 districts of Kerala, significantly known the **'cultural capital' and 'gold district' of Kerala**, blessed with many religious sites, centres of art and culture, along with its rich history and tradition in gold jewelry craftsmanship and annual gold exhibition, making it one of the the richest city in India. The district is also known for the Thrissur Pooram which is the most colourful temple festival in the world. It is a hub for international tourism due to it's ecological and cultural significnace. Historically, the city of Thrissur remained a centre of trade and commerce until it became the capital of the Kingdom of Cochin. It wasn't until 1949, that the Thrissur district was formally formed by merging six taluks and the Kunnathuna taluk which was a part of Kottayam district, with its headquarters at Thrissur City.

The district is divided into 7 taluks, 16 blocks and 86 gram panchayats. It has 8 urban local bodies, 7 municipalities and 1 municipal corporation. The planning framework is based on the decentralization of power to local self-government institutions (LSGIs), **emphasizing on people centered planning**. Thrissur district has an area of about 3,032 sq.km. The district is home to a population of 31 lakhs, constituting an approximate 9% of Kerala's population. It had an average population density of 1031 ppl/sqkm and a growth rate of 4.94%, with an urban population of 67%, making it the third largest urban agglomeration in Kerala after Kochi and Kozhikode.

Demographical statistics

Between 2001 and 2011, the district experienced significant urbanization due to the availability of jobs in construction, handloom, agriculture, mining, and quarrying. The workforce participation rate in rural areas remained stable at 32% in 1991 and 2001 but increased to 37% in 2011. Meanwhile, urban areas saw a slight increase in the workforce participation rate (WFPR) from 31% in 1991 to 34.1% in 2011. There has been a shift in the proportion of main and marginal workers in Thrissur, reflecting evolving employment patterns. There is a visible disparity in the WFPR between men and women in Thrissur. The WFPR for males rose from 44.7% to 53.3% in 2011. In comparison, the WFPR for females grew from 14.7% in 1991 to 18.7% in 2011.

Thrissur District is the third-largest coastal district in Kerala and is **rich in agricultural land and forest, but shows a decrease in agricultural land and an increase in built-up and barren land due to migration and changes in economic activity.** The district's highland region is mostly used for plantation and forest operations, while the midland region is mostly used for agriculture. The passage also notes that the mining industry contributes to the expansion of barren land.

Thrissur Municipal Corporation has become the growth center of the district, with the hierarchy of settlements includeing one growth center, three growth points, seven service centers, and seventy central villages.

Thrissur's growing population & Housing shortage

Regarding housing, Kerala has registered significant growth in both quality and quantity, with the government working on housing issues since the 1950s. However, despite the apparent aggregate-level success, a significant proportion of underprivileged and poor sections of society still do not have reasonable shelter. Housing data from indicates that the proportion of households belonging to the Scheduled Tribe communities residing in dilapidated houses was almost four times the national average. Even though majority of the households live in good condition, 12. 5% of the district consists of homeless, both with and without land, which is evident in the form of poverty as well. **The total number of households in Thrissur District is 7.5 lakhs with 2.7% houseless households, 1.02% landless households, and a housing gap of 2.43%.**

Climatic assessment and impact of mining on environment

Thrissur district has a tropical monsoon climate with a harsh hot season, abundant and seasonal rainfall. The average wind speed is 2.7m/s which can go up to a maximum of 9m/s. Thrissur district can be divided into four geological belts, including the Charnockite belt, Gneissic belt, Granitic gneiss belt, and Quaternaries of the coastal tract. The region is rich in mineral deposits, including granite construction stones, laterite building stones, tile and brick clay, lime shell, and sand, with granite being the most mined. However, **mining activity can have negative impacts on the environment,** including releasing pollutants into the atmosphere, affecting water ecosystems and groundwater tables, and altering land environments.The total land degraded in Thrissur is 173.56 sq.km. due to water Erosion (50.94 sq.km.), waterlogging or surface ponding (39.74 sq.km.), anthropogenic factors (13.84 sq.km.) & Other factors (69.04 sq.km.).

Urbanization and Human-wildlife conflict

The Thrissur division of the Kerala Forest Department includes Thrissur and Palakkad districts. The forest area in Thrissur district is 1036.19 sq km, which is 33.34% of the total geographical area, and this region includes Peechi-Vazhani Sanctuary and Chimmony Wildlife Sanctuary. Human-wildlife conflict (HWC) in the district is caused because of rapid urbanization, lack of protected areas, increasing encroachment in the forest areas, and transport network. **The Kuthiran tunnel, constructed in 2021 to control traffic, is an active HWC hotspot as elephants started crossing to raid crops in the Machad range which was previously devoid of elephants.** In 2019-2020, 758 cases of HWC cases were registered within district forest administration. There have been 14 cases of forest fire in the district out of which four were at Peechi Wildlife Sanctuary. HWC leads to undesirable consequences for people, resources, and wildlife, for which preventive measures like solar power fencing, elephant proof trench, elephant proof wall, bio fence, and kayyala can be used.

Degradation of Kole wetlands and increasing pollution

The Periyar, Chalakudy, Karuvannur, Kurumali and Ponnani are the main river systems in the district. However, according to the national green tribunal, **21 rivers in Kerala are listed to be extremely polluted, out of which 3 are in the Thrissur district - Kechery river, Karuvannur river, and Puzhakal river. The main cause of river pollution is suspected to be dumping of solid wastes and untreated sewage into the rivers.** Additionally, the district faces **groundwater scarcity due to the topographical slope towards the west, which drains most of the rainwater into the sea, giving it no time to seep into the ground and recharge the groundwater table.**

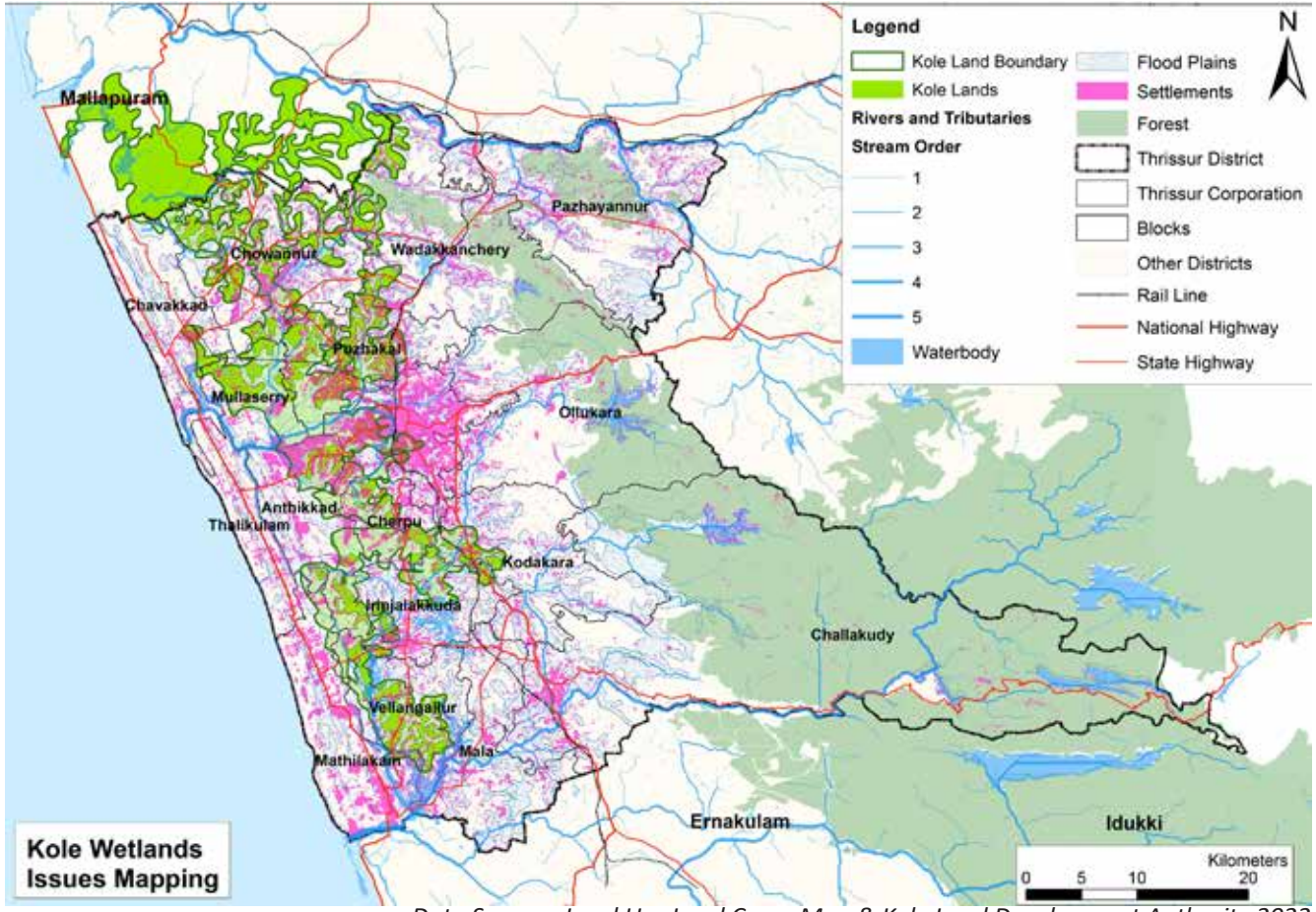
The Kole Wetlands in Thrissur, Kerala, India are an important ecosystem that provide agricultural goods and fishery products, while also acting as a natural promoter for water retention, groundwater recharge, water purification, flood mitigation, and nutrient retention that supports aquaculture and wildlife. The wetlands cover an area of 447.50 sq. km. in between the BharathPuzha and Chalakuddy rivers, consisting of 14.76% of the district area. The wetlands are majorly classified into rivers, backwaters, reservoirs, freshwater lakes, lagoons, sand beaches, and marshy lands. The Kole lands have agriculture, fishery, animal husbandry, and allied primary economic activities as the major land use distribution apart from the built-up area for different development activities. However, **due to factors like increasing cultivation, labor and seed costs, unavailability of irrigation facilities, and the rise of real estate demands, agriculture production in Kole lands is reducing and these lands are being converted into cash crops fields and real estate development lands.**

The wetlands are threatened by activities like infrastructure development, mining, excessive fishery practice, and pollution in wetland areas, leading to habitat changes like the invasion of species, saltwater intrusion, changes in water level, sedimentation, effluents, sewage disposal, and floods in urban areas. A total of 120.19 sq. km. (26.86 %)of the Kole wetlands has already been converted for different type of development activities with now remaining to only 327.32 sq. km. of Kole area. While at the district level the Kole area is reduced to consist only 10.80% of the total district area from 14.76%. **Paddy cultivation co-existing with the wetland ecosystem, is also reduced** in the past time due to different factors of conversion for cash crops and development projects.

Issue of pollution in Thrissur city, specifically coastal pollution is caused by industries. **Out of 155 industries identified, 21 fall in the red category and release the highest amount of pollutants and water discharge.** The coastal and marine water pollution has increased globally due to various factors, including direct discharges from rivers, drainage from port areas, oil spills, and industrial and domestic effluents. The need for an action plan to restore sea water quality and address the ecological changes caused by pollution is the need of the hour. The city has four air quality monitoring stations, and the major air pollutants are PM2.5 and PM10, which are found to be present in almost double the permissible limit by WHO. **25% of the district is facing ground water pollution**. Measures that can be adopted to improve the groundwater quality in Thrissur including levying fines on industries that discharge industrial effluents illegally and utilizing district's

wastewater to recharge groundwater.

Figure 1 Flood and Built-Up area analysis of the Kole Lands

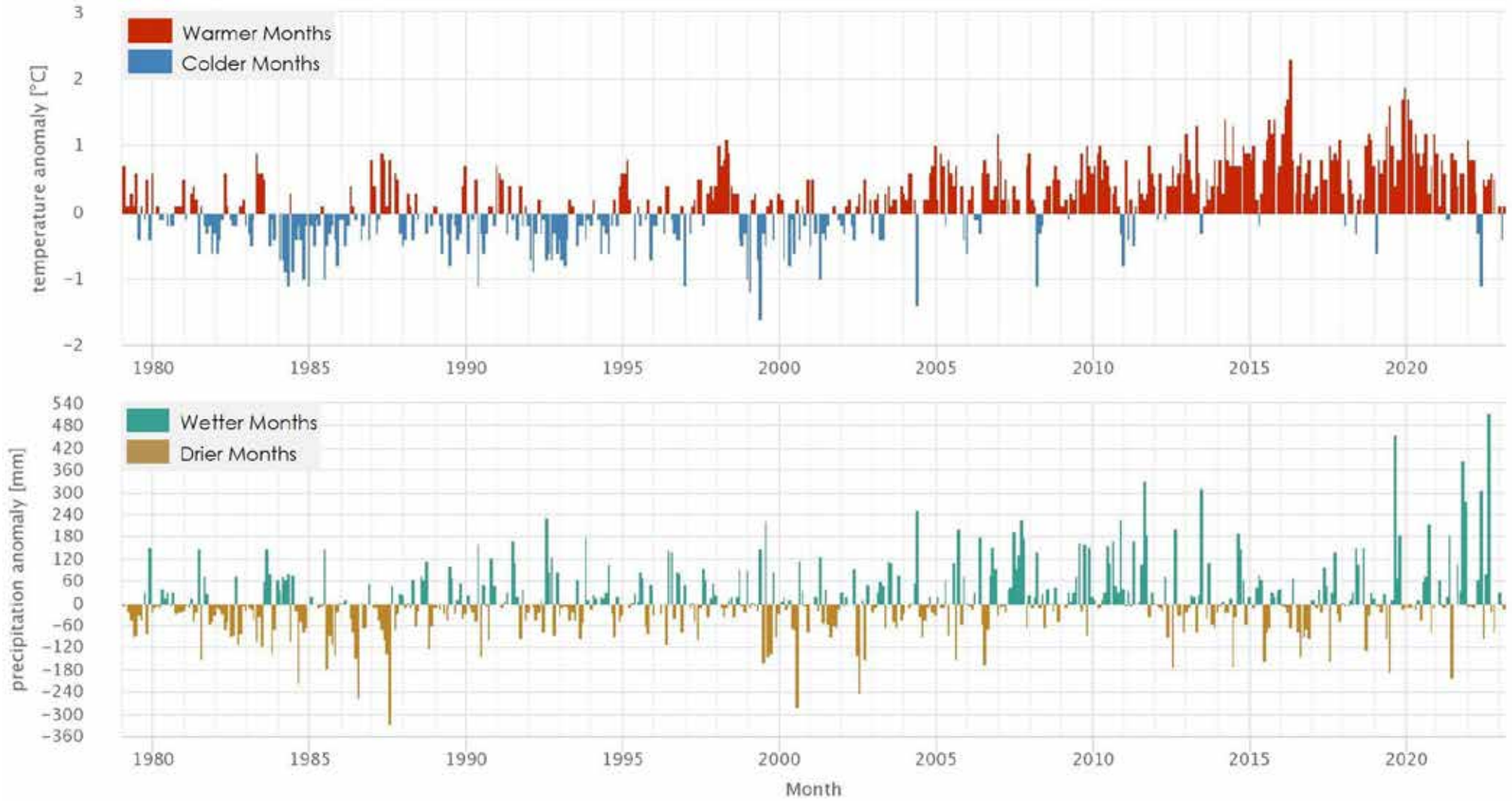


Data Source : Land Use Land Cover Map & Kole Land Development Authority 2022

Increasing climatic changes fuelling coastal hazards

The coastal zones in Thrissur district are facing unique problems due to continuous morphological and shoreline changes. The district has 81.193 km of coastline, with 18 coastal villages affected by coastal hazards. The existing population residing in these villages is 2.9 lakh within an area of 15,762 hectares, and the population density is 18.48 pph. **Coastal areas are vulnerable to disasters, and the destruction of natural habitats and coastal communities has been fueled by mining beach sand and private entrepreneurs taking land in the name of tourism and development.** Only a small percentage of the coastline is stable, while the rest is artificial or affected by low or high accretion. The state has a Coastal Zone Management plan, but violations of CRZ provisions in the name of development worsen the plight of coastal communities.

Figure 2 Monthly anomalies for Temperature and Precipitation of Thrissur, 1979-2023



Source : www.meteoblue.com

Thrissur district is experiencing extreme climate events due to climate change, with increased temperatures leading to health hazards and affecting agriculture and biodiversity. Rainfall patterns have also become more erratic, with some years experiencing more rainfall than others, leading to flooding and droughts. Sea level rise poses a significant threat to coastal communities, with projections showing that 150 sq. km. of land in the Thrissur district could be submerged by the year 2130. GHG emissions from various sources have contributed to climate change, with mitigation measures such as promoting renewable energy and sustainable practices being essential.

Disaster prone zone identification and analysis of land suitability

Thrissur is highly vulnerable to disasters, ranking amongst the top ten landslide-prone districts of the country and with more than 33% of the area susceptible to floods. In 2018-19, over 80,000 people were affected by floods and landslides, resulting in an economic loss of over 595 Crore INR. During the 2018 flood, nearly 30% of the total road length in Thrissur was damaged, severely impacting access to essential services and relief operations. The statistics indicate a need for planned flood-resilient infrastructure, especially roads, to ensure connectivity for emergency operations, the transportation of goods and services, and the import of relief utilities like food and medical supplies. This will reduce the risk of loss of life, prolonged suffering, and economic hardship during disasters.

In the case of Thrissur, a disaster-prone and environmentally fragile city, **the goal of land-use appropriateness is to conserve environmentally vulnerable regions and govern how they are developed**, while discovering more prospective development locations for higher economic growth in a sustainable way. **Land use suitability describes an analysis of eight parameters, with proximity to roads being the highest weighted parameter, to determine land suitability for development.** The results are shown further in a land-use suitability map, with different classifications and permissible activities depending on the level of suitability, with the goal to identify areas suitable for different types of land use, such as agriculture, forestry, urban development, conservation etc.

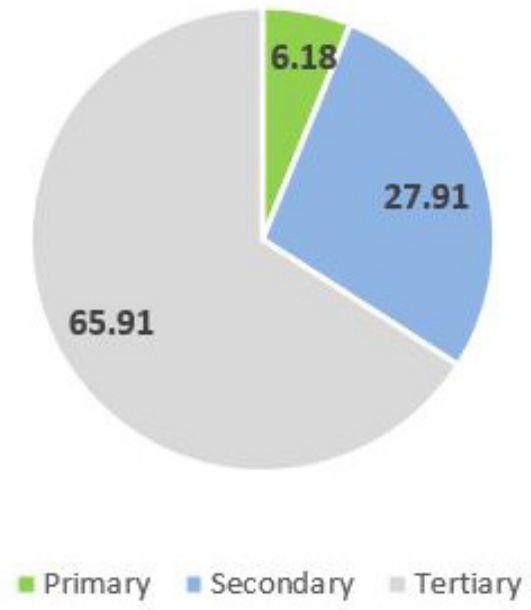
Economic growth of Thrissur

Thrissur is also a major business and commercial center. It is known for its banking, business acumen, gold production, and the production of 70% of Kerala's plain gold jewelry. It is home to a variety of industries, including textiles, wood, coir, fish, agricultural products, and tiles. While the services sector contributes the most to the national, state, and district economies, Thrissur has a higher percentage of industry contribution compared to the state average.

Agricultural scenario and its gaps

Despite having lowest share in the GDP, the secondary sector is an important sector, supporting the other sectors in terms of provision of raw materials and contributing the overall growth. There are various issues which need to be looked at like reducing crop area, and production, insufficient export facilities, slow adoption of new technologies and limited extension services in fisheries sector, reduction in medicinal plant production, gap in fodder availability and non availability of byproduct processing from meat sector, etc. To reduce the gaps and to make primary sector more flourishing, various proposals like fallow & Waste land conversion through lease, GI tagged products marketing strategy, district export hubs, development and preservation of Livestock, Ensuring optimum fodder availability, Eco-friendly technological interventions, modern fish markets and fish processing industries, Ayurveda park has been proposed.

Figure 3 Sector- wise GDVA contribution of Thrissur, 2021- 22



Data Source : Department of economics and statistics, Thrissur

Potential industries of the district

Thrissur district is home to a vibrant small business sector, with 13,327 registered MSME units generating a turnover of 1120 crore and employing 27,928 people in 2022-2023. The district also has 80 large-scale industries, including gold trade, furniture production, handloom, note book making, plastic-based firms, and agro-food processing, among others. **Construction and manufacturing industries contribute the most to the economy of the secondary sector, with the paper industry generating the most turnover per unit followed by gold and general manufacturing industries.** The district has six industrial estates and 11 small industrial parks, with a total of 212 industrial businesses and 125 units respectively. The Kerala perspective plan 2030 emphasizes the augmentation of the Handloom industry, and the district produces 70% of plain gold jewellery in Kerala per day.

Need of planning intervention for the tertiary sector

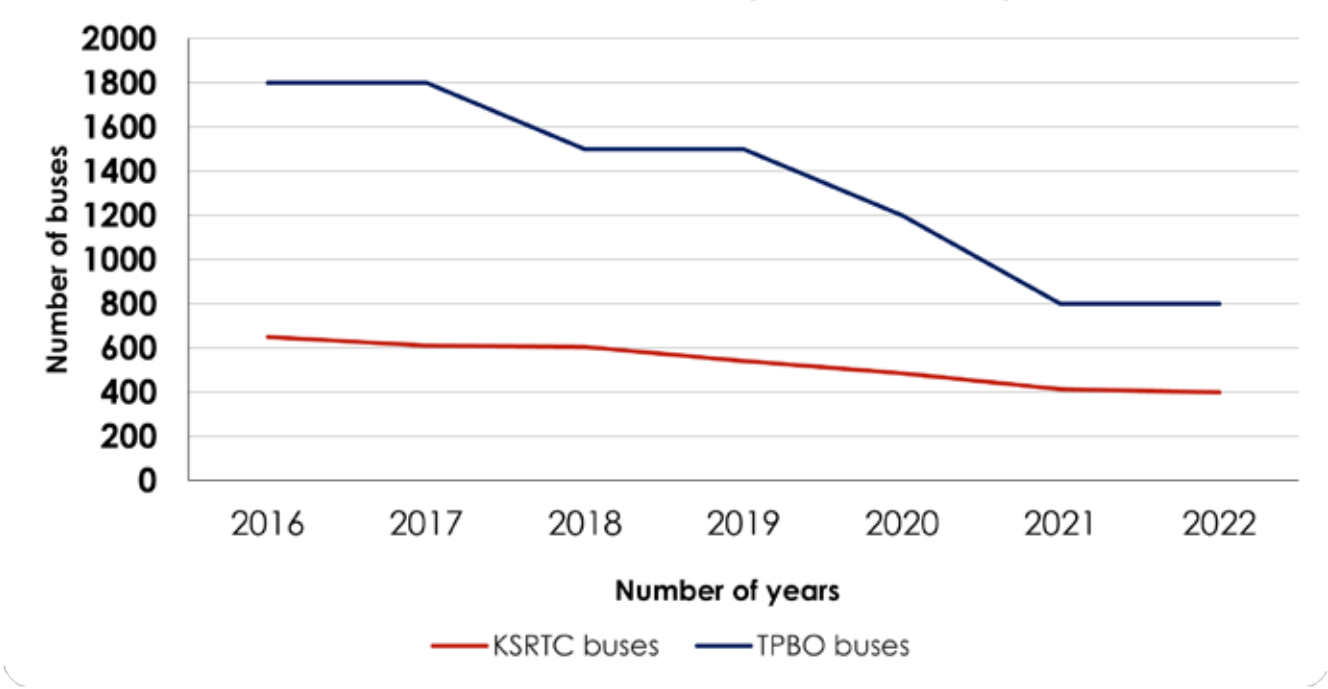
Issues in the service sector of economy of Thrissur were analysed in every aspects. While the tertiary sector seems to be flourishing from a far, there are various shortcomings that were observed. For example, **the real estate was seen degrading the land, IT sector is not creating enough jobs to sustain the youth and tourism sector although booming for the domestic tourists, could not attract foreign tourists.** The proposal for the economy in Thrissur is given to make Thrissur a competitive district. **There are interventions done in four categories, institutions and regulations,**

infrastructure and land, skills and innovation, and lastly, enterprises. For the service sector, there are proposals of Private Economic Zone and THINK cluster to create more jobs and opportunities for the youth. While in tourism there are new circuits created to facilitate better movement between the destinations as well as identification of new destinations along the circuits have been done.

Declining modal share of public transport

The transportation sector of Thrissur was analysed on the aspects of road, railways, buses, IPT, waterways and freight movement. National highways permit a maximum speed of 80 km/h, state highways permit 50 km/h and district roads permit 30- 40 km/h. The NHs in the district have a width of 12-45 meters, SHs have a width of 9-25 meters, MDRs have a width of 6-15 meters, and ODRs have a width of 5-12 meters, **which are lower as per the prescribed IRC standards of road widths**.

Figure 4 Growth rate of KSRTC and TPBO buses in Thrissur, 2016- 22



Data Source : KSRTC Annual report 2021, TPBO Annual Doc report 2023

There are a total of 1200 buses in Thrissur district, with **0.33 bus per 1000 population, which is lower than the national average standard of 1 bus per 1000 population** of MoHUA guidelines. On an average, buses are being used by 5.4 lakh passengers per day. The average growth rate of registered vehicles is 6.83%. It was found that there is a **sharp decline in the growth rate of vehicular registration of buses in modal share from a rate of 3.6** in the year 2016-2017 **to 0.05** in the year 2021-2022 as per the Annual Vehicular Registration Report, RTO Thrissur. The number of KSRTC buses have reduced from 514 buses in the year 2016 to 400 (Refer Figure 4) buses in the year 2023 (KSRTC Annual Report 2021). This **decline can be attributed to rising prices of bus tickets, a reduction in the quality of service particularly in the Thrissur district (Central Zone having minimum buses within the state of Kerala), an inflow of money raising aspirations of the public to own private vehicles etc.**

Accident vulnerability of roads

As per Thrisur police reports, there was a total of 4,748 accidents on 2022, with 8.3 % deaths, 17.7% minor, 69.8% grievous and 4.16% property damages. Contribution of car and two wheeler vehicle in accident are 30.06% and 40.92% respectively. Average growth of accident in last five years is increasing by 12.87% and as well as fatality rate is increasing with 11.26%. On average, there were 10 accidents per day, and 1 person died per day in Thrissur due to road accidents. The average fatality per 100 accidents is 8, which is comparatively lower than the national average being 1,130 accidents and 422 fatalities per day. Four roads - NH66, NH544, SH22, and SH69 - have the highest accident rates per km. The sudden decrease of road capacity from four lane to two lane road and the diversion tendency of drivers into the minor roads makes more accident vulnerable.

Identification of waterways to combat carbon emission

As seen, Thrissur's NH66 is highly skewed toward road congestion and accounts for 90% carbon emission via. road transportation, the emission from diesel contribute 64%, whereas the remaining from petrol. To mitigate this NW3 is identified for IWT mobility from kottapuram traversing Thrissur which runs parallel to NH66, which is economic, fuel efficient and cost effective and free from congestion and environmental friendly as analysed. Useful for trade traversing from kochi and beypore ports & in Thrissur for tourism, fisheries trade from fish landing centres and harbours.

Although the district was identified to have complete vehicular accessibility within 45 minutes of drivetime, there are several persistent problems contributing to the deterioration of connectivity. **The aforementioned problems include a lack of end-to-end connectivity, unavailability of upgraded infrastructure and facilities, irregular time schedules and routes for public transport, safety issues for vulnerable road users, increase in travel time due to undulated topography and settlement pattern with short term development.** To combat the identified problems, i**t is being proposed for Thrissur to have an upgraded and integrated system of transport with the aim of improving last mile connectivity.** Proposals would be integrated under the Monorail and the

Multi-Modal Transport hub to provide seamless connectivity drastically improving the passenger and daily commuter experience to transform Thrissur into an example of Sustainable Public Transit systems.

Addressing educated unemployment and need for sports integration in the district

Apart from road infrastructure as discussed above, the other infrastructural categories of Thrissur include social (education, healthcare and sports, palliative care) and physical (electricity, water suply and solid waste management). The scenario of education in Thrissur has remarkable infrastructure up to high school level and government schemes that have contributed to the upliftment of primary education. However, after passing higher secondary level, one faces a dilemma as **the colleges are not enough to accommodate the growing number of students and lacking technical courses and their aligned jobs, highlighting the issue of educated unemployment in the state due to the lack of job-oriented vocational courses and neglect of professional and technical education. The government's negligible contribution in encouraging self-entrepreneurship also is one limitation.** Various proposals needs to be worked upon to eradicate the condition of educated unemployment, including upgradation of technical education, targeted skill development for self-entrepreneurship, and Thrissur as an educational hub.

The district is facilitated with excellent primary healthcare facilities, a decentralized system of healthcare, and a strong focus on Indian System of Medicine (ISM), **but the district needs to invest in the sports and fitness sector to create a healthier population and explore opportunities for sports as a career.** The district also has a large pool of qualified professionals that could be exploited to develop national level research institutions.

Demand for old age homes and palliative care

By analyzing the decadal change in demography it can be studied that in every decade percentage of children is decreasing and the elderly population is increasing. Presently child is 22% (6.88 Lakh) and the elderly is 14% (4.28 Lakh) and it keeps changing continuously, affecting WFPR. The economic dependency in Thrissur will increase in the future. This is because the life expectancy of females (79.2 years) is higher than males (73.5 years), and the sex ratio of Thrissur is 1108, which indicates that there are more females than males. Therefore, **in 2047, the major elderly population will be female, and most of them will be widows.** Additionally, the **low workforce participation rate of women (15% in 2001 and 19% in 2011) compared to men (50% in 2001 and 53% in 2011) suggests that the dependent female elderly population will be higher and they will be completely economically dependent.** This scenario could have significant implications for the economy and social structure of Thrissur in the future. In the region, the disabled population is 2.1% (66137), with an equal distribution between rural and urban areas and a slightly higher representation of females (52%). **The majority of disabilities (24%) are related to movement, and disabled children make up 9.0% while disabled elderly people comprise 32% of the total disabled population.**

Analyzing gaps in physical infrastructure

Thrissur has multiple power generation and distribution institutions, including KSEB Limited, Thrissur Corporation Electricity Department, Anert, Energy Management Cell, and Electrical Inspectorate. The district has significant potential for solar and wind energy generation. The district's energy consumption pattern is 52.41% domestic, 14% commercial, 11.26% industrial, and 14% agricultural. The Thrissur Corporation aims to create 250 million units of electricity by 2025 and has already erected a 200KW solar plant as part of this project.

The district generates over 300,000 tonnes of household waste per year, with over two-thirds being biodegradable. Biomedical waste is processed in a treatment plant in Palakkad. Biodegradable waste is treated in several plants and through pig farming, but t**here is a gap of 7.04 TPD for solid waste management in Thrissur Municipal Corporation.** Non-biodegradable waste is exported, and there is no processing plant for construction and demolition waste. There are issues with the toilet system in the district as well and the existence of sewage treatment plants to address water contamination.

Water related issues include scarcity, which is caused by the drying up of hand pumps and wells, which results in a shortage of drinking water in certain areas. Secondly, **coastal erosion and waterlogging affects the groundwater quality in coastal aquifers.** Further groundwater depletion is becoming a problem in semi-urban regions due to extensive groundwater depletion. **Quarrying and the removal of vegetation for construction and laterite removal are other issues that negatively affect the groundwater quality and flow patterns, causing the drying up of wells and boreholes.** Iron above permissible limits in groundwater has been observed in some areas. Techniques such as groundwater recharge and conservation might help in mitigating these issues.

The analytical issues discussed so far highlights the need for aligned proposals, through which the issues can be intervened spatially, with the aim of achieving a competitive district and sustainable development.

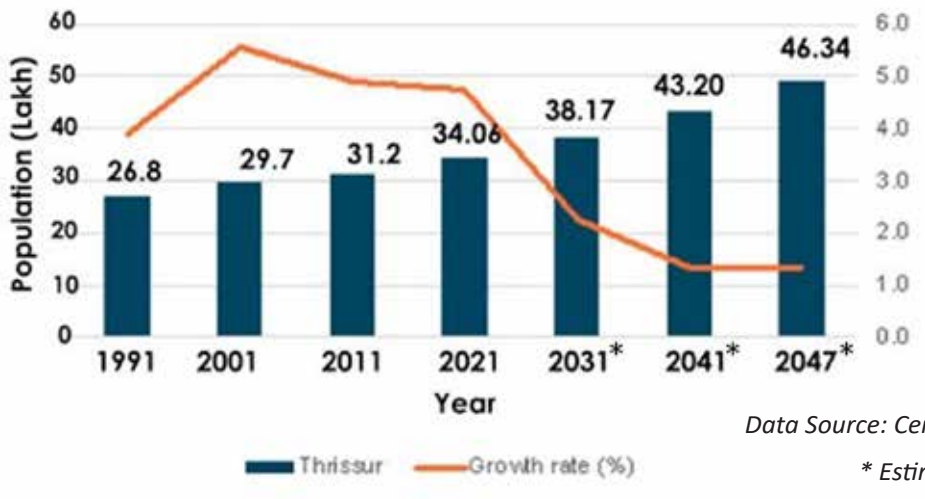
Population dynamics for the year 2047

The population of Thrissur district shows a gradual increase from **31.21 lakh in 2011** to **46.34 lakh in 2047** (Figure 5). Most of the important decisions like the demand for water, power and waste disposal facilities, housing, open spaces and schools, the supply of labour etc. are all estimated from the projected population. Urban and rural population of Thrissur has witnessed changes drastically from 67% urban and 33% rural in 2011 which is according to projections, 81% urban and 19% rural currently and will stand at **90% urban and 10% rural in 2047.** Thrissur's decadal growth rate depicts a decrease from 1991 to 2047 from **10% to 1.33%**. The growth rate is positive, but its rate of change is negative.

Furthermore, due to a higher number of young people leaving the district than coming in, the district is predicted to become 'grey' by 2047. This would have a negative impact on the future demographic profile and create economic issues. The disabled population in the region is 2.1% (66,137), with an equal distribution between rural and urban areas and a slightly higher representation of females (52%). The majority of disabilities (24%) are movement-related, and handicapped children account for 9.0% of the disabled population, while disabled senior adults account for 32% of the overall impaired population. While the decision to have fewer children has an immediate impact on individuals, Policy interventions that look at family planning at two levels - policy and service level may have an influence on society as a whole.

To establish the provisions for facilities to cater to the needs of the projected population, **2 growth centres, 3 growth points, 12 service centres, and 72 central villages** have been proposed by employing the cgntrality index method. These indicated places would aid in the implementation of the district's improved infrastructure.

Figure 5: Population trend and growth rate for Thrissur from 1991-2047



Data Source: Census 1991-2011,

** Estimated by author*

To create a seamless and efficient network of transportation systems.

The proposals range from the development of new transport infrastructure to the implementation of innovative technology which enhances safety and comfortable transportation. Based on the analysis, **road upgrade plan** is proposed for the district covering a total length of 93 km, out of which 88.86 km would be for road upgradation and 4.13 km will be for new road construction using a combination of Public-Private Partnership (PPP) and Build-Operate-Transfer (BOT) models. To enhance the quality and efficiency of bus transport systems, **sustainable bus transport improvement plan** has been proposed which includes Introducing Intelligent Transportation systems (ITS), improvement of bus depots capacity and parking spaces, expanding the fleet of low-floor buses, introducing real-time information systems, increasing bus frequency, increasing bus frequency, provision of electric buses and EV charging stations and introduce online bus ticketing and payment systems.

Within the plan, **new bus routes, bus depots, integrated terminus with multi modal hubs** have been proposed. 18 new bus routes were identified which would be situated along the 2 national highways NH66 and NH544, the different state highways and the major district roads. Furthermore 27 subroutes for buses were identified along the other district roads. The total route length of the identified routes amounted to 1342 kms of road length. It was analyzed that for the year 2047, with a bus fleet of 4632 buses there would be a requirement of approximately 8 bus terminus. Additionally, to facilitate electrification of buses, 4000 electric buses, EV stations at all bus depots and terminus facilitated by a proposed solar park have been proposed to reduce the carbon footprint.

Modernization of Intermediate Public Transport (IPT) Services has also been proposed which includes formal IPT stands on existing routes, formal parking spaces for IPT, and promoting the use of IPT as shared services, rationalizing the existing public transportation routes and restricting the use of IPT only in the inner areas of the city and prioritizing electric auto permits over conventional vehicle. To reduce traffic and encourage modal shift from private to public transport, the construction of a **monorail transit system** for regional connectivity has been proposed. It would comprise 3 cars with expected capacity of 500-675 people. With the headway of 15 minutes, it can carry 2700 people per hour and with 5 minutes headway can carry 8100 people per hour. Another proposed initiative to enhance commuter connectivity and accessibility is the **Multi-Modal Transport Hub (MMTH)** of total area 90 acres that integrates train, auto/taxi, bus service, and waterway for seamless and end-to-end connectivity. The hub would include a warehouse with a capacity of 700000 cubic feet, a cold storage facility spanning 30,000 square feet, and a container freight station capable of handling 50 containers per day. **Introduction of air taxis and water taxis** have been proposed in the district as part of the multi-modal transport system. The integration of all proposed transport systems would ensure end-to-end connectivity and would create an exclusive model for the state and improve travel experiences.

Driving an outlook plan for climate resilient district

The proposed district resilience plan seeks to address various challenges and ensure the long-term sustainability of the region and its communities. Incorporating resilience into the Thrissur district regional plan is crucial to ensuring the region's prosperity and well-being. Firstly, **climate change mitigation strategies** include use of renewable energy sources, imposing taxes on the use of fossil fuels and CO2 emissions markets, sustainable mobility, circular economy through waste management, conservation of eco-sensitive areas and preservation of biodiversity. Moreover, by switching to **inland water transport mobility,** which is a cost-effective, environmentally and fuel efficient form of transportation, reduction in carbon emissions will be achieved. For the management of human wildlife conflict, the proposal involves **creation of barriers** in different divisions, **deploying deterrents**, or active guarding, and creating more protected areas and buffer zones, with enhancement of the safety of people and wildlife.

Furthermore, to ensure that the connectivity routes remain flood-resistant and to lessen the effect of extreme weather events on the transportation infrastructure, **flood-resilient connectivity routes** are proposed, featuring an elevated design, effective drainage systems, use of resilient materials, and roadside barriers. For the coastal stretch, **three coastal regulation zones**—Coastal Regulation Zone I (CRZ 1) from 0-250 m from the coastline, being the most vulnerable, CRZ II from 250 m to 500 m, and CRZ III from 500 m to 2000 m—have been proposed to regulate the development in a sustainable manner. These zones outline the activities that are prohibited, permitted, and infrastructure-related in each proposed regulation zone.

Additionally, for the **river development**, proposed project consists of three phases: a short-term plan that focuses on the immediate actions to be taken to revitalize the river; a mid-term plan that focuses on water management, providing river regulation zones and categorizes activities as prohibited and permissible; and a long-term plan that focuses on enhancing the overall quality of the rivers. For the conservation of kole wetlands, **kole regulation zones** are proposed along with land and project management interventions, policy intervention guidelines, databank preparation guidelines, improving infrastructure services, encouraging economy generating activities, rejuvenation of canal and using them for lotus farming. Moreover, **sustainable groundwater and surface water management plan** will be developed for the Thrissur district, paving the way for water resilience in the area benefiting the public, developing healthy, long-term water-oriented amenity corridors giving rise to new growth zones and prospects for land value capture. **Smart agri villages** are proposed to promote smart agriculture and are models showcasing sustainable and self-reliant farming systems encompassing all integrated approaches for natural resource conservation. Through the project, 10 villages in the district will adopt efficient cropping systems, organic farming, demo plots, fish farming, and agro-clinics for crop protection.

Pipeline of socio economic infrastructure projects, attracting investments, increasing industrial growth and opening new development opportunities.

The proposed projects are the initiatives to focus on socio economic development of the district including housing, education, sports, investments, and the elderly sector. For housing development of the district, **all-inclusive and resilient housing for sustainable communities** has been proposed, which targets the housing needs of the population which is and will be residing in the district in the coming years by providing them with resilient, all-inclusive housing as well as developing an efficient mechanism in provision and development of housing facilities, especially to the marginalized and the migrant workers. Considering the environmental sensitivity of the region, housing as a sector, would focus on sustainability and affordability for the communities, on top of it will be an anchor to the infrastructure and social development in the region.

For developing the education infrastructure, the proposed project focuses on **enhancing human resource through optimisation of infrastructure**. This aims to upgrade the educational infrastructure of Thrissur, keeping in mind the scarcity of land, by incorporating the proposed institutes into thé existing infrastructure of schools, colleges, universities & public libraries. It will help in mitigating migration by providing optimum opportunities & exposure to the youth as well as making the district competitive as a whole.

Thrissur has a commendable healthcare system with accessible, equitable, affordable, and quality healthcare services for all. However, there are new threats to the health scenario, such as mental health problems, lifestyle diseases, etc. Rapid urbanization, drastic lifestyle changes, heavy alcohol and tobacco use, affinity for corporate jobs, low priority for exercise, high levels of stress in all strata of population are some of the reasons contributing to the prevalence of these diseases. Thus, to ensure healthy, active and productive life to the people, **district sports grid** project has been proposed to promote healthy living among all segments of society, in line with the Kerala Sports Act 2000's guiding philosophy of "Sports for All" and "Health for All". This proposal seeks to make physical activity and sports an integral part of an individual's lifestyle and society as a whole and thus translates into benefits in terms of health, social cohesion, economic activity, cultural enrichment and improved quality of life.

Thrissur has a growing elderly population that demands the highest standard of care and support. Therefore, **age-friendly infrastructure for the elderly people** has been proposed which aims to provide age-friendly infrastructure for all. This mainly focuses on the elderly by providing palliative care at different levels according to their need, mainly serving the age group of 80+ and disabled elderly. Also, the targeted programs are proposed for building employment opportunities for the age group between 60 - 80. The district has witnessed a significant growth in the service and the manufacturing sectors and there is scope for future growth in the ecological, social, and financial sectors. This implies that businesses in these areas may benefit from increased investment and support to help them grow and develop further. Therefore, **sector-specific investment programme** has been proposed for the district which aims to provide a sector-specific investment scheme

for each block to target the social welfare needs, environmental mitigation and start-up business financing with the greatest potential for growth, leading to a sustainable and inclusive economy.

Reaching new heights in physical infrastructure development

To meet the future demand of the district, several initiatives have been proposed for the development of the physical infrastructure as it serves as the backbone of growth regardless of sector. The project **Urjayati urja** has been proposed to meet future electricity needs while promoting sustainability, focusing on renewable energy and energy efficiency measures, including the generation of electricity from 200 MW solar, 50 MW wind, and 20 MW waste-to-energy sources. To address the projected water requirements of industrial and for irrigation and reduce dependency on ground water and meet the district's future water needs, a **sea water desalination plant** with a capacity of 100 MLD would be developed on 60 acres of area in the district at a cost of 500-900 crores. To enhance the **sewage treatment system** and the **solid waste management** of the district, certain initiatives have been proposed. 60 STPs using Bio membrane reactor technology , having a treatment capacity of 618 MLD out of a total of 625.37 MLD. The remaining 7.73 MLD will be treated at biomethane plants. The total area needed for the STPs is 49.44 ha. SWM is divided into vermicompost, windrow, and biomethane plants with treatment capacities of 160 TPD, 792.23 TPD, and 263.77 TPD, respectively. The required areas for these plants are 10 ha, 13.20 ha, and 2.20 ha,

Increased production, marketing and economic growth

Keeping in mind the objectives of the regional plan for symbolic economy, **fallow & waste land conversion through lease** will be implemented that will include identifying lands and allocating to farmers for 30-year leases, aided by corporate social responsibility (CSR), creating shared value. Moreover, a **district export hub** is proposed at two potential locations in the district considering the connectivity and production of crops in the domain. MSMEs, farmers and small industries will be benefited through the export opportunities in the expanded markets, draw investments, boost manufacturing, reduce transaction cost for the exporter and generate employment in the district. Additionally, a **marketing plan for GI products** is proposed to be put forth in four stages, starting with the creation of the logo, tagline, and "Made in Thrissur" strategy and continuing with the annual festivals and fairs, encouraging promotional activities, and product innovation in order to appeal to a larger market.

Furthermore, the demand and supply gap in the dairy sector will be focusing on three factors - cattle rearing at the household level, fodder availability throughout the year, and **integrated indigenous cattle centre**. Proposal for **fodder development** enhancing current yield capacity of 200MT/Ha through green fodder and enhancements, while **new egg nurseries** to bridge the gap, enhancement of the fowl population, and introducing new nurseries at deprived areas. For increasing meat production, **pig fattening units** are proposed through improved feed for rapid fattening. Also, to tackle the challenges faced by the fisheries sector, the use of **recirculatory aquaculture systems (RAS)**, an innovative and sustainable fish farming technique will be used. The proposal also includes

modern fish markets and fish processing industries in four villages in the district that are well connected to the fishing harbors and national highways, with the potential to bring positive changes to the lives of the fishing community and boost the local economy.

With the concept of sustainable production, conservation, and achieving economy through the marketing of medicinal plants and production, an **ayurveda park** is proposed with an objective of making the district, a central hub of ayurveda industry through the PPP model linking cultivators, industries, and research institutes. Moreover, 2 industries have been identified in each block of Thrissur for the proposed scheme **"One Block Two Industries"**. **Primary Processing Centers (PPC)** concentrating on the manufacturing subset, **11 agro-processing clusters and a central processing center** around the intended PPCs will also be developed to provide a way to link agricultural products to the market.

Unfolding the role of manufacturing sector in boosting economy

Kuthampulli village in the Thrissur district is well-known for its kasavu handloom weaving of traditional saree. In order to promote the sector, **handloom village upgradation and handloom park** is proposed within a 5 km radius for 2000 weavers over a 10-year period, under the mega handloom cluster development programme in the national handloom development programme (NHDP) requiring funding of 70 crores per cluster for a 5-year period. It will include areas set aside for women to gather and perform the spindle work for the looms in the handloom park while being paid for it. It will also serve as a destination for tourists to learn about and observe the production of the Kuthampully saree and include areas for fairs and exhibitions.

In the construction sector, phosphogypsum being a solid by-product of the production of phosphoric acid, can be utilized to support comprehensive socioeconomic growth across all regions, draw investments into the district to promote manufacturing and exports, create jobs, and establish an environment that fosters innovation and technology at the district level, but currently, a significant proportion of it is getting wasted without being processed, leading to significant environmental damage. Thus, **phosphogypsum products manufacturing industry** is proposed with an area of 2 acres seeking an employment generation of 250 investors through the PPP model. Furthermore, in order to promote Thrissur's gold heritage and traditions, a **gold exhibition center and gallery** is proposed with an area of 17 acres and expected employment for 3000 people and 1000 exhibitors. It will be in Thrissur M Corp. and include facilities for showcasing various types of jewelry made by skilled artisans and also host competitions based on the uniqueness of the jewelry design.

Thrissur as a "Competitive District"

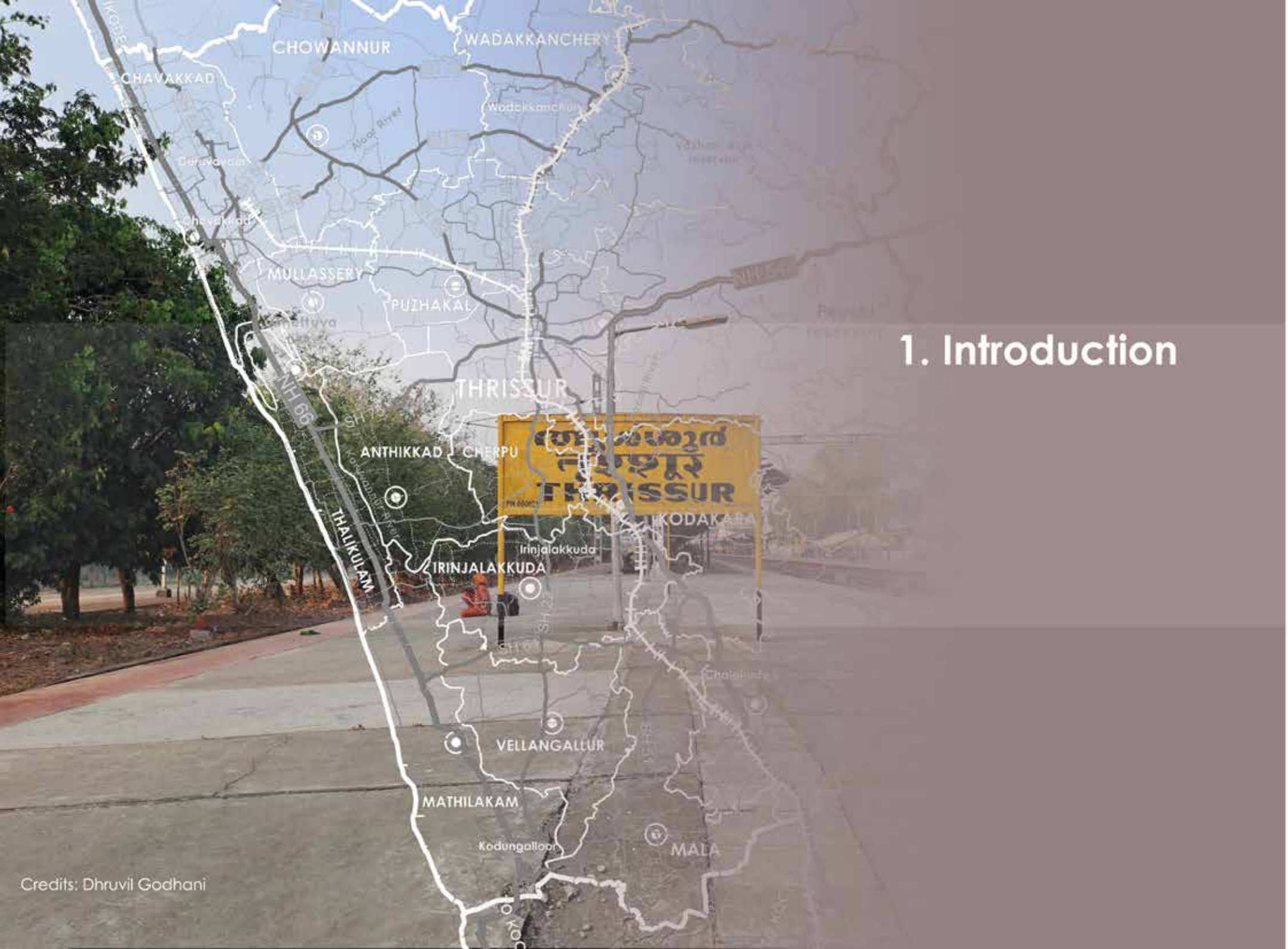
While Coimbatore, a city near to the Thrissur district, is a competitive city, Thrissur is proposed as a whole competitive district. In order to alleviate the economic issues of the district, competition is increased through proposals in four intervention categories namely **institutions and regulations, skills and innovations, infrastructure and land and enterprises**. Through the various economic proposals in the above mentioned category, Thrissur is projected to have increased job

opportunities, better liveability and services. To enhance the economic development as well as encourage employment for the service sector, a **Private Economic Zone (PEZ)** has been proposed which aims to create about 18,000 jobs in the IT sector for the youth f the district. Covering an area of 45 acres, PEZ works towards the institutions and regulations as well as the enterprise solutions to create jobs while also shifting the focus of the real estate projects from the kole wetlands to an identified growth point. In order to achieve the aim of climate resilience, the economic zone will be IGBC green SEZ certified. **THINK (Thrissur Innovation and Knowledge) cluster** is another proposed initiative which aims to create a platform for the collaboration of science, technological innovation, industry and entrepreneurship. The cluster would cover an area of 6 acres and create over 10,000 jobs, would combine academic, industrial, corporate, and start-up ecosystems to establish a hub actively encouraging innovation, knowledge generation, and technology implementation for socio-economic benefits.

Promoting the unique cultural and historical heritage of Thrissur, the proposal aims at creating vibrant and **sustainable tourism** in the district, opening economic and social opportunities for local communities by encouraging tourism-related businesses. Developing **kuthampully (pazhayannur) and kalashamala as responsible tourism destinations** where tourists can experience the local culture with funding of 3-4cr approx. Also, the revival of various pilgrim centers is proposed and development of potential beaches will be undertaken promoting adventure tourism along with skill development. Furthermore, a **transformational retreat and remote habitat center** is proposed with the objective to provide experiential tourism and will act as a work-cation place, planned for corporate organizations sending their employees to work remotely from safe spaces in attractive natural settings and revitalize themselves by living in nature and the project cost being 1.5-2 crores. Also, to showcase Thrissur's rich culture and heritage, a **five-day festival Thrissur ulsavam** will be conducted once a year in Nov - Dec for 5 days and will attract approximately 15000 visitors initially providing visitors with the opportunity to explore the city's heritage sites, pilgrim sites, cultural sites, eco-tourism village, handloom village, beaches, and waterfalls.

With the objective of designing a time-bound package connecting destinations and increasing the staying time of tourists in the district, **new tourist circuits** are proposed and will be divided into 3 zones namely, North Zone, Center Zone, and South Zone. Each zone will have an urban area acting as the hub for that zone which will have sufficient infrastructure and connectivity to main city.

Understanding the identified challenges and supporting proposals, the further detailed report is formulated with a deeper insight



1. Introduction

Credits: Dhruvil Godhani

1. Introduction

Regional Planning is essentially a spatial economic planning across a region. In planning parlance, a 'Region' is defined as a well delineated space, often larger than a city having spatial contiguity, socio-cultural cohesiveness, fairly homogeneous natural endowment with a definite statistical and administrative unit. Since spatial planning in India is largely confined to its towns and cities, the space between cities and their surroundings has been growing in an unplanned haphazard manner. Under this backdrop, a regional plan can bring holistic development across rural and urban settlements of different orders and hierarchies. This would mutually benefit the rural and urban settlements by harnessing their growth potential and would thereby build a prosperous region.

Although a regional plan is usually prepared for regions having distinctive natural characteristics like coastal region, hilly region, riparian region, tribal region etc., an administrative district has lately been considered as the ideal unit of the regional plan. In order to achieve optimum outcomes in terms of balanced development with convergence of resources and enforcement of inter-sectoral priorities across space, District Planning is regarded as the most prudent intervention for overall economic growth and development of a district. Planning for the district as a region is therefore considered as the most suitable approach under which the entire country as whole can be covered in the spatio-economic planning exercise. The distribution of natural resources across the hierarchy of settlements in the district makes it most convenient unit of planning with a sound logical premise. The significance of district planning was not only acknowledged during the planned regime of India's development trajectory, but it was also constitutionally recognized as the viable unit of spatio-sectoral (economic) planning by the Seventy Fourth Constitutional Amendment Act 1992 which provided for the constitution of District Planning Committee.

For the study purpose, Thrissur district has been identified for the preparation of the regional plan. Thrissur, previously known as Trichur, is a city in Kerala, India, and serves as the administrative center for the Thrissur district. It is the third largest urban area in Kerala, following Kochi and Kozhikode. Often referred to as the "cultural capital of God's own country," the district covers a total area of 3032 sq. km and had a population of 2,974,232 according to the 2011 census. It is divided into seven taluks: Thrissur, Chavakkad, Talappilly, Kunnamkulam, Mukundapuram, Chalakudy, and Kodungallur. The district is further divided into 16 blocks and 86 gram panchayats. It has eight urban local bodies, consisting of seven municipalities and one Municipal corporation.

Thrissur's natural environment is characterized by verdant forests, undulating hills, and picturesque backwaters, which make it a popular tourist destination. It is home to several major river systems, including the Periyar, Chalakudy, Karuvannur, Kurumali River (which is the main tributary of the Karuvannur River), and the Ponnani (Bharatha Puzha), which creates a vast estuary. Agriculture is the mainstay of the local economy, with the primary crops being paddy, coconut, and rubber. The district also boasts a thriving manufacturing sector, with textile and jewelry production being its main industries. Furthermore, the district is an education hub and is home to various well-known universities and research institutions.

1.1 Vision, Aim and Objectives

This regional planning academic exercise is intended to inculcate the knowledge and skill sets related to the preparation of district plan in line with the principles outlined under different planning and development guidelines. With a vision to transform Thrissur into a hub of climate resilient sustainable symbolic economy, the proposed regional plan aims to achieve climate resilience, economic prosperity and balanced regional development based on the pillars of symbolic economy through sustainability. These pillars include economically and ecologically resilient systems, creative education and knowledge based economy, and identity amongst the community using their culture and heritage, marketing the city internationally and developing the industries.

To achieve this vision and aim, the study outlines several objectives, including the analysis of the existing resources and economic base of the district, identification of potential sectors, assessment of the existing infrastructure and estimation of future requirements for climate resilient symbolic economy, recommendation for facilitation of sustainable solutions for the symbolic economy development and preparation of socio-economically and ecologically sustainable balanced regional plan of Thrissur district.

Vision: To transform Thrissur into a hub of climate resilient sustainable symbolic economy

Aim: To achieve climate resilience, economic prosperity and balanced regional development based on the pillars of symbolic economy through sustainability

Objectives:

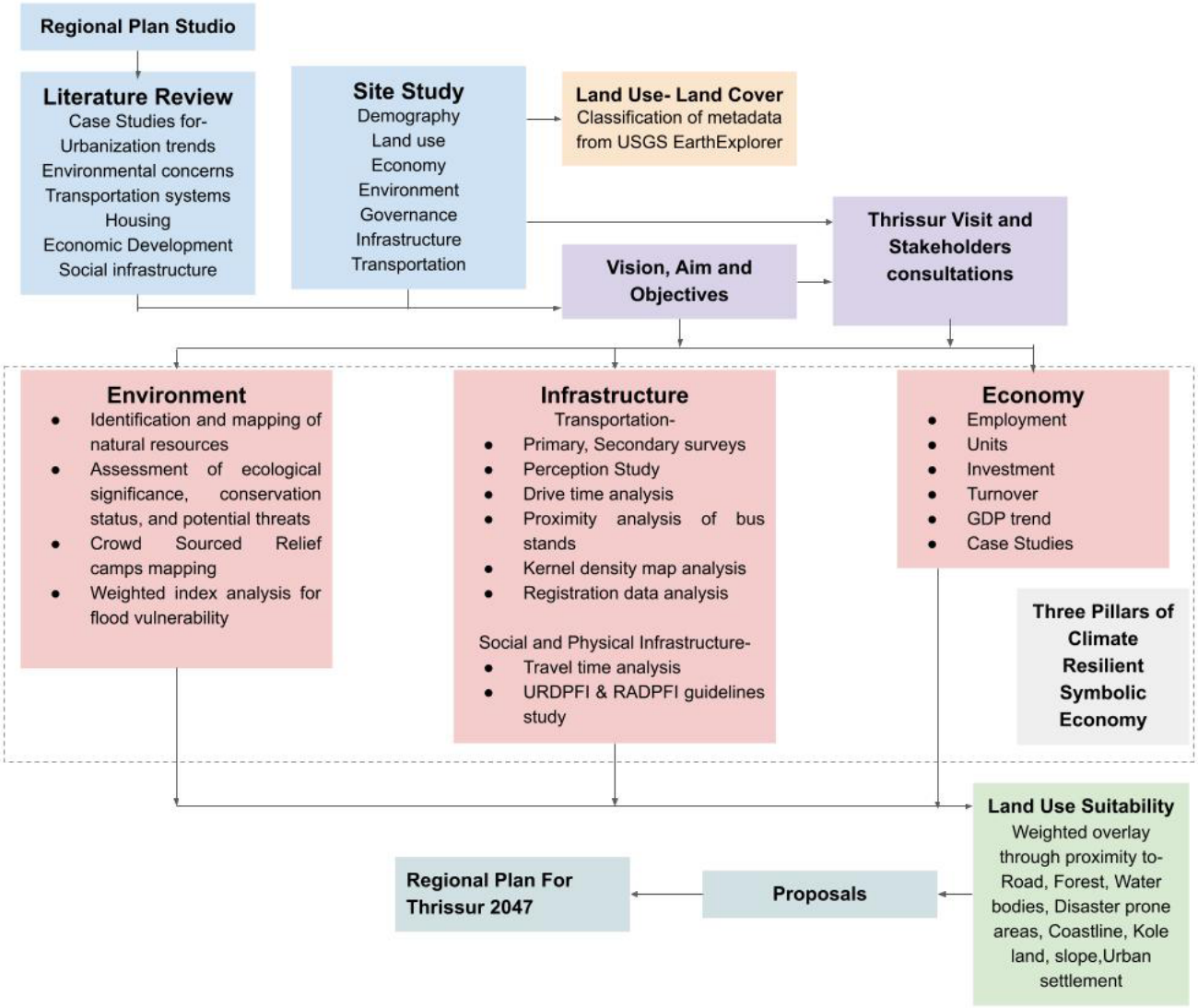
1. To analyze the existing resource and economic base of Thrissur district.

2. To identify the potential sectors, assess existing infrastructure and estimate the future requirements for climate resilient symbolic economy.

3. To recommend sustainable solutions for facilitating symbolic economy development.

4. To prepare ecologically and socio-economically sustainable and balanced regional plan of Thrissur district.

Figure 1.1 Methodology



1.2 Methodology

This methodology presents a systematic approach to develop a regional plan for Thrissur, India. The methodology encompasses a series of steps, including literature review, data collection and analysis, stakeholder engagement, and proposal formulation. Various analysis methods are employed to understand the existing conditions, identify key issues, and devise appropriate strategies and proposals for the regional plan. The process began with a comprehensive literature review, followed by data collection and analysis using various techniques discussed further in this section, stakeholder consultations, and ended with the formulation of a final regional plan.

1.2.1 Literature Review

An extensive study of the various national and international case studies with similar aspects to that of Thrissur was carried out. The review included studies on urbanization trends, environmental concerns, transportation systems, housing, economic development, and social infrastructure. For example, the Kollam district development plan was studied to understand the southern India reference in district planning. There were various parallels drawn between these case studies and Thrissur through the

literature review as well as the methods for analysis were inspired from the former.

1.2.2 Site Study

History of Thrissur as well as the administrative setup of Thrissur was studied further in detail to understand the context of the district before advancing to the analysis of the different aspects of it. The different aspects studied were, demography, land use, economy, environment, governance, infrastructure and transportation. The Land Use- Land Cover (LULC) was prepared by classifying the metadata obtained from USGS EarthExplorer into ranges and generated in ArcGIS to understand the current scenario of land development of the district.

1.2.3 Establishing the vision

Since Thrissur is the cultural capital of India, it is important to develop not just the physical aspects of it but also preserve its intangible characteristics. In order to achieve this, the vision of a "Symbolic" economy was adopted for the regional plan. Establishing a vision is a crucial step in the regional planning process as it provides a clear direction and purpose for the development of Thrissur. Through the vision, literature review and study of Thrissur district in various aspects, there are three "pillars" of Symbolic Economy that were defined and studied. These three pillars are-

(a) Environment

(b) Infrastructure

(c) Economy

Along with the symbolic economic development, the district is also envisioned to be climate resilient. The resilience is possible only when all the different aspects are studied and molded to achieve the vision of "Climate resilience symbolic economy". Thus, primary and secondary data were gathered in accordance with the vision established. The data is then analysed keeping the base of various standards like URDPFI.

1.2.4 Thrissur Visit and Stakeholders consultations

Once the vision, aim, and objectives were established as well as the study of Thrissur was conducted through online means, the class of 36 students along with the three faculty members, went for a 10 days study tour to Thrissur. This study in Thrissur was carried out in various groups of students to cover every aspect of the district. Along with the various office visits, the students and the faculties also had multiple meetings with the key stakeholders in the administration of district like the District collector, Thrissur Management Association (TMA) members, ESAF Bank Chairperson and other members, and Kerala Institute of Local Administration (KILA) members as well. The district's operations were well understood by the children as a result. Along with the students from Government Engineering College (GEC), Thrissur, the students visited each of the 16 blocks in order to overcome the language barrier and learn about the blocks through the block offices in order to better grasp the context of blocks existing in the district. Various reports were gathered from these block offices and analyzed to determine the problems and the advantages of the individual blocks.

1.2.5 Data Collection and Analysis

To understand the existing conditions and identify key issues, comprehensive data collection was undertaken during the visit. Primary data, such as surveys and interviews, and secondary data, including census data, satellite imagery, and existing plans, were gathered. Geographic Information System (GIS) techniques were employed for spatial analysis and visualization. The collected data was analyzed using various methods. The methods according to the pillars of symbolic economy are discussed below:

(a) Environment

The environmental factors, such as air quality, water bodies, and natural resources were assessed to identify areas of ecological significance and potential risks.

The data from local authorities was used to assess air and water pollution levels in different areas of Thrissur. Later, the data was analyzed to identify pollution hotspots and sources, such as industries or traffic congestion or polluted wells. Identification and mapping of natural resources like forests, wetlands, and biodiversity-rich areas using satellite imagery, GIS data, and on-ground surveys is done. Assessment of ecological significance, conservation status, and potential threats through secondary data obtained from the concerned authorities was carried out.

In terms of disaster risk assessment, vulnerability mapping is done based on the parameters including, geographic area affected, agricultural area, population affected, length of connectivity affected by spatial analysis using GIS. For the data regarding relief camps there

crowdsourced maps of Thrissur flood 2018 was used from Google. Weighted index analysis using the above parameters to identify the most flood vulnerable blocks was adopted as well.

(b) Infrastructure

The methodology for assessing the transport and connectivity scenario in the study area includes four types of surveys: primary, secondary, tertiary, and perception surveys.

The primary survey involves traffic volume count at different locations in the study area. This data helped to understand the traffic flow pattern, identify areas of congestion and traffic bottlenecks, and prioritize the development of infrastructure accordingly.

The secondary survey included data collection from various department offices related to transport and connectivity, such as the Regional Transport Office (RTO), Urban and Rural Police Department, KSRTC office, Kerala Water Authority Thrissur, Railway Station, Thrissur Automobile Association, and others. The data collected from these sources provide an understanding of the existing infrastructure and transportation network, including public transport systems, road conditions, and other relevant factors.

The secondary data consisted of official government documents and reports related to transport and connectivity in the study area. This data provides additional information on the existing infrastructure, transport policies, and plans for future development.

In addition to these surveys, a perception survey was conducted, which involved data entry of personal travel history such as mode of transport, fare, time taken, and other relevant information. This survey helped in understanding the travel patterns and preferences of people in the study area, including their perceptions of existing transport infrastructure and services.

GIS based and excel data analysis based on data collected from the primary and secondary data and perception survey such as drive time analysis, proximity analysis of bus stands, registration data analysis, kernel density map analysis, etc. was then carried out.

Together, these surveys and analysis provide a comprehensive understanding of the transport and connectivity scenario in the study.

The standards were studied from the URDPFI & RADPFI Guidelines and then compared with the existing data sourced from the concerned authorities from Thrissur for social and physical infrastructure. Travel time analysis for accessibility check (using ArcGis) & Census was carried out to assess the state of educational infrastructure of the district.

(c) Economy

Economy is divided into its three sectors to study and analyze in detail. These sectors being primary, secondary and tertiary. Each sector acquired data from the relevant authorities during the visit to Thrissur and analyzed the data to find the gaps. There was analysis carried out for key economic indicators, such as gross domestic product (GDP), per capita income, inflation rates, employment rates, and poverty levels and trends were examined over time to understand the overall economic performance of Thrissur and identify areas of growth or decline.

The analysis of industries was done through the GDVA contribution,MSME data and large scale industry data. The employment, units, investment and turnover were further analyzed to determine turnover, employees and investment per unit. The yearly blockwise shift in concentration of units was identified from the location of industries. To determine the backward and forward linkages in the gold industry, the study made reference to reports such as the Niti Aayog and India's gold market. Additionally, data was collected from the Kerala industry export indicators. An understanding of the workmanship of the craftsmen and artisans has also been done which provided insight into the challenges they face in obtaining adequate workspace which further led to the proposal of providing them with the workspace studying the case of Hong Kong. The Hong Kong exhibition center was conducted to get an insight of the areas required and the number of exhibitors and workers to be employed.

1.2.6 Land Use Suitability

Once all the three pillars were studied, the final part of the analysis was carried out to understand the buildable land characteristics in order to propose new projects in the district. The goal of land-use suitability analysis is to conserve environmentally vulnerable regions and govern how they are developed because Thrissur is a disaster-prone and environmentally fragile district. While discovering more prospective development locations for higher economic growth in a sustainable way. The process of finding suitable areas depends on different

variables or criteria. In the suitability analysis eight parameters were taken into consideration namely proximity to road, proximity to forest, proximity to water bodies, proximity to disaster prone areas, proximity to coastline, proximity to Kole land, slope, and proximity to urban settlement. These criteria have a different level of importance and various literature were reviewed to assign weights to carry out weighted overlay technique. The area was then categorized as a no-development zone, less suitable, moderately suitable, suitable, and highly suitable. This would help in preserving the natural resources while promoting economic growth in a sustainable manner.

1.2.7 Proposals

Building upon the identified issues, strategies are developed to address them effectively. These strategies encompass various aspects such as, transportation improvements, environmental conservation, and social infrastructure development. The proposals are formulated to provide practical and actionable recommendations for implementation. These proposals start with the population projections to identify the requirement of infrastructure and employment opportunities, followed by the transportations proposals to lay the foundation of the infrastructure for the other sectors to be built upon. The rest of the sectors' proposals are then carried out in a systematic manner.

The individual proposals are integrated into a comprehensive regional plan that ensures synergy among various sectors. The plan emphasizes the coordination between the three pillars of symbolic economy, environment, infrastructure and economy to achieve various sustainable development goals in order to make Thrissur a climate resilient symbolic economy by the year 2047. The final regional plan is accompanied by an implementation framework that outlines the roles and responsibilities of different stakeholders and specifies a timeline for execution.

History

Thrissur district is one of the 14 districts in the Indian state of Kerala. Spanning an area of about 3,032 sq.km, Thrissur district is home to a population of 31.0 lakhs constituting an approximate 9% of Kerala's population. It had an average population density of 1031 ppl/sqkm and a growth rate of 4.94% (Census 2011).

Thrissur district is bordered by the districts of Palakkad and Malappuram to the north, the district of Ernakulam to the south and Coimbatore to the east. The Lakshadweep Sea lies to the west and the Western Ghats stretches towards the east. It is part of the historical Malabar Coast, which has been trading internationally since ancient times. The main language spoken is Malayalam.

Historically the city of Thrissur and its surrounding area has been under several different empires, kingdoms and princely states. It had remained a centre of trade and commerce until it became the capital of the Kingdom of Cochin under Raja Rama Verma IX (Shaktan Thampuran). Under his reign the first survey map of Thrissur was prepared by the English company Gould with the existing wetlands and

Figure 1.2 District Location Map



Source: Survey Of India, 2022

fortification. Presently both the kole lands and the fortification have disappeared.

Till the year 1946, the district was part of former Cochin State. After the merger of Cochin State with Travancore in 1949, Thrissur district became part of the Travancore-Cochin State. It wasn't until 1949, that the Thrissur district was formally formed by merging six taluks and the Kunnathuna taluk which was a part of Kottayam district, with its headquarters at Thrissur City.

Thrissur is also known as the 'Cultural Capital of Kerala' because of the presence of many religious sites, centres of art and culture such as the Kerala Nadaka Academy, Kerala

Sahitya Academy, Kerala Kalamandalam and others, various education institutes such Kerala Agricultural University, Kerala Institute of Local Administration, Kerala Police Academy, several Ayurveda centres, handloom and gold industries. The district is also known for the Thrissur Pooram which is the most colourful temple festival in the world.

In 3000 BC, the Muzris port, in Kodungallur entered the world trade map ad first international trading route connecting the Middle East with the Indian Subcontinent. It was used to trade spices, diamonds, ivory and various other materials. The first mosque in the Indian Subcontinent, the Cheraman Juma Masjid was built in 629 AD within the district. The first Church of India, the St. Thomas Church is also present in the district. The centre point of Thrissur town, the Thekkinkadu Maidan and Vadakkunnathan temple located in a high area (hillock of 65 acres) are some of the religious sites having maximum footfall in the district.

Thrissur is also known as the "Gold District" because of its rich history and tradition in gold jewelry craftsmanship, its modern gold jewelry industry, and its famous annual gold exhibition. It borders the district of Ernakulam which is also the richest district in the state and recently the city of Thrissur was declared to be the richest city in India having a combined wealth of Rs 40,000 crores held by the residents due to the inflow of money by workers from the Gulf countries.

It is also a hub for international tourism due to it's ecological and cultural significnace which reduced drastically due to the recent pandemic. While the domestic tourism is slowly getting back on track post COVID, the foreign footfall is still decreasing. Due to the lack of opportunities, the ratio of educated unemployment is scaling along with migration, contrasting the status of Thrissur as a knowledge hub & learning city.

Vembanad Ponnani Kole Wetland ecosystem is the largest brackish, humid, tropical wetland ecosystem in the Southwest Coast of India. A part of this RAMSAR site falls under the administrative division of Thrissur district.

1.3 Regional Setting

Thrissur district is located in the Central part of Kerala, India. The district is bounded by Malappuram and Palakkad district in the north, Ernakulam and Idukki district in the south, Lakshdweep Sea in the west, and Tamil Nadu state in the east. Thrissur district is surrounded by 4 international airports i.e., Calicut International Airport, Cochin International Airport, Coimbatore International Airport and Trivandrum International Airport. Industrial centers such as Kochi, Palakkad, Kozhikode, Coimbatore etc. also surrounds the district.

1.3.1 Palakkad

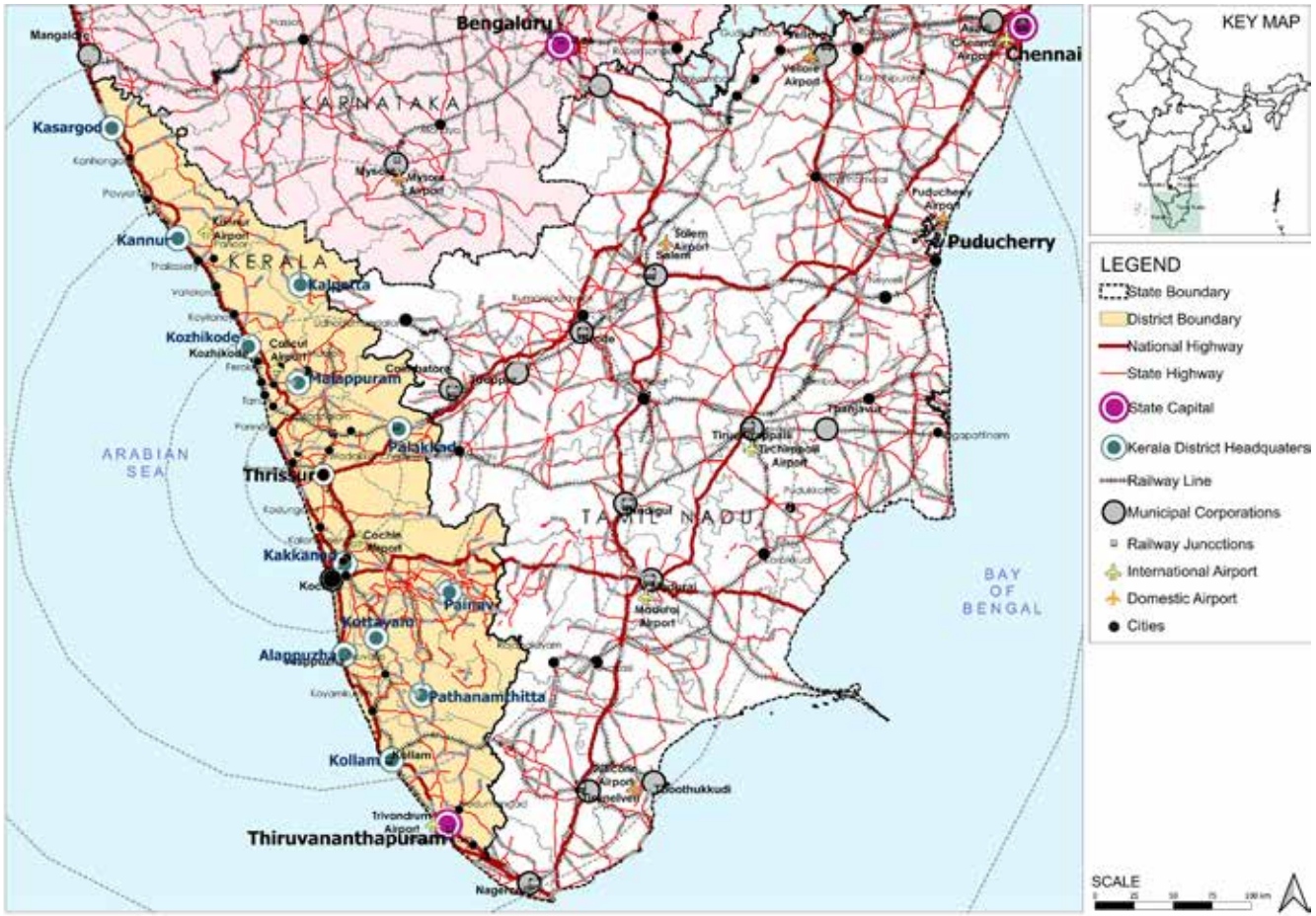
Agriculture is the backbone of the economy of the district. The district is well known as an abode of several reputed educational institutions. The presence of Palakkad Gap and proximity to Coimbatore makes Palakkad economically important. Palakkad Gap is a low mountain pass in the Western Ghats between Palakkad in Kerala and Coimbatore in Tamil Nadu. The pass is located between the Nilgiri Hills to the north and Anaimalai Hills to the south. It acts as an important transport corridor between the two States has served as a vital trade route between the east and west coasts of peninsular India since ancient times. Palakkad is also the 2nd Industrial Hub of Kerala after Kochi. There are many steel manufacturing units and other production centres making it second largest industrial area in Kerala.

Palakkad is located to the North east of Thrissur district in Kerala, India. The two districts are closely interdependent in many respects. In terms of economy, the two districts are linked in terms of trade, commerce, and services. The bustling market town of Shornur, located on the Palakkad-Thrissur border, is a major trading hub for the two districts. They are also connected in terms of transportation. The Palakkad-Thrissur highway is one of the main roads connecting the two districts.

1.3.2 Kozhikode

Kozhikode is well connected with roadways, railways, and airways. Agriculture and fishing play a main role in the economy. Kozhikode was famous for pepper and other spice trading. Kozhikode is the centre of both domestic and international trade. Both large scale and small-scale industries are in plenty. Some of the items produced here includes cotton cloth, handloom, textiles, bricks, tiles, etc. It has a business-oriented economy. It is the major trade hub of North Kerala. There are no. of IT Parks proposed here. Kozhikode and Thrissur districts are both located in the Kerala. The two districts have a strong interdependency due to their close proximity. Both districts are connected through several major roads, like NH 66. There is a high level of economic and social interaction between the two districts. Kozhikode is a major business hub, and many businesses from Thrissur district are reliant on the facilities of Kozhikode.

Figure 1.3Regional Setting of Thrissur District



Source: Bhuvan.nrsc.gov.in

1.3.3 Coimbatore

Coimbatore houses many small, medium and large textile mills. The growth of textiles naturally led to the inception of textile machinery manufacturing. The Coimbatore region is famed for the quality of its cotton and dyed fabric. It is famous for automobile industries, manufacturing of textile industry equipment's, spares, and varied engineering goods and services. It is called the "Manchester of South India" due to its extensive textile industry, fed by the surrounding cotton fields. Coimbatore and Thrissur districts have a close interdependency. The two districts are also connected by road and rail links. The Coimbatore-Thrissur National Highway (NH-544) passes through both districts, providing an important transport link between the two cities. The two districts are also connected by the Coimbatore-Thrissur railway line. The Coimbatore Airport is also a major air hub for people travelling between the two cities.

1.3.4 Kochi

Kochi is famous for many things such as jewellery, tourism, ayurveda, rubber, coffee, spices, banana products etc. Kochi is the financial capital of Kerala. All the major business heads and centres are located in the city and it accounts for the largest number of employment opportunities in the state. Currently the GDP growth rate of the city is as high as 8.3 per cent, making it the fastest developing two-tier city in India. Some of the leading areas of business and employment opportunities in Kochi lie in sectors like ship-building, chemical industry, Information Technology, manufacturing, import/ expert, construction, tourism, banking, legal and health services. Kochi and Thrissur districts have a strong interdependency on each other. The two districts are connected by a number of roads and railways, allowing for easy travel between them. This has helped to foster a strong interdependency between them, as travellers and goods can easily move between the two districts.

1.3.5 Kochi Port

Kochi Port serves as a major gateway for trade in Kerala and South India. It handles a significant portion of the state's imports and exports, including agricultural products, industrial goods, and raw materials. The port plays a crucial role in the economic development of the state. It generates employment opportunities and contributes to the growth of the local economy. It is strategically close to busiest international sea routes. One is Gulf to Singapore and far East and the other is Suez to Singapore / far East. Kerala's operational external trade is due to Cochin port. The port's success enhances the reputation of the state as a hub for trade and commerce, attracting more investment and business opportunities.

1.3.6 Kakkanad

Kakkanad is a major industrial and residential region in the city of Kochi. Kakkanad is home for a portion of the industrial base of Kochi. It is home for the Cochin Special Economic Zone (CSEZ). Industrial projects like Fashion City are proposed in Kakkanad. Kakkanad is home for the largest IT Township in India, the Smart City and the second largest IT industrial park in Kerala, the Kochi InfoPark. It is also home for a Software Export Promotion Zone (SEPZ). The international submarine cable systems landing in Kochi has their nodes installed in Kakkanad.

1.3.7 Thrissur

The main city of Thrissur district is Thrissur, also known as the "Cultural Capital of Kerala". It is known for its rich cultural heritage and is home to many ancient temples and churches. The city is also the cultural, educational and commercial hub of the district. Other major towns and cities in Thrissur district include Guruvayur, Chalakudy, Kodungallur, Irinjalakuda, and Kodungallur.

1.4 Legal framework

The Municipality Act in line with the 74th Constitutional Amendment Act 1992 established the District Planning Committee (DPC), which serves as the apex body. The Department of Town and Country Planning served as the nodal organization for the creation of these Development Plans. For the purpose of kicking off the LDP preparation in each Local Self Government Institutions (LSGI), a coordination committee made up mostly of elected political heads of the LSGIs is constituted at the district level. The enactment of the Kerala Panchayat Raj Act of 1994 and the Kerala Municipality Act of 1994 has decentralized power to the local self-government institutions in Thrissur district. This has been a significant step towards good governance, as it has provided the necessary functional and fiscal powers to the three tiers of Panchayats: Grama, Block, and Zilla Panchayats along with Municipal Councils/Corporations for urban areas - to undertake planning and development activities in their respective areas.

1.4.1 Town and Country Planning Act, 2016

The Kerala Town and Country Planning Act, 2016 mandates the preparation of District Development Plans and Urban Development Plans for the state. These plans are intended to guide the growth and development of urban and rural areas in a sustainable and equitable manner. The district development plans are prepared by the District Planning Committee (DPC), which is constituted under the act. The DPC is responsible for preparing the development plan for the entire district, which includes both rural and urban areas. The plan includes a land use map, zoning regulations, and development control rules. The plan is prepared based on the spatial data and analysis of the district. The urban development plans are prepared by the respective urban local bodies (ULBs), such as municipalities, corporations, and panchayats. These plans provide detailed guidelines for the development of urban areas, including land use, transportation, infrastructure, and housing. The ULBs are required to prepare and update their plans in consultation with the State Town and Country Planning Department and other relevant agencies. To implement these plans, the Kerala Town and Country Planning Act, 2016 mandates coordination between the Town and Country Planning Department and the Local Self Government Department (LSGD). All town and country planning officers are required to coordinate with the LSGD and implement programs under its guidance. This ensures that the plans are integrated with the development activities of the local bodies and are implemented in a coordinated and effective manner.

1.5 Administrative Setup

Thrissur district's administrative setup is classified into eight parts – Collectorate, two revenue division, seven taluks, municipal corporation, seven municipalities, sixteen blocks, eighty-six panchayaths, and two hundred fifty five villages.

1.5.1 District Administration

District administrative setup has three level of hierarchy - Collector in the cadre of I.A.S heads the district. He acts as the district magistrate for maintaining law and order in his jurisdiction. He deals mainly with planning and development, law and order, general elections, arms licensing etc.

The Additional Collector/ District Revenue Officer runs the revenue administration under various enactments in the district. He is also designated as Additional District Magistrate. He mainly deals with civil supplies, land matters, mines and minerals, village officers etc.

The District Revenue Officer (DRO) and Deputy Collectors assists the collector in discharging their duties. The district revenue officer looks after all the branches of the

collectorate. He deals mainly with general administration and is vested with supervision of day-to-day functions of the collectorate. There are two revenue divisions in Thrissur located in Thrissur and Irinjalakuda .

1.5.2 Local Self Government Institutions

The district has 111 LSGIs and a total of 2,036 wards, including 86 gram panchayats, 16 block panchayats, 1 district panchayat, 7 municipalities, and 1 corporation. Gram panchayats are responsible for rural administration, while block panchayats oversee the development of a group of gram panchayats. These local self-government institutions in Kerala have been granted significant resources and administrative powers, enabling them to effectively implement developmental programs. Grama Sabhas play a vital role in identifying and executing these programs.

The Local Administration Department, along with associated departments such as the Panchayat Directorate, Directorate of Urban Affairs, Commissionerate of Rural Development, and Town and Country Planning Department, collaborate to formulate and implement grassroots-level development initiatives. Numerous allied institutions and training centers under LSGD provide support for local administration activities (Figure - 1.2).

1.5.3 Municipal Corporation

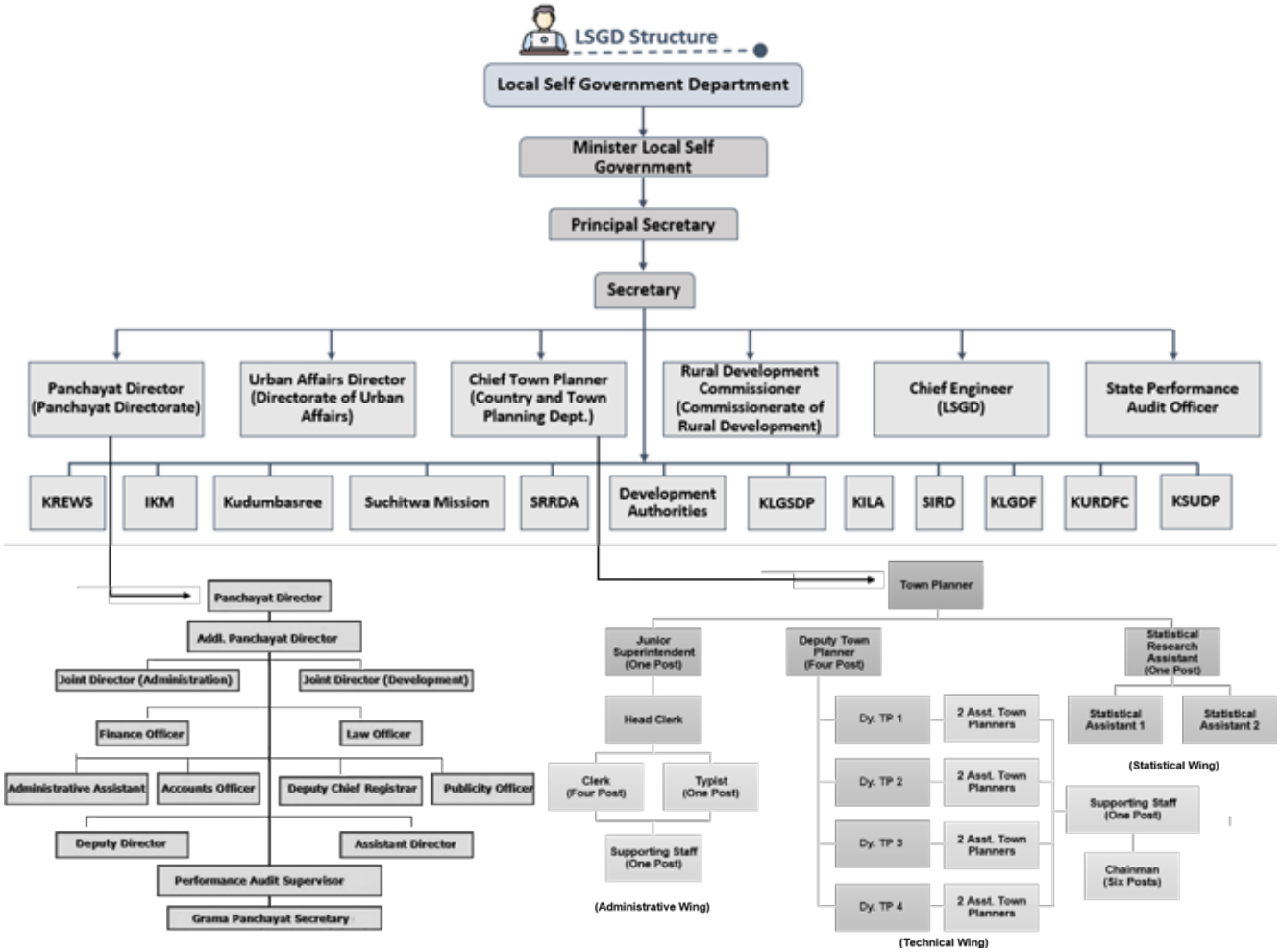
The Corporation comprises three legislative assemblies Thrissur, Ollur and Cherpu. The city is administered by the Thrissur M. Corp., headed by a mayor.

The corporation is the second-largest city corporation in the state of Kerala in India. The organization setup of Thrissur M. Corp. is comprised of two wings namely Executive and Administrative Wing (Figure - 1. 3).

1.5.4 Organizational Setup Of Panchayat Level Administration

Panchat administration is done under the panchayat director. The Grama Panchayat is responsible for local governance, supported by the Grama Sabha and a Secretary. Standing Committees and Ward Members address specific sectors and represent localities, ensuring effective grassroots administration and community participation. The organizational structure is represented in Figure 1.2.

Figure 1.4 LSGD, Panchayat, , and, DTPO Thrissur's Organisational Structure



Source: LSGD Kerala, Dept. of Panchayats, Gok, and LSGD Planning

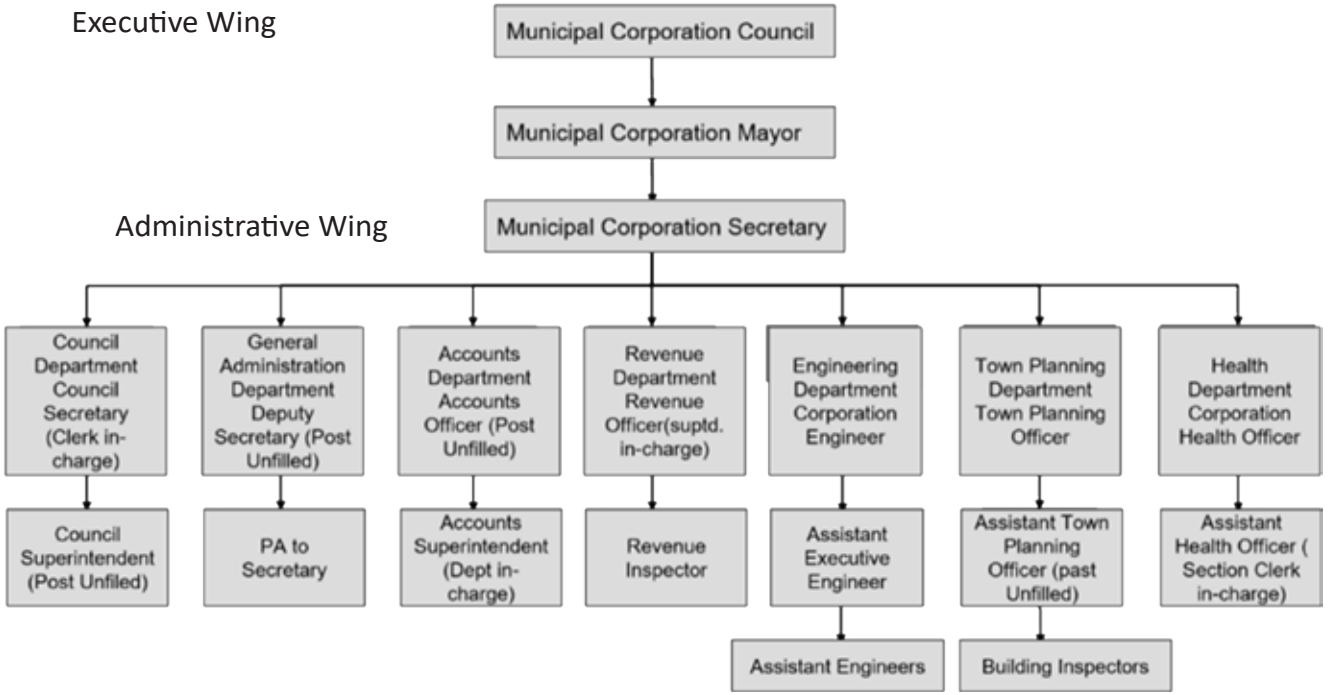
1.5.5 Organizational Setup Of District Town Planning Office

District town planning office is divided into three divisions namely, administrative, technical, and statistical wing under the town planner (Figure - 1.2).

1.5.6 Administrative Division Map

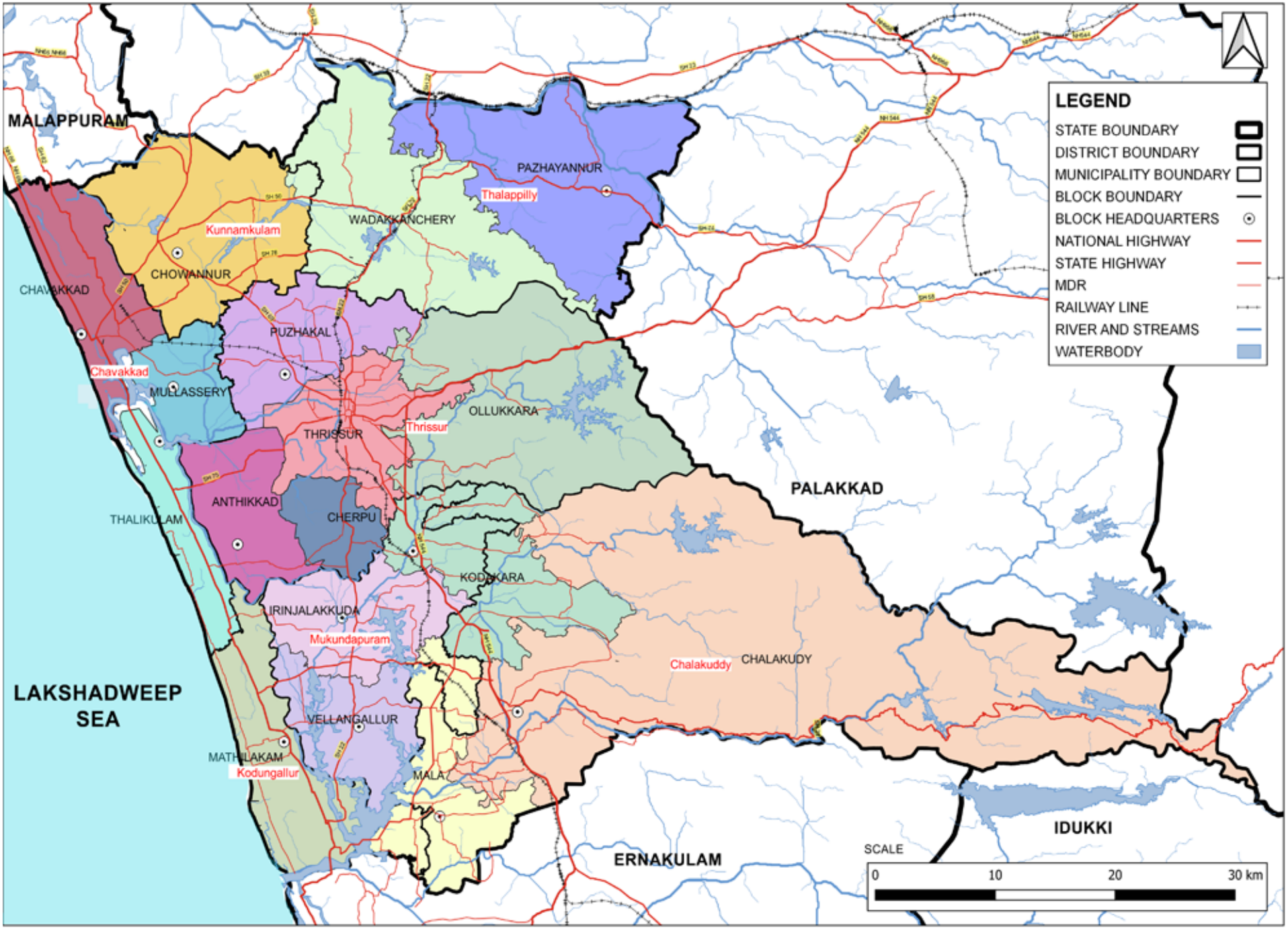
Administrative division map shows Thrissur's blocks and municipalities along with municipal corporation(Figure - 1.4).

Figure 1.5 Organization Setup of Thrissur Municipal Corporation



Source: LSGD, City report Thrissur, 2005(Vol-2).

Figure 1.6 Administrative division map





Credits: Pradhi Pathak

2. BUILT and NATURAL ENVIRONMENT

S. Gayathri 2022MURP011
Anjali Netam 202MURP024
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Shervin Azmeena KN 2022MURP026
Dhruvil Godhani 2022MURP027
Sandeep Singh 2022MURP030
Tarishi Kumawat 2022MURP032
Reeti Choudhary 2022MURP033

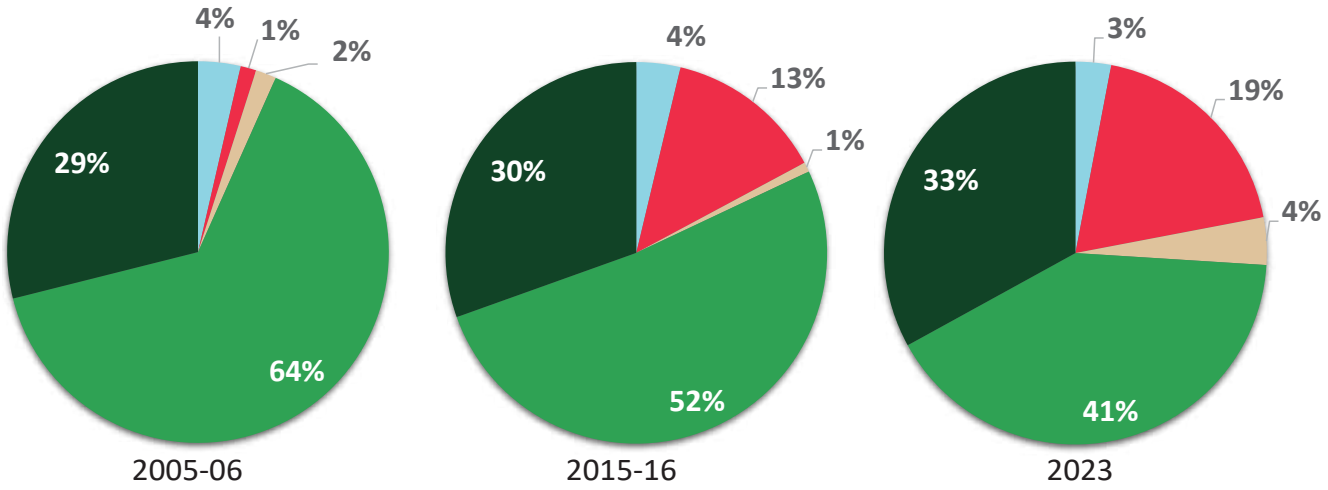
2. Environment - Built and Natural

2.1 Land Use Land Cover - Built Environment

The major activities, whether agriculture, residential, or forest, all indicate the use of a portion of land. As a result, an examination of present land use is required to comprehend the primary economic activity of a region as well as the potential of unoccupied land for economic activities. Land use/land cover geospatial data as well as change patterns are essential for planning, applying, and managing the country's land resources. Land use/land cover assessments are becoming more essential in a wide range of industry sectors, such as agriculture planning, community and land registry border surveys, environmental research, and agro-climatic zone-based planning procedures. Land use/land cover information improves understanding of land usage features such as agricultural patterns, fallow land, forestry and grazing areas, barren land, lakes and rivers, and so on, which is useful for development planning.

The district is divided into four micro regions based on physiographic features: the Thrissur coast, the Thrissur plain, the Wadakkanchery uplands, and the Kodassery forested hills. The forest in the area is both wet deciduous and semi-evergreen, encompassing a total area of 1258.48 square kilometres. The presence of large forest reserves has a beneficial impact on the climate and leads to increased rainfall in the district. Further, Thrissur's considerable evergreen forest cover provides a natural dwelling for a broad diversity of plants and wildlife. The district's principal river systems include the Bharathapuzha, Keecheri, Puzhakkal, Karuvannur, and Chalakkudy, with the Bharathapuzha being the state's second-longest.

Figure 2.1 LULC Comparison, Years 2005-06, 2015-16 & 2023



Data Source : Bhuvan & USGS Earth Explorer, Year- 2023

2.1.1 Area Comparison of Land Use Years 2005-06, 2015-16 & 2023

For the purpose of analysing land cover, we compare land cover data from 2005, 2016 & 2023. Agriculture land was more plentiful in 2005; however, in the next ten years, agricultural land has decreased and barren land has increased due to people leaving the farming sector to find employment in other sectors of the economy. Built-up land expanded after 2005 as people moved from rural to urban areas, leading to a rise in urban areas and built-up land. Hence, in this comparison, it is observed that agricultural land is decreasing while built-up land and barren land are increasing every year in urban areas.

2.1.2 Land Use break up of Thrissur District

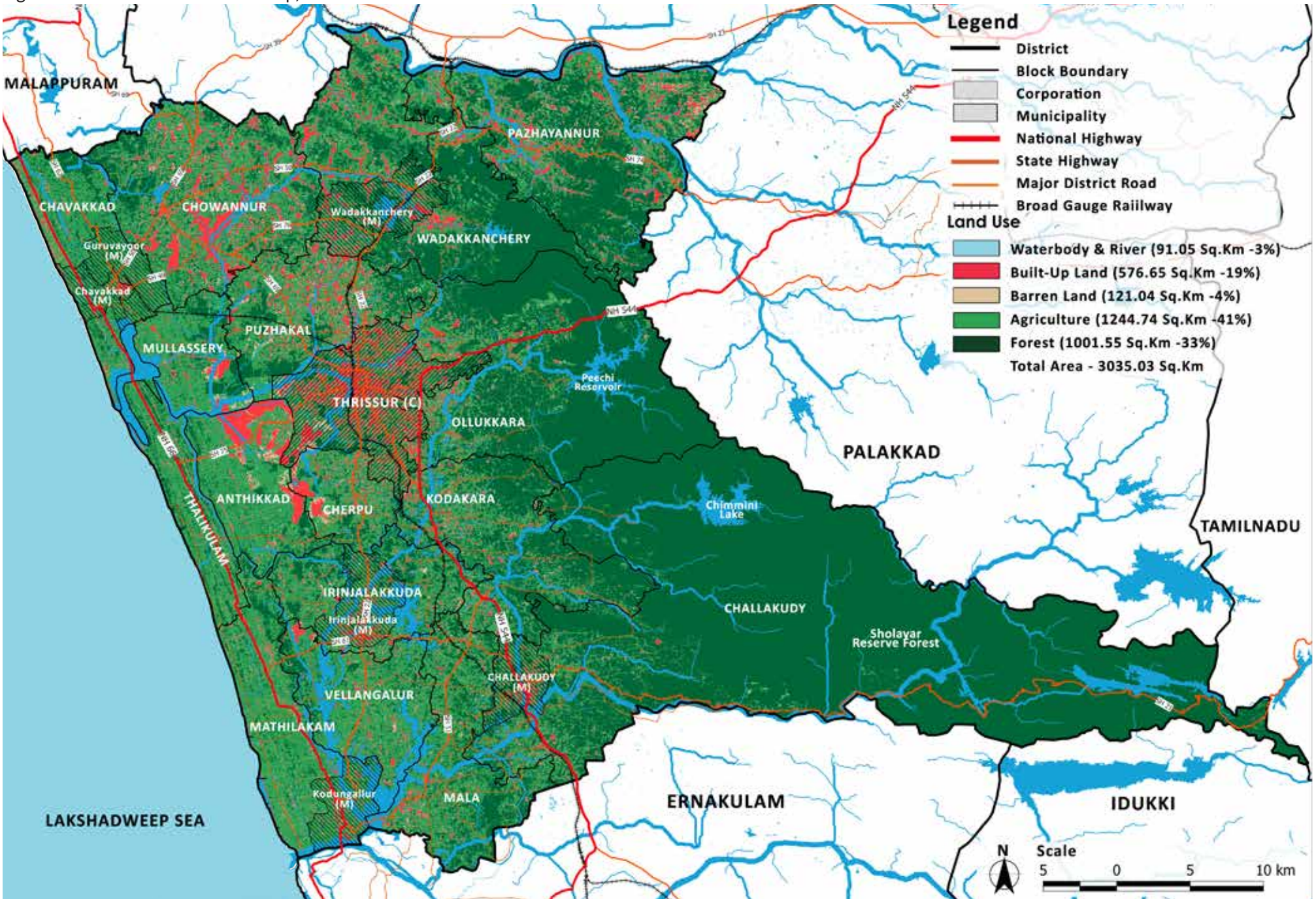
The district has a total area of 3035.03 sq km. Table 2.1 shows the division of land use regions in the entire district and their share of the total district area. According to the district's land use study, the majority of the district's total land area is divided into two primary uses: agricultural land (43%), and forest land (42%). The district's prominent element of land use is that it is rich in prospective resources like farmland and timber.

Table 2.1 District LULC Break-Up, 2023

Break-Up	Area (Sq.Km)	%
Waterbody	91.05	3%
Built-Up	576.65	19%
Barren Land	121.04	4%
Agriculture	1244.74	41%
Forest	1001.55	33%

Data Source : USGS Earth Explorer, Year- 2023

Figure 2.2 Land Use Land Cover Map, Thrissur District - 2023



Data Source : USGS Earth Explorer, Year- 2023

The assessment of land use reveals that the majority of plantation / forest operations are focused in the district's highland region. The majority of urban activity is observed to be concentrated around important transit corridors and in coastal regions. The district's agricultural operations are mostly centred in the district's midland region.

2.1.3 Land Cover wise classification at Block level, 2023

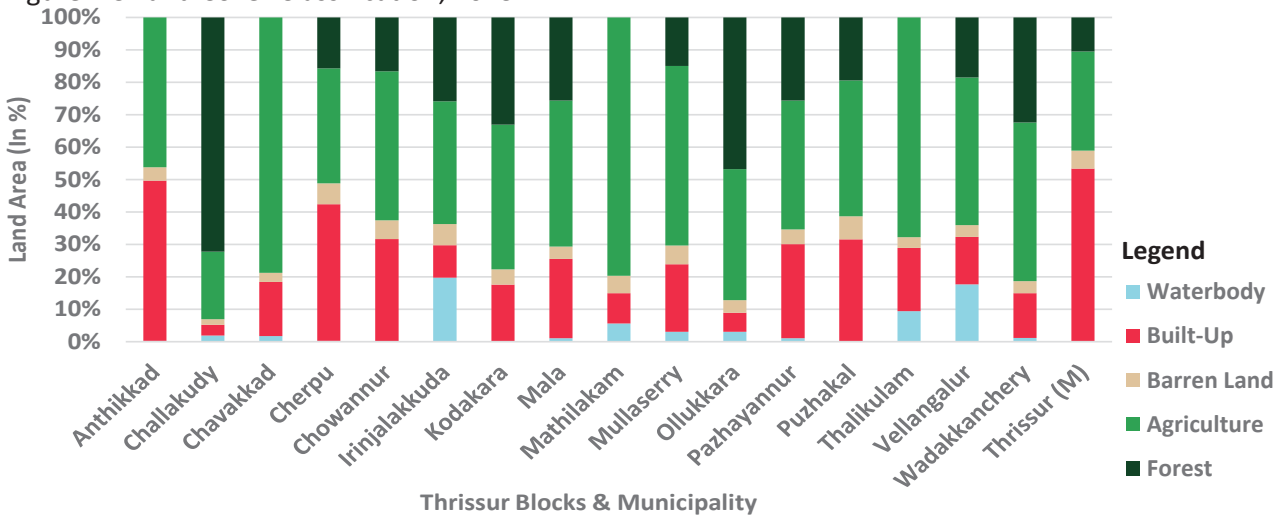
As per the block-by-block examination, the majority of the forest area is located in the eastern side's blocks, including Chalakkudy, Kodakara, Olukara, Wadakkanchery, etc. The largest area of forest is concentrated in the Chalakkudy block. The district's midland areas contain the majority of land suitable for agriculture. As any crop may be easily harvested in this area. Several blocks' built-up areas are growing, including the Thrissur Municipality, Anthikkad, Chowannur, Cherpu, etc. While the agricultural land that was previously used for agriculture has decreased after 2015.

Table 2.2 Land Cover Classification at Block Level, Year - 2023

Sr.No	Block Name	Waterbody	Builtup	Waste land	Agriculture	Forest
1	Anthikkad	0.36	72.73	6.12	68.07	0
2	Challakudy	13.82	24.27	13.04	153.62	532.23
3	Chavakkad	1.95	19.25	3.27	90.76	0
4	Cherpu	0.16	31.23	4.77	26.25	11.64
5	Chowannur	0.3	65.28	12.14	95.33	34.52
6	Irinjalakkuda	20.06	10.12	6.66	38.42	26.35
7	Kodakara	0.08	21.25	5.67	54.06	40.15
8	Mala	1.5	34.56	5.37	63.78	36.25
9	Mathilakam	7.18	11.87	6.77	101.55	0
10	Mullaserry	1.94	13.23	3.68	35.13	9.52
11	Ollukkara	7.67	14.96	9.67	102.35	118.35
12	Pazhayannur	2.6	68.52	10.64	94.06	60.72
13	Puzhakal	0.03	42.78	9.6	56.95	26.36
14	Thalikulam	8.3	17.23	2.93	59.94	0
15	Vellangalur	22.71	18.76	4.73	58.56	23.81
16	Wadakkanchery	2.34	27.78	7.44	98.37	65.35
17	Thrissur (M)	0.05	82.83	8.54	47.54	16.3

Data Source : USGS Earth Explorer, Year- 2023

Figure 2.3 Land Cover Classification, 2023



Data Source : USGS Earth Explorer, Year- 2023

The availability of more job possibilities and the expansion of important economic sectors are driving up the number of migrants. Agricultural land has declined as a result of their arrivals, whereas urban areas and vacant land have grown. Because many immigrants are no longer working in the agricultural sector, their land is not being properly maintained and is being converted into barren land. The area of barren land is increasing as a result, as shown in Table 2.2. The mining industry is also contributing to the

expansion of barren land due to improper use of the land after acquiring minerals. Therefore, the land cover classification of the region will lead to block wise development in various economic sectors.

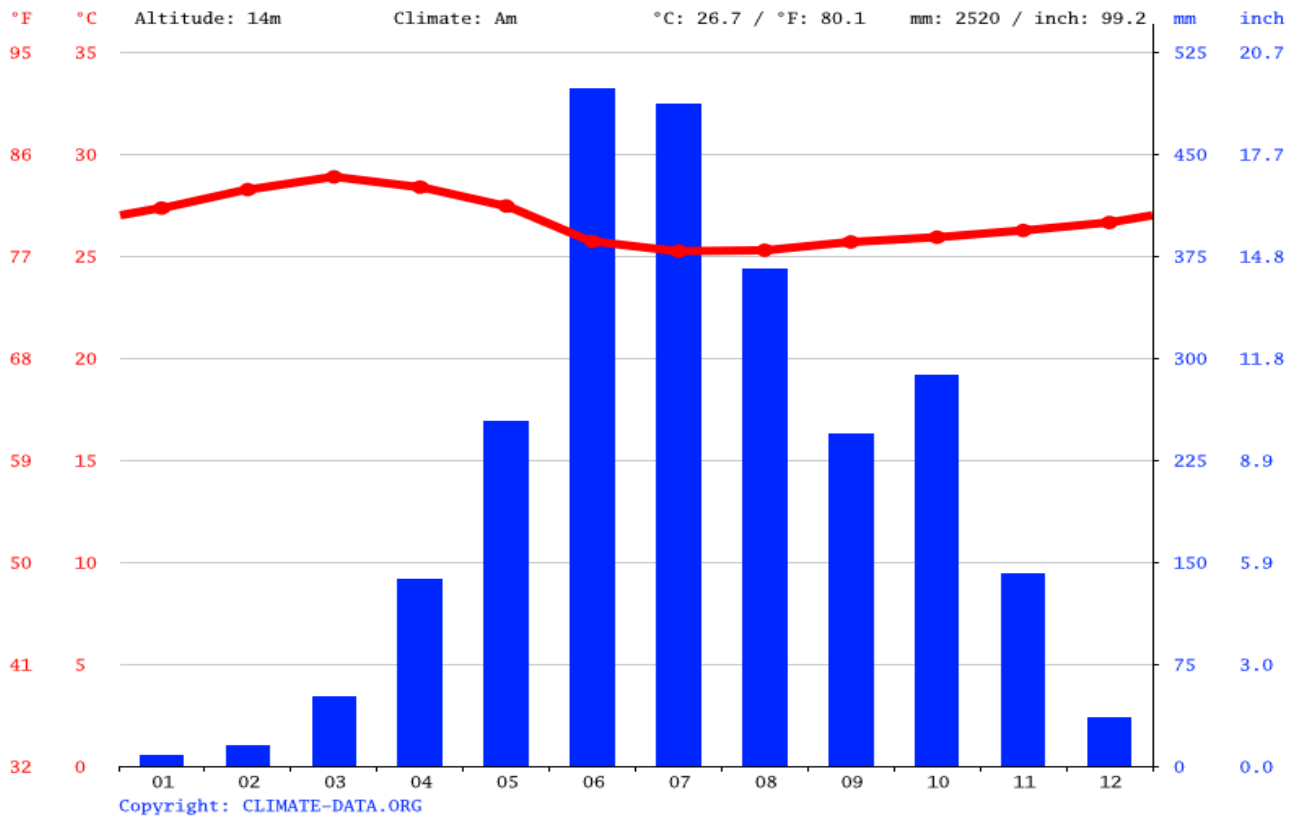
These distribution of land use and land cover factors impacts most on the sustainable growth and environmental factors, as many a times haphazard development seems to led for deterioration of ecology of the surroundings. The similar trend has been seen in the district of Thrissur raising to many alarming issues. Thrissur being the cultural capital of God's own country and a ecologically sensitive and fragile area contributes to the physical features of the district including its natural subdivisions, forests, rivers, lakes, backwaters and Kole lands. The geography & weather pattern, makes it an environmentally sensitive region. Various human activities are the genesis to the destruction of these natural physical features in the form of pollution, climate change and disasters.

2.2 Climate

According to the Köppen-Geiger climate classification, the district has a tropical monsoon climate with a harsh summer season, abundant as well as seasonal rainfall. The climate condition is divided into four seasons i.e., Summer (March-May), South-West monsoon (June-September), North-East monsoon/post monsoon/retreating monsoon (October-November) and Winter (December-February).

The minimum recorded temperature is 22°C, while the average temperature is 26.7°C. March being the hottest month of the year with

Figure 2.4 Climate Graph



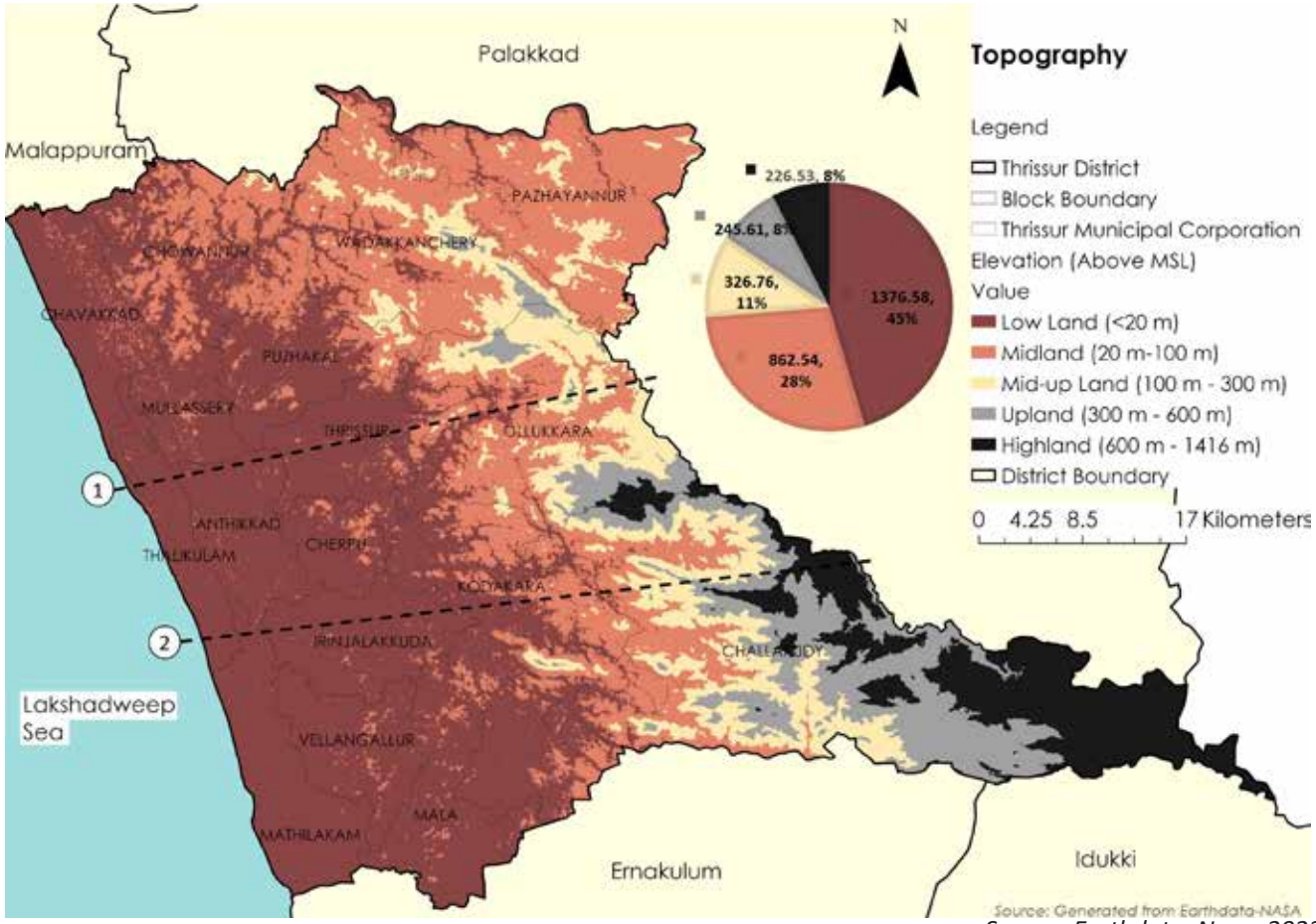
Source: www.climate-data.org, 2023

Table 2.3 Monthly Climate Data

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	27.3 °C (81.2) °F	28.3 °C (82.9) °F	28.9 °C (84) °F	28.4 °C (83.1) °F	27.4 °C (81.4) °F	25.7 °C (78.3) °F	25.2 °C (77.4) °F	25.3 °C (77.5) °F	25.7 °C (78.2) °F	25.9 °C (78.6) °F	26.2 °C (79.2) °F	26.6 °C (79.9) °F
Min. Temperature °C (°F)	23 °C (73.4) °F	23.8 °C (74.8) °F	25.1 °C (77.2) °F	25.6 °C (78) °F	25.2 °C (77.4) °F	24.2 °C (75.5) °F	23.7 °C (74.6) °F	23.6 °C (74.5) °F	23.6 °C (74.8) °F	23.6 °C (74.5) °F	23.3 °C (74) °F	23 °C (73.4) °F
Max. Temperature °C (°F)	33 °C (91.4) °F	34.1 °C (93.4) °F	34.1 °C (93.4) °F	32.2 °C (89.9) °F	30.5 °C (86.8) °F	28.1 °C (82.6) °F	27.7 °C (81.8) °F	27.8 °C (82) °F	28.5 °C (83.3) °F	29.1 °C (84.3) °F	30 °C (85.9) °F	31.2 °C (88.2) °F
Precipitation / Rainfall mm (in)	8 (0)	15 (0)	51 (2)	137 (5)	253 (9)	498 (19)	486 (19)	365 (14)	244 (9)	287 (11)	141 (5)	35 (1)
Humidity(%)	58%	59%	67%	76%	83%	89%	89%	89%	87%	86%	79%	65%
Rainy days (d)	1	2	8	17	19	21	21	21	18	19	12	4
avg. Sun hours (hours)	10.1	10.0	9.6	7.7	6.4	5.0	5.4	5.9	6.5	7.2	9.0	9.7

Source: www.climate-data.org, 2023

Figure 2.5 Topography Map



Source: Earthdata, Nasa, 2023

an average temperature of 28.9 °C. Minimum average temperatures of the year 25.2 °C occur in July. The variation in temperatures throughout the year is 3.6 °C. The South-West monsoon usually arrives in the last week of May. Rainfall reduces after the month of July. In a typical year, there are approximately 124 rainy days. The average annual rainfall is 3100 mm. The maximum rainfall occurs during June to September (71.24 % of the total rainfall) followed by 16.27% during North East monsoon, 12.1% during March to May and the remaining 0.37% is accounted during January and February. The greatest amount of precipitation occurs in June, with an average of 498 mm. The month with the highest number of rainy days is July (28.33 days). The month with the lowest number of rainy days is January (1.67 days) with an average precipitation of 8mm. The difference in precipitation between the driest and wettest months is 490 mm. The extensive forest reserves have a positive impact on the climate and increase rainfall in the region (Figure 2.4 & Table 2.3).

Throughout the year, the air is extremely humid, with a relative humidity of more than 70%. The month with the highest relative humidity is June (89.32 %). The month with the lowest relative humidity is January (58.40 %). Winds are normally low to moderate, becoming stronger during the monsoon season. The average wind speed is 2.7m/s which can go up to a maximum of 9m/s (Table 2.3).

2.3 Topography

Thrissur has elevation ranging from 0 m to 1416 m forming three naturally occurring divisions - low land, midland and highland regions. The land descends from the the heights of Western Ghats lying in the east and sloping towards the west as shown in figure 2.5. The slope ranges from 0° to 56.3° with an average slope of 6.32°. Kodungallur, Thalikkulam, Chavakkad and Mathilakam Blocks belong to the low-lying region, Cherpu, Irinjalakuda, Anthikkad, Mullassery, Thrissur, Puzhakkal, Chowannur, Kunnamkulam Blocks belong to midland region and Ollukkara, Chalakudy, Pazhayannur and Kodakara Blocks belong to highland regions (Figure 2.5).

Table 2.4 shows the five natural divisions with their areas and percentage covered of the total geographic areas, major part lies in low land regions followed by mid land, mid-up land, upland and highland regions

Low Lands – The low land region runs parallel to the Lakshadweep in a confined strip running north - south having an elevation of 20

m above MSL. The region formed of marine sediment modified significantly by intense cultivation, is sandwiched between the sea coast and midlands representing the Kole lands. During the process of inundation, a large amount of nutrient-rich alluvial soil is deposited, making the wetlands highly fertile for paddy cultivation. The major rivers in this region are the Chalakudy River and the Periyar River.

Mid Lands – The midland region is located between the coastal area and the highlands. This constitutes Midland, Mid-up land and Upland. The Midland (20m to 100m above MSL) consists of undulating to rolling terrain with scattered flat-topped low laterite hillocks separated by large and narrow valleys. Figure 2.6, Cross Section 1 shows the flat-topped hillocks which are rich in buff-coloured hard laterite and often utilized as a construction material. The Mid-up lands (100m to 300m above MSL) have moderate to hilly terrain with scattered rocky outcrops, steep side slopes, and sporadic small valleys. The slope ranges from 10 - 40%. The Upland (300m to 600m above MSL) constitutes hilly terrain having high hills with very steep side slopes where slope ranges from 25- 50%. The major rivers in this region are the Bharathapuzha River and the Chalakudy River.

Highlands – The highlands have elevation above 600 m and comprises the hilly terrain of the Western Ghats (Sahyadri) with escarpments, summits and rocky cliffs. Figure 2.6, Cross-Section 2 shows the intensity of hilly terrain of Western Ghats nearly 50km away from the shores. They are thickly forested areas running along the east and south-east parts constituting a chain of hills. The Western Ghats divides the district from Tamil Nadu which contains several ridges and conical peaks.

There are about 30 peaks in the district with heights ranging between 330 meters and 1439 meters. The major rivers in this region are the Periyar River and the Chalakudy River.

Figure 2.6 Topography Cross-sections



Source: Generated using Google Earth, 2023

Table 2.4 Area and Percentage of Topographic divisions

	Low Land	Mid Land	Mid-up Land	Up Land	High land
Area (Sq. Km.)	1376.58	862.54	326.76	245.61	226.53
Percentage of Total geographical area	45.31%	28.39%	10.75%	8.08%	7.46%

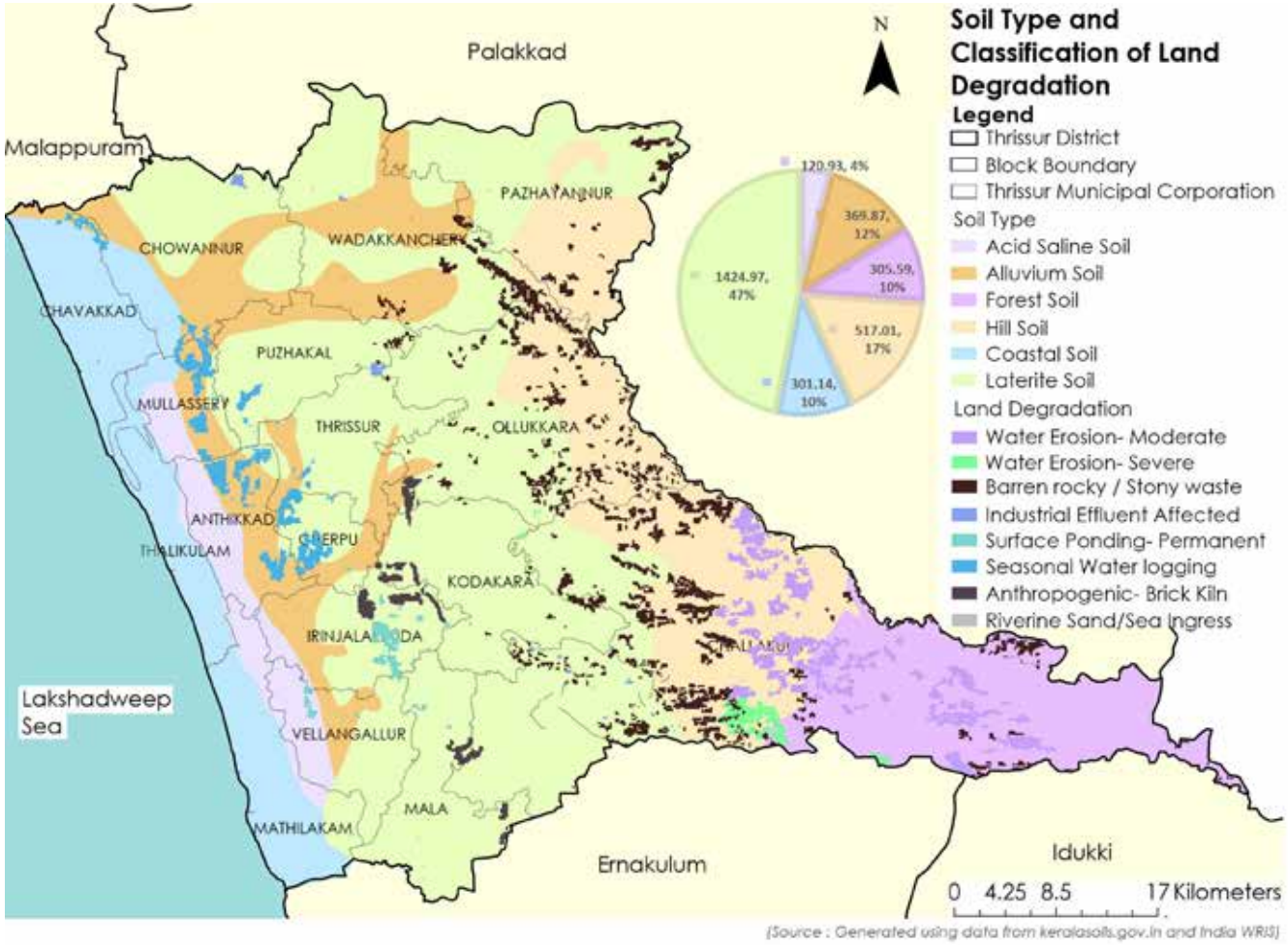
Source: District Spatial Plan, 2011

2.4 Soil

Thrissur district covers mainly six types of soils - Coastal alluvium, acid saline, alluvium, laterite soil, hill soil and forest soil (Figure 2.7). Low land region has Coastal Alluvium, Acid Saline, Alluvium soil and Laterite soil. Midland region has Alluvial soil, Laterite soil and Hill soil. Highland region has Forest and Hill soil. Table 2.5 represents the area of various soil types with their percentage out of total geographical area.

Agriculture, through its social, economic and ecological activities, has the ability to suffice some of the 11th Sustainable Development Goal's aims (SDG). The aims are as follows: a) decreasing cities' negative environmental effect (target 11.6), b) giving access to green areas (target 11.7), and c) promoting resource efficiency in cities (target 11b). However, urban growth on

Figure 2.7 Types of Soil and Classification of Land Degradation



Source: Department of Soil Survey & Soil Conservation, 2016

Table 2.5 Area and Percentage of types of soil

Soil type	Acid Saline	Alluvium Soil	Forest Soil	Hill Soil	Coastal Soil	Laterite Soil
Area (Sq. Km.)	120.93	369.87	305.59	517.01	301.14	1424.97
Percentage of Total geographical area	3.97%	12.16%	10.05%	17%	9.9%	46.88%

Source: District Spatial Plan, 2011

surrounding farmlands immediately diminishes the land under agricultural land use available to fulfil a developing society's resource demands. (Refer Chapter 7 for more information on agriculture). This is because at times cultivable land is sold to developers for financial incentives, risk reduction for the farmer. (Satterthwaite et al., 2010; Devadoss and Manchu, 2007; Tobin and Brainard, 1990).

This approach has prompted several problems, including food security, decreased agricultural production and agricultural labour, a deteriorating irrigation system, an increase in fallow agricultural land, and significant changes in local people's culture, environment, and way of life (ADB, 2007, Kelly, 1998, Zana Naab et al., 2013, Thuo, 2013). Soil conservation is a popular goal in urban planning, but consideration of soil value as a criterion for agricultural land conservation is few and far between. Although it is hard to prevent land conversion from agriculture to other uses for development, it is vital to maintain agricultural areas to some level in order to assure decrease in negative environmental impacts and ensure food security. This can be done by studying the characteristics of soil in terms of type, fertility, water retaining capacity, productivity etc and demarcating land in terms of developable and non-developable land.

2.4.1 Water Holding Capacity of Soils

The quantity of water that a specific soil can hold for crop usage is referred to as its soil water holding capacity. The greatest soil water holding capacity for the entire field is defined as field capacity. The goal for agricultural producers is to maintain the field at or near capacity

otherwise the field may be struck by draughts. Water holding capacity of coarse sands, fine sands, loamy sands is 0.75 - 1.25 inches of water per foot of soil. For sandy loams, fine sandy loams is 1.25 - 1.75 inches of water per foot of soil. For very fine sandy loams, loams, silt loams 1.50 - 2.30 is inches of water per foot of soil and for clay loams, silty clay loams, sandy clay loams 1.75 - 2.50 inches of water per foot of soil.

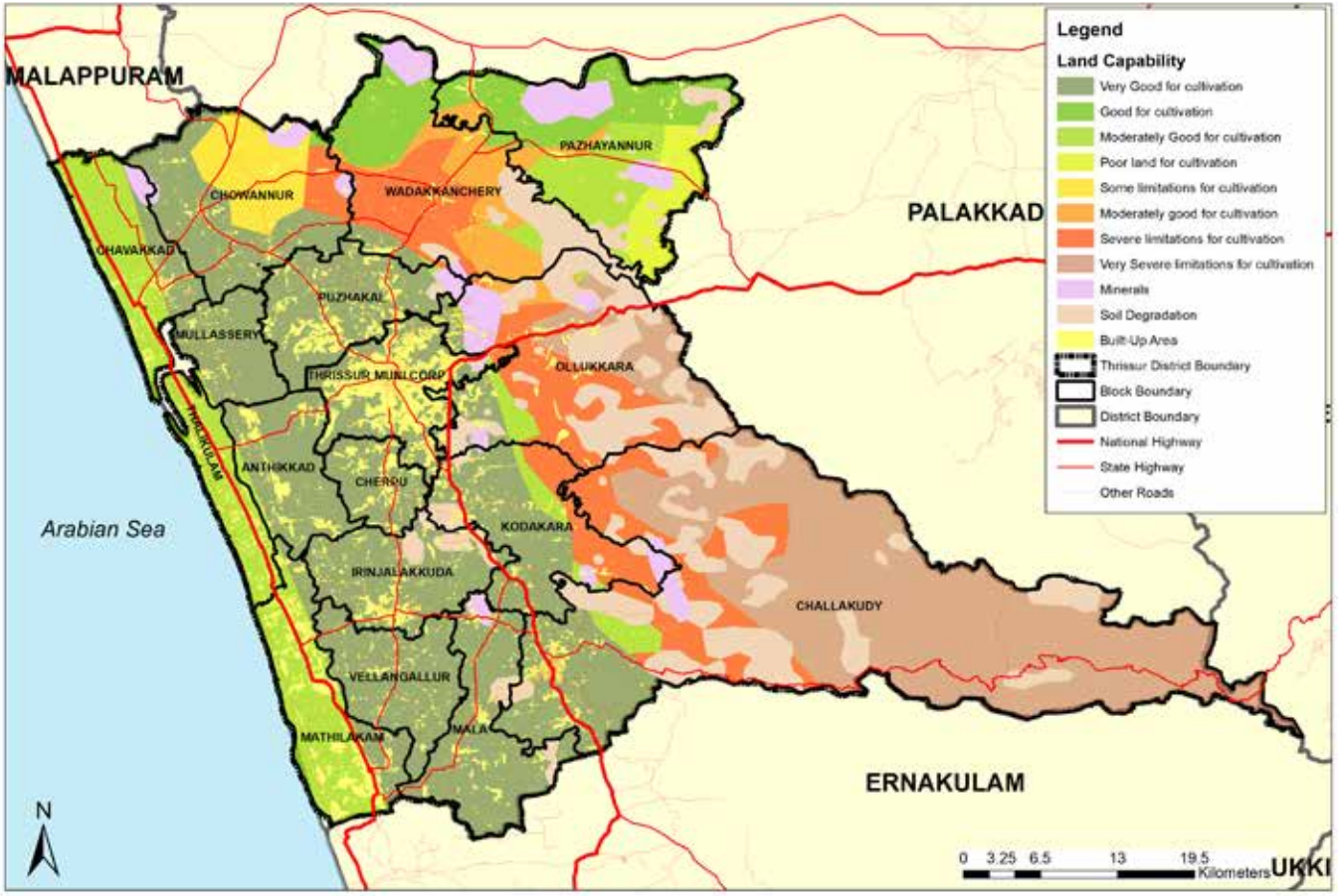
Figure 2.8 represents the capability of cultivation of soil analysed on the parameters aforementioned. It can be concluded that there are belts of land parcels which need to be conserved. Areas which have severe limitations on cultivation except for area under forest (which has limitation because of the presence of forest) may be considered for future development and areas under high suitability of cultivation must be retained in their natural form and impoved upon.

2.4.2 Land Degradation

Land degradation is the deterioration or loss of productive capability of the soil leading to the depletion of natural resources. It causes agricultural productivity to diminish, resulting in food insecurity, increased food costs, climate change, environmental risks, and biodiversity and ecosystem services loss. A total of 173.56 sq.km. land is degraded due to water erosion (50.94 sq.km.), waterlogging or surface ponding (39.74 sq.km.), anthropogenic factors (13.84 sq.km.) & Other factors (69.04 sq.km.). Figure 2.8 shows the classification of soil degradation.

Water erosion (moderate sheet erosion) and Water erosion (severe sheet erosion) refers to the reduction in the depth of the topsoil layer, resulting in soil loss of 20-40 tons/ha/year and soil loss of more than 40 tons/ha/year respectively. These majorly have impacted the uplands and highlands of the region. Waterlogging (seasonal surface ponding) is waterlogging with ponding for 4-6 months impacting one crop (excluding paddy). Waterlogging (permanent surface ponding) is persistent waterlogging with ponding lasting more than six months impacting one crop (excluding paddy lands). Water logging generally occurs in the low lands of the region.

Figure 2.8 Soil Capability Map

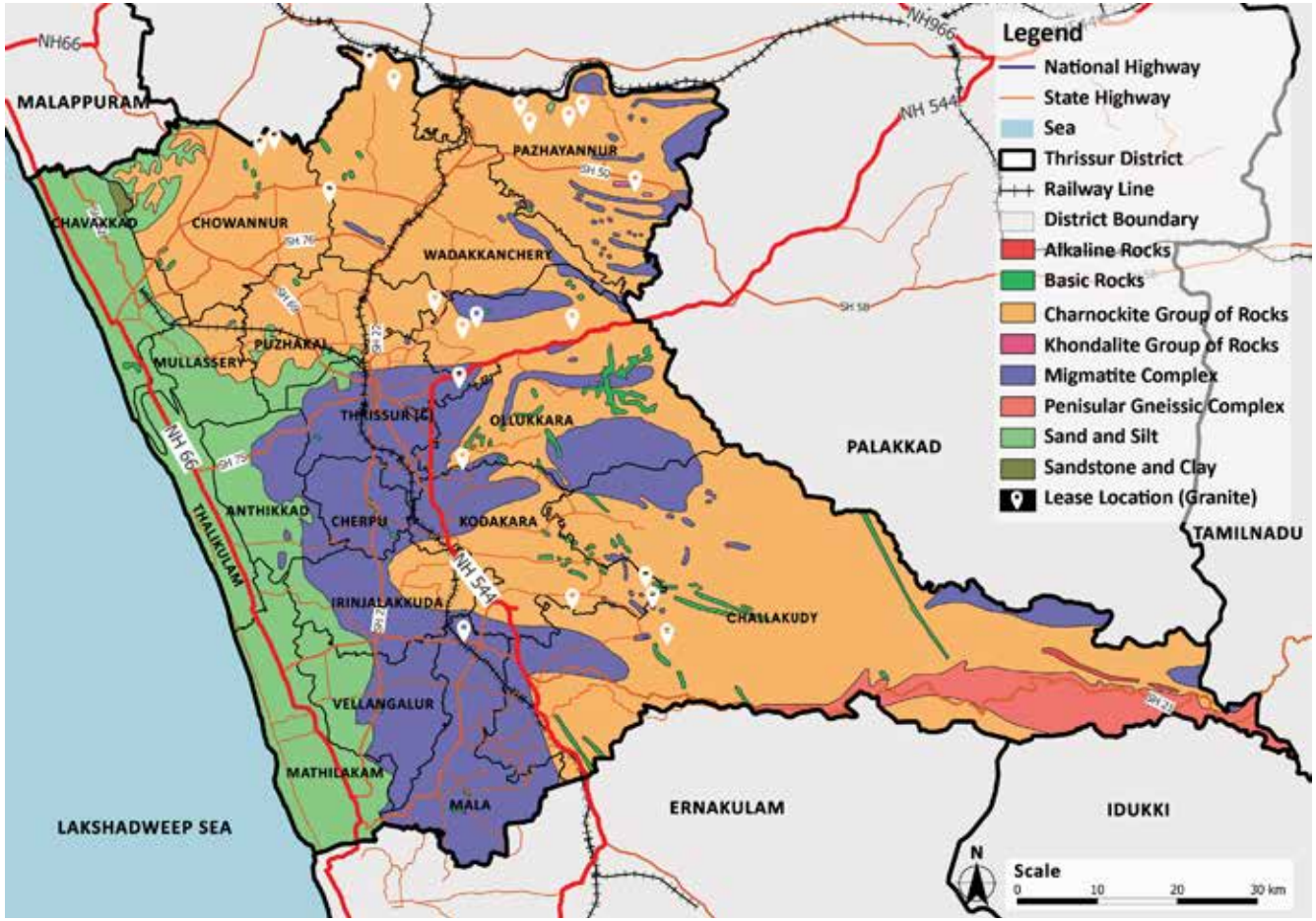


Source: National Bureau of Soil Survey & Land Use planning, ICAR, 2000 using GIS Analysis

Anthropogenic factors include brick kilns, industrial effluents, mining and dump areas. Industrial effluent areas are the areas impacted by wastewater emitted from industries (excluding regions under industry). Mining and dump areas are surface and open-pit mines, as well as mining dumps. This type of land degradation has affected the low lands and some parts of mid lands.

The other factors constitute barren rocky/stony waste and riverine sands/sea intrusion (other than arid areas, consists primarily

Figure 2.9 Minerals and Lease Locations In Thrissur District



Source: Kerala State Landuse Board,2014 & District Survey Report, Thrissur-2022

Table 2.6 Production of Minerals during the Last 3 years ,Thrissur District

Minerals	2019-2020	2020-2021	2021-2022
Granite Building Stone (in Tonnes)	12,62,683	18,62,466	27,75,933
Laterite Building stone (in Tonnes)	15,332	5,100	0
Ordinary Earth (in Tonnes)	6,28,677	3,99,545	5,66,414
Ordinary Soil (in Tonnes)	0	2,437	1,718
Brick Clay (in Tonnes)	57,386	14,452	0

Source: District Survey Report, Thrissur-2022

of sands). Suitable measures such as afforestation, control of mining activities, proper discharge and disposal of industrial effluents and wastes after treatment, proper management of waste-lands, avoiding over use of fertilizers and pesticides, etc. for controlling land degradation have to be taken.

2.5 Mining & Geology

The Thrissur district is separated into four geographical belts. The initial one is the Charnockite Belt, which is extensive and conspicuous across the area. The second is the gneissic belt, which is distinguished by biotite gneiss and hornblende. Biotite gneiss and quartzo-feldspathic gneiss are the first two belts, followed by granitic gneiss (PGC) in the south-eastern portion and quaternaries of the coastal tract in the fourth.

Mineral deposits can be categorised as major or minor. A few small mineral reserves exist in the region, including granite construction stones, laterite building stones, tile and brick clay, lime shell, and sand. Now a day, granite is mined in different blocks, such Pazhayannur, Wadakkanchery, Ollukara, Kodakar, etc. The Peninsular Gneissic Complex's pink granite (granite gneiss) is seen along the South Eastern boundary. Charnockite is the most common rock in the Thrissur region. It is generally enormous, but if foliated, it looks gneissic. The amount of Migmatite Complex Biotite Gneiss is second only to Charnockite. It is the most significant granite in the western part. Shell deposits have been discovered in the Quaternary soil along the shore of Irumbanallur. China clay deposits has been found near Thrissur

and Koratty areas. While there is a rich tile clay deposit in Chalakkudy, and Wadakkanchery area of the Thrissur district.

The district is abundant in building stones like laterite and granite. Ilmenite concentrations have been observed in the coastal plain deposits of Chavakkad, whereas laterite covering in the region northwest of Thrissur is rich in alumina as well as bauxite in some areas. The region has been reported to have iron ore, allanite, and gold. The royalties received from the mining of mineral reserves such as Granite, Laterite, Ordinary Clay, Ordinary Earth and Brick Clay contribute significantly to the district's revenue generation. The highest royalty is charged for granite construction stones and the lowest for Ordinary soil.

Table 2.7 Royalty Collected for various Minerals during the Last 3 years ,Thrissur District

Minerals	2019-2020	2020-2021	2021-2022
Granite Building Stone (in ruppes)	3,03,04,399	4,46,91,974	6,66,22,380
Laterite Building stone (in rupees)	3,67,956	1,22,400	0
Ordinary Earth (in rupees)	1,25,73,547	79,90,897	1,13,28,275
Ordinary Soil (in rupees)	0	97,480	68,736
Brick Clay (in rupees)	22,95,440	5,78,080	0
Misc (in rupees)	1,99,23,815	4,46,45,799	2,62,79,853
Total (in rupees)	6,54,65,157	9,81,26,630	10,42,99,244

Source: District Survey Report, Thrissur-2022

2.5.1 Development Trend & potentials

Granite building stones employed in construction are valued by making floor tiles. Laterite mining has less environmental implications and can be used for marketing as a construction material. The shortage of sand from the rivers is met by promoting M-sand, Weathered rock sand and desilting the dams within the Thrissur District. In Thrissur District about 10,000 MT of M Sand has been produced per day to overcome the shortage of sand.

2.5.2 Impact on the Environment due to Mining

Mining activity can have negative impacts on the environment. Diesel-powered mining machinery, compressors, generators, and other devices used in mining can release pollutants such as SiO2 and CO into the atmosphere. Mine discharge, which is the fluid pumped out of accessible mines, can also have a significant impact on the water ecosystem and groundwater table. Additionally, mining can have an impact on the land environment. Pre-mining land can be altered as a result of mining and related operations, and agricultural and forest areas may need to be diverted for mining.

2.5.3 Issues Identification

Clay mining, have led to rapid degradation of the wetlands (paddy fields), which is significantly reflected in the declining agricultural productivity of the state. Mining of clays several meters below the prescribed levels, water draining from the unaffected paddy lands into the adjacent mine pits, and subsequent pumping of water for further mining impose severe problems on the hydrological regime, lowering the water table and creating severe water shortage problems in the mining areas. The mining of ordinary sand from paleo-channels also cases some environmental concerns.

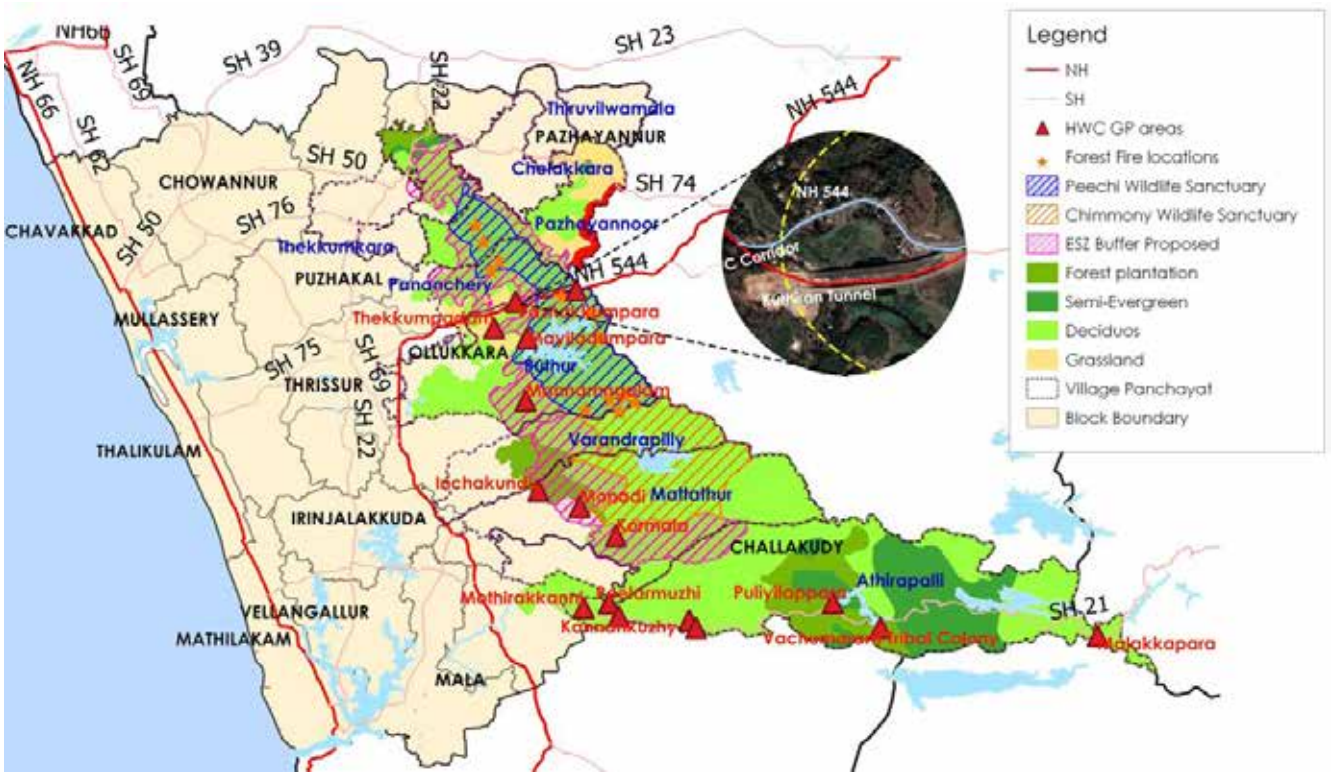
Several remedial activities may be implemented to decrease the environmental implications of the mining process. These activities include producing gap-filling trees in the protective barriers left surrounding the quarry area, adopting technological reclamation methods to reduce the environmental effect of mining, and conceptualizing dense poly-culture plants in the mining zone using local plant species.

2.5.4 Stakeholders

In Thrissur district, private agencies are given sanction for mineral extraction by the Department of Mining and Geology, which is responsible for exploration and prospecting of minerals, as well as the implementation of Acts and Rules for the regulation and development of mineral extraction. The Department of Industries also sanctions long-term mining leases for various minerals, which are implemented through the Department of Mining and Geology. To regulate the extraction of minor minerals in the state, the Department of Mining & Geology framed the Kerala Minor Mineral Concession Rules in 2015.

The Centre for Earth Science Studies

Figure 2.10 Forest cover and typology Map



Source: Kerala Forest Research Institute, 2021

Table 2.8 Forest Cover

Block Name	Gram Panchayats	Block Area (sqkm)	Forest Area (sqkm)	% of Block
Chalakudy	Atahirapalli, mattathur, Varandrapalli	830.40	695.00	83.70
Ollukara	Puthur, Pananchery	293.42	240.00	81.79
Wadakkanchery	Mullukkara, Pazhayanoor, Vadakkancherry	248.67	91.00	36.59
Pazhayannur	Pazhayanoor, Chelakkara	235.60	60.00	25.47

Source: GIS Analysis, 2023

(CESS) is the major autonomous body in this sector, and it is a research organization related to earth science studies under the Kerala State Council for Science and Technology. The organization receives funds from the Central/State Governments and other agencies.

2.6 Forest

Kerala Forest Department works in six divisions in the state. Thrissur Division includes the Thrissur district and Palakkad district. Effective forest area in Thrissur district is 1036.19 sqkm which is 33.34% of the total geographical area. National average of forest cover in India is 24.62% and Kerala state average is 29.65% (Source: FSI 2020). As per National Forest Policy 1/3rd of the Geographical area should be Forest area. Thrissur forest has three divisions – 1) Thrissur 2) Chalakudy 3) Vazhachal. Two wildlife sanctuaries, Peechi and Chimmony come under Peechi Forest Division. Thrissur division is further categorized into three subdivisions - Wadankkachery, Machad and Pattikkad.

Figure 2.10 and Table 2.8 shows the forest land is concentrated in the eastern part; highlands or uplands region, spread over four blocks namely Wadakkanchery, Ollukkara, Chalakudy and Pazhayannur. These blocks come under 11 Gram Panchayat of Athirapalli, Kodassery, Mattathur, Varantharapalli, Puthur, Pananchery, Pazhayannur, Chelakkara, Erumapetty, Varavoor and Mullurkkara.

The vast forest land in the upland region is filled with rich natural resources such as rosewood, timber, rubber, coffee, etc, which has got economic potential in terms of forest products. Also, it is one of the main environmentally sensitive areas of the district. Two wildlife sanctuaries are situated in this area, Peechi-Vazhani Sanctuary (situated in Wadakkanchery, Pazhayannur, Pananchery and Puthur Grama Panchayats) and Chimmony Wildlife Sanctuary (situated in Mattathur and Varantharapilly Grama Panchayats). These large forest reserves favourably affect the climate and induce more rain in the district.

2.6.1 Types of Forest

The major types of forests based on the legal status are reserved forest, vested forest, ecological fragile land and proposed forest. Thrissur district includes 207 sqkm of reserved forest area, 4.31 sqkm of vested forest, 0.74 sqkm of EFL and about 0.03 sqkm of proposed forest land.

Reserved Forest is Any land, proposed to be constituted as a Reserved Forests notified under Section 4 of Kerala Forest Act, 1961 and such forests notified under Section 19 of the Act after completing the procedures under Section 5 to 18 of the Act. Vested Forest is Any Private Forests, were the ownership and possession of such forest is vested with the Government under Section 3 of the Kerala Private Forest (Vesting & Assignment) Act, 1971 and such forests are deemed Reserved Forests as per Section 4 of the Act.

Ecologically Fragile Land means any portion of land held by any person and lying contiguous or encircled by a reserve forest or vested forest or any other forest land owned by the government and predominantly supporting natural vegetation; and any land declared to be ecologically fragile lands (EFL) by the government by notification in the official gazette under Section 4 of Kerala Forest (Vesting & Management of Ecologically Fragile Lands) Act, 2003. In terms of forest canopy density classes, 18.90% of forest cover in the district is very dense forest (VDF), 41.07% is moderate dense forest (MDF) and remaining 40.03% is open forest (OF).

Table 2.9 Major Human Wildlife Conflict Locations

HWC Measure		Thrissur	Vazhanchal	Chalakudy	Current Situation
EPT	Existing	2.3	2.3	2.6	Effective against larger wild animals, require maintenance
SPF	Existing	-	0.79	-	Less expensive, more effective than EPTs
	Required	1.5	33.6	9	
EWES	Existing	No	No	No	No rapid response teams in any division
	Required	Yes	Yes	Yes	
No. of Families Affected		**351**	**160**	**372**	**EPT: Elephant Proof Trench, SPT: Solar Power Fence, EWES: Early Warning Electronic System**

Source: Kerala State of Environment and Related Issues, 2021

2.6.2 Flora and Fauna

For the flora composition of the district, semi-evergreen, moist deciduous forest, forest plantations and grasslands are found in the region. The tropical evergreen forests with its luxuriant vegetation with loafty trees are found in sholayar valley. The semi evergreen forests which lie between the moist deciduous and evergreen forest occur in the Athirappally reserve of Vazhachal division. The main forest product is timber, rose wood. Other hardwood species which command steady market are Irul, Pullamaruthu, Koramaruthu, Venga, Venteak, Pongu, Akil etc. Minor forest products like Mattipal, Karuvelampatta, Marottii, Poovam, Zamalporia, Kanjiram, Elevangam are abundant in these forests. There are also rubber, tea and coffee plantations in these forest tracts. Calophyllum polyanthum, Syzigium cumini, Mesua ferrea, Terminalia tomentosa etc. are some of the indigenous species of plants found here. For the fauna composition these forested hills have various indigenous wildlife species like Indian giant squirrel, Purple heron, Shikra, Asian common toad, Nilgiri langur, Asian elephant, tiger, Lion tailed macaque, etc.

2.6.3 Environmental Concern Zone

In order to preserve the environmentally sensitive areas of the district so as to ensure sustainable development, areas where environmentally sensitive land uses are concentrated are delineated as Environmental Concern Zone. The Department of Forests and Wildlife published eco sensitive zones around various protected areas to prevent these sensitive areas from degrading. The proposed Environmental Sensitive Zone (ESZ) buffer in Thrissur District is around 180 sqkms apread over 7 village panchayats namely – Athirapalli, Mattathur, Varandrapalli, Puthur, Pananchery, Pazhyannoor and Chelakkara. Forest related activities including eco-tourism spots, aromatic & medicinal plant cultivation, eco-shops based on natural resources of the region, outlets for forest related products. Watershed related activity & soil conservation may also be promoted in this buffer zone. Agriculture and Allied activity non detrimental to forests can be promoted as supporting activity in this zone while deforestation, wet land reclamation, industrialization, urbanization will be restricted here.

2.6.4 Human Wildlife Conflict

Human-wildlife conflict (HWC) is negative interaction between humans and animals with undesirable consequences for people, resources and wildlife. In 2019-2020, 758 cases of human-wildlife conflict cases were registered within district forest administration. Figure 3.7 shows major human wildlife locations in the district which are concentrated most in the Chalakudy block (Vazhachal division) followed by Ollukara block (Peechi division). The type of conflicts include crop damage by wild boars, herd of elephants, monkeys, giant Indian squirrels, etc , animal bites, livestock lifting of cattle and grazing animals, human injuries and deaths.

Some causes of these conflicts are rapid urbanization, lack of protected area, transport network, increasing encroachment in the forest areas. An active HWC hotspot is the Kuthiran tunnel which was constructed in 2021 to control traffic on the way to Palakad district (shown in the enlarged figure 2.10). After construction, elephants started crossing to Machad range to raid crops which were previously devoid of elephants. The areas of high degree of conflict in each Forest Division under respective gram panchayats have been listed in the table 2.9. The preventive measures adopted in each division to prevent HWC are listed in the table 2.9 along with the number of families living.

Existing mitigation strategies for human wildlife conflict in India have been copied from Africa. Some preventive measures to mitigate HWC cases are solar power fencing, elephant proof trench, elephant proof wall, bio fence, stone pitched trench, kayyala (stone or a rubble wall) etc. The conditions of solar fencing in Chalakudy block is fully damaged due to crop raids by wild elephants and needs to be reconstructed. There have been 14 cases of forest fire in the district out of which 4 were at Peechi Wildlife Sanctuary. For mitigation, 142 km of fire lines have been constructed in the region with fire stations and 13 thousand of on-ground fire watchers.

2.7 River & Water Bodies

The Bharathapuzha, Keecheri, Puzhakkal, Karuvannur, and Chalakkudy having catchment area of 4400ha, 401ha, 234ha, 1054ha, 1401ha respectively are among the district's significant rivers having reservoirs like Peechi (Karuvannur), Chimmony (Karuvannur), Vazhani (Kecheri), Sholayar (Chalakuddy), and Peringalkuthu (Chalakuddy) in the high lands of the district for irrigation, hydropower, tourism, and other purposes. There are three freshwater lakes which are Muriyad Lake, Kattakampal Lake, and Enammakkal Lake. The other major wetlands are the Kole wetlands and backwaters or Kayals situated mostly in the mid and lowlands of the district. These backwaters are the Chettuva backwater, Azhikode estuary, Kodungalloor Kayal, and Akathumuri backwater.

2.7.1 River pollution

According to the national green tribunal 21 rivers in Kerala are listed to be extremely polluted, out of which 3 are in the Thrissur district, they are kechery river stretch from puliyannor to kacheri has BOD of 6.8, karuvannur river has BOD of 5PPM and puzhakal river having BOD of 6PPM from ollarikara to puzhakal. There are no industries along the banks of rivers directly discharging effluent, or industries which have water intake from the rivers. Dumping of solid wastes and unauthorized discharge of untreated sewage into the river is suspected as the cause for the degradation of the quality of water. All these polluted stretches pass through the kole land, thus major part of the pollutants are contributed by the fertilizers and pesticides and other agricultural wastes. In puzhakal river the polluted stretch is from ollarikara to puzhakkal, Recently boating services for tourism have started across river,. There is direct discharge of untreated waste water and solid waste into river was noticed from Dharmasastha temple. Kechery river which pass through the chowanur block,the stretch from pulliyanoor to kechery is polluted (Figure 2.11). This block is one of the fast developing and has more build up compared to the other blocks. Due to this the river is facing encroachment, when we overlay the buildup map over the polluted stretch it is clearly seen that the build up area on the kole lands of puzhakkal are mostly along the river. Which explains the River pollution is mainly due to the drainages from houses, hospitals, residential apartments and automobile service stations upstream in the corporation area.

2.7.2 Ground water scenario

Kerala has topographical slope towards the west, due to which most of the rain water received during the south west monsoon drains into the sea give it no time to seep into the ground and recharge the ground water table. Ollukara block , part of chalakudy and wadakanchery block has scarcity of groundwater, as these blocks are situated at the highlands of

the Thrissur district and the rain water runoff into the sea before being able to recharge the groundwater.

2.8 Kole Wetlands

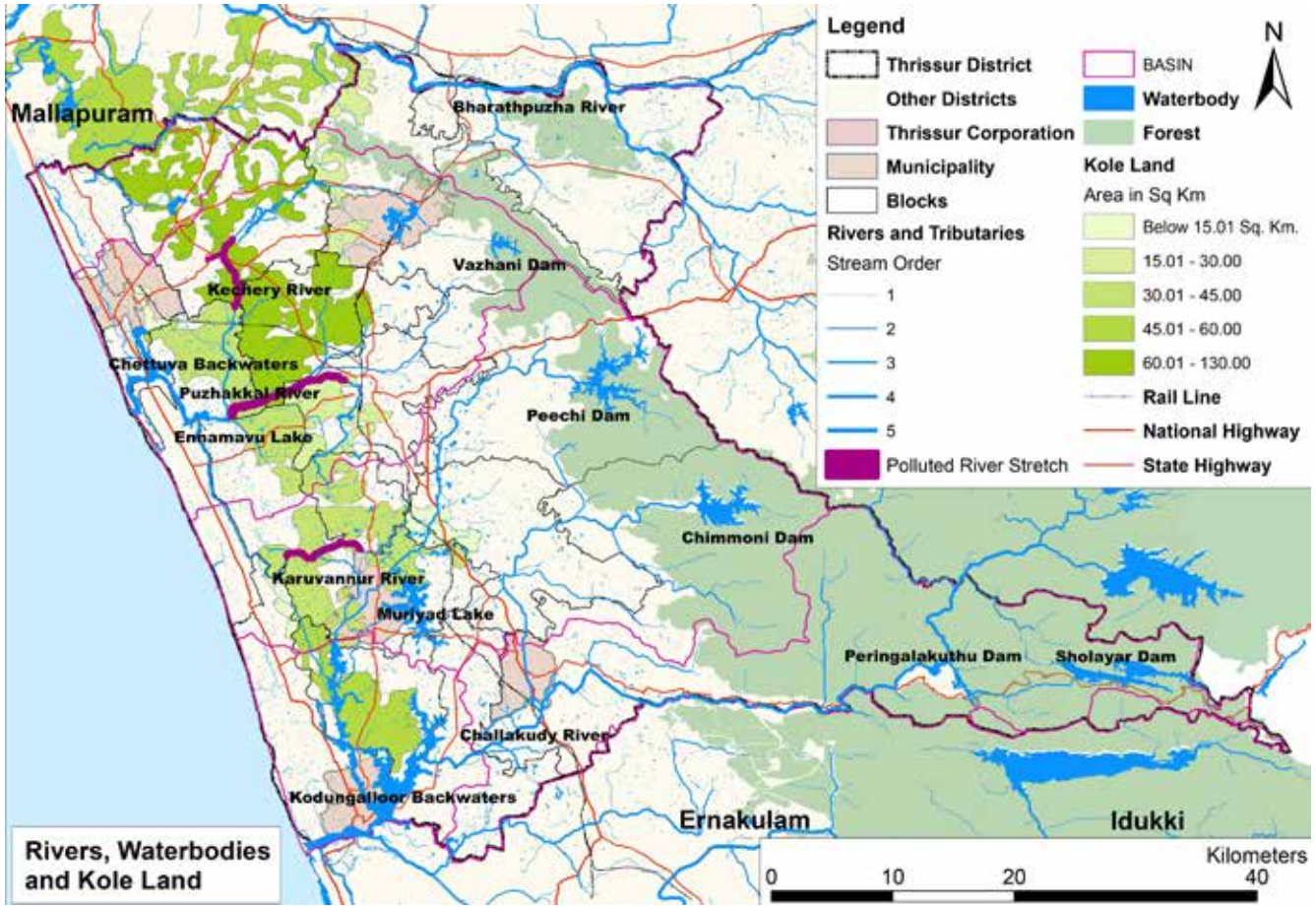
Wetlands are the most productive life-supporting ecosystem that provides agricultural goods, and fishery products supporting local employment and generating economy. The wetlands also act as the natural promoter for water retention, groundwater recharge, water purification, flood mitigation, and nutrient retention supporting aquaculture and wildlife.

The Ramsar Convention defined wetlands as the "Areas of marsh, fen, peat-land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters."

India has a total of 15.3 million ha (4.7%) of the area covered under wetlands from which Kerala covers an area of 1695.90 sq. km. of land under wetlands contributing 4.13% in the area of state land. Kerala has a total of 4354 wetlands, from which Ashtamudi, Sasthamkotta, and Vembanad-Kol are the three Ramsar sites that lie in Kerala. The Vembanad-Ponnani Kole Wetland ecosystem is the largest brackish, humid, tropical wetland ecosystem on the Southwest coast of India comprising 1512.50 sq. km. of the area included as a Ramsar site in 2002 (Understanding the Kole Lands in Kerala, Jeena T Srinivasan, 2010).

Thrissur district has Kole wetlands spread between the BharathPuzha River and the Chalakuddy River covering a total number of 11 blocks and Thrissur corporation with Kole lands extending to the Malappuram district (Figure 2.11 showing River, Water bodies, and Kole lands). These are the marshy lands that cover an area of 447.50 sq. km. in between these two rivers consisting of 14.76% of the district area (Table 3.10). The district has a total of 529 wetlands spread over 132.85 sq. km. of land (4.38% of the district area) extending between the Kechery and Karuvannur rivers of the district.

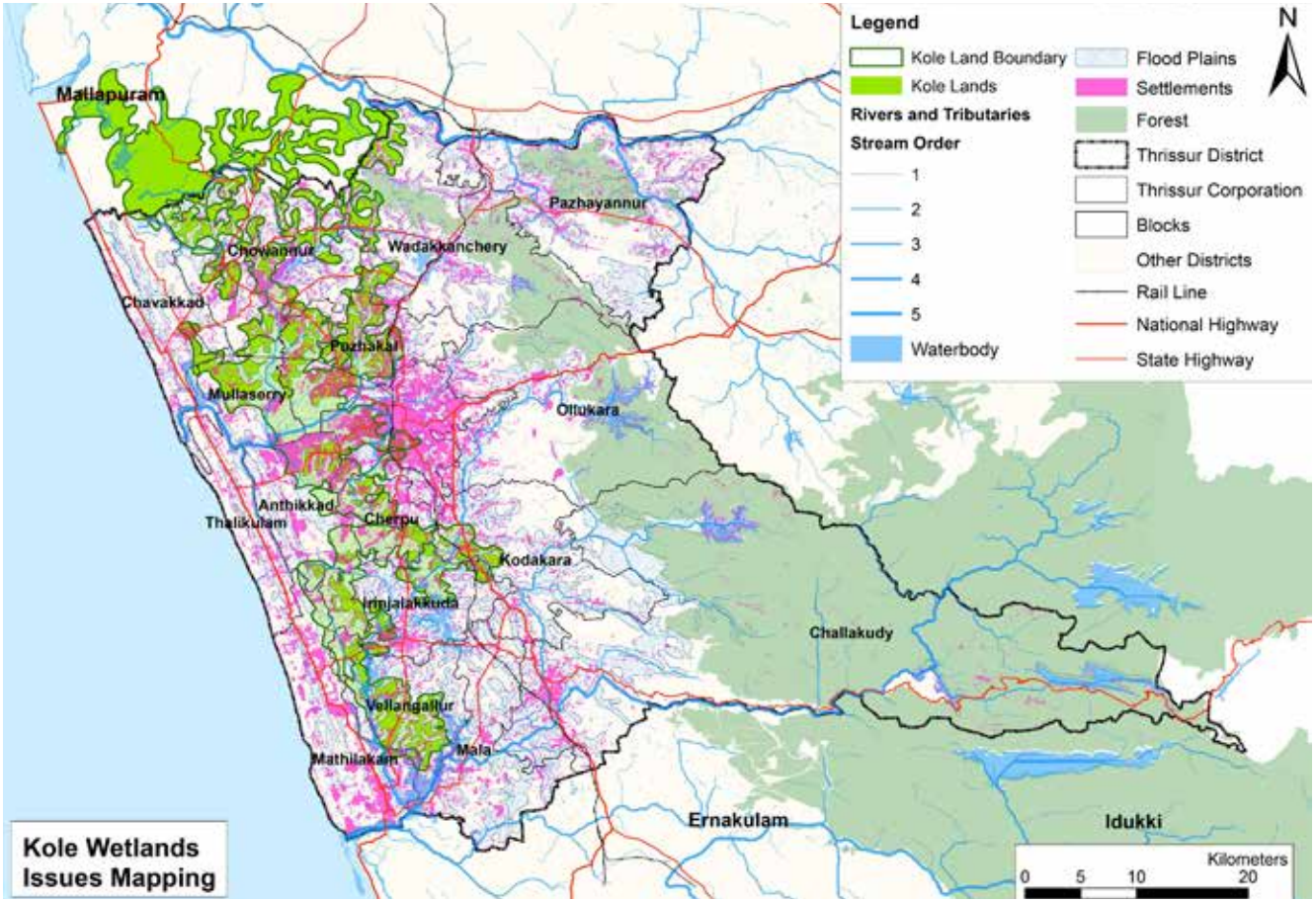
Figure 2.11 Rivers, Water Bodies and Kole Wetland Map



Source: Irrigation Department & District Spatial Plan 2011

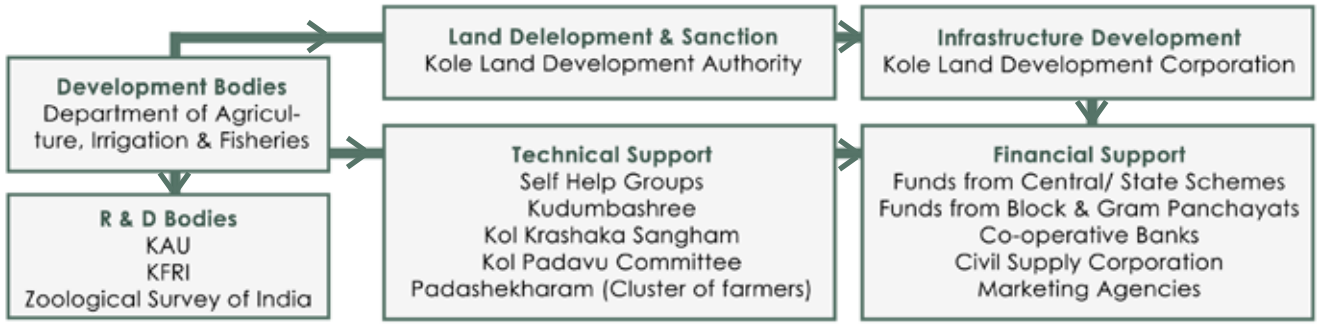
These wetlands are majorly classified into Rivers, Backwaters, Reservoirs, freshwater lakes, lagoons, sand beaches, and marshy lands are the major wetlands that cover an area of 130.14 sq. km. of land while the other minor wetlands are the small water bodies like Panchayat ponds, Private & public ponds, Quarry ponds, and Irrigation tanks covering an area of 2.71 sq. km. of land (DSP, Thrissur, 2011).

Figure 2.12 Flood and Built-Up area analysis of the Kole Lands



Source: Land Use Land Cover Map 2023 & Kerala Forest Research Institute

Figure 2.13 Potential Stakeholders for the Kole Area Development



Source: Various government departments

2.8.1 Major Characteristics and Developments

These lands are the major rice granary of Kerala that lies below the mean sea level ranging from 0.5 to 2.5 meters acting as the natural drainage system of the district flourishing many agricultural and fishery goods with forest and plantation for medicinal goods. The Kole lands also plays major role in flood mitigation by storing the running and excessive water during the heavy rains and flood as the lands lie below the MSL level. These wetlands have an interspersed system of canals making Kole lands the major source of irrigation and recharging source for groundwater and aquifiers providing rich quality soil and aquaculture with favorable conditions for the breeding of bird and fish species.

Kole lands have agriculture (paddy cultivation), fishery, animal husbandry, and allied primary economic activities as the major land use distribution apart from the built-up area for different development activities. The Kole lands are divided into small parcels of cultivable fields called 'Padavu' which are privately owned by small farmers having an economic value of $66.91 million (2011). The major canals used to irrigate the Kole lands are Link canal, Herbert canal, Chirakkalthodu, Perumpuzhachal, Chettupuzhachal, Neerolithodu, Nandi thodu, etc. whose flow in the fields, canals, and rivers is controlled with the help of Sluices and Regulators. The Soil available in the Kole lands is acidic in nature and contains elements of sodium chloride, iron, aluminum, manganese, and sulphur (Irrigation Department, govt. of Kerala).

The Kole lands provide a high yield capacity for producing paddy but due to different fac-

tors like increase in cultivation, labor and seed costs, unavailability of irrigation facilities, and rise of real estate demands, agriculture production is reduced in the Kole Lands and the fields have started to convert into cash crops fields and real estate development lands for meeting different infrastructure and development demands. As per the LULC map 2023 (Figure 2.2), a total area of 120.19 sq. km. is converted for the development of different infrastructure, housing, residences, commercial sector, and other projects resulting in a decrease of Kole area to 372.83 sq. km. only which is 12.3 % of the district area (Table 2.10 and Figure 2.12). The other development projects on the Kole land are the construction of canals, bunds, sluices, regulators, and de-siltation of water bodies for agricultural purposes to provide fresh water for irrigation and drinking purposes and to control saltwater ingression and flow of water.

Table 2.10 Block-wise Floood & Built-Up Area Analysis of Kole Land

Flood & Settlement mapping of ecologically sensitive Kole Wetland Area				
Block/Corporation	**Kole Land Area (Sq. Km.)**	**Flood Affected Kole Land Area (Sq. Km.)**	**Built-up Area on Kole Land (Sq. Km.)**	**Kole Land Remaining Area (Sq. Km.)**
Chowannur	79.41	37.53	18.87	60.54
Puzhakkal	74.22	37.17	23.87	50.35
Vellangallur	49.29	26.27	8.69	40.6
Irijalakkuda	43.85	28.31	8.02	35.83
Mullaserry	42.16	26.68	5.4	36.76
Anthikkad	37.7	29.29	15.03	22.67
Cherpu	33.35	23.04	9.11	24.24
Thrissur C	29.42	19.29	18.29	11.13
Wadakkanchery	27.34	9.81	5.31	22.03
Kodakara	14.87	9.3	3.63	11.24
Mathilakam	9.92	8.48	2.28	7.64
Chavakkad	5.98	1.7	1.69	4.29
Total	**447.51**	**256.87**	**120.19**	**327.32**

Source: Analysis using GIS Mapping, March 2023

2.8.2 Potential Stakeholders, Wetland Acts, and Governing Agencies

There are different stakeholders involved in the development and conservation of Kole fields. It includes a number of governing agencies, departments, self-help groups, financial institutions, and research & development agencies which are interrelated with each other and are responsible for the sustainable development of the Kole fields (Figure 2.13).

The conservation, protection, and promotion of wetlands at the international levelare done by TheRamsar convention. The Ministry of Environment, Forest & Climate Change (MoEF-CC) under the Government of India helps in wetland management at the national level. At the state level, the department of Environment and the department of Science and Technology is in charge of wetland conservation and management in their respective states. The Kole Land Development Authority has been formed for land related issues and Kole Land development Corporation has been formed by state government to look over the infrastructure and development projects in Kole area.

The state steering committee along with various concerned departments deals with issues in wetland areas. A number of R&D organizations in the state are involved in the study of various aspects of wetlands. The Kerala Forest and Wildlife department manages the forest and mangrove areas, while the Kerala Agricultural University coordinates the agricultural activities around wetlands. The Water Resource and Irrigation department manages rivers, freshwater lakes, backwater areas, reservoirs, etc. and Science and Technology department coordinates the Coastal Regulation zone activities. The other departments of fisheries, mining, and related activities work in coordination with wetlands conservation programs.

The Kerala Government initiates various acts for wetland conservation like The Kerala Conservation of Paddy Land and Wetland Act, 2008 managed by the State Wetland Authority Kerala (SWAK) for Conservation of paddy land and wetland, restricts the conversion of wetlands and paddy fields fora sustainable ecosystem. While the other section of this act allowed the filling of paddy land of more than ten cents in a Panchayat or five cents in a Municipality/ Corporation, for the construction of the residential building for the owner of the paddy land such that it should not affect the cultivation in adjoining paddy lands, the measures to be adopted to ensure the free flow of water to the adjoining paddy lands. But this section led to the unorganized development of built areas and the clusters of these developments now require more infrastructure for health, sanitation, education, and other facilities which will adversely affect the ecosystem of the Kole lands. While the other section states about the preparation of the data bank with the details of the cultivable paddy land and wetland, and exhibits the same for information to the public for conseravtion of Kole area but the data bank is not prepared till now (The Kerala Conservation of Paddy Land and Wetland Act 2008).

While Section 3A of the Kerala finance Act, 2015 allowed to regularization of the Kole lands reclaimed or converted before thecommencement of the wetland act, 2008 which led to the development of sensitive land (The Kerala Finance Act, 2015). In the same way The Kerala Conservation of Paddy Land and Wetland (Amendment) Act, 2018 introduced the term 'Un-notified Land' as a new category of land that can be regularized for development as well as this amendment reduced and limited the role of local-level monitoring committees in the process of sanctioning the development projects that led to more real estate and construction projects in and around the Kole areas. The Government of Kerala has taken some initiatives like setting up new institutions for providing support to agricultural activities in Kole lands. The government initiated a comprehensive conservation program under which government runs various public awareness programs for increasing awareness of the importance of wetlands conservation.

2.8.3 Key Issues

Wetlands support the natural existence of ecosystems with economy, culture, and livelihood, yet the area of wetlands is shrinking at an alarming rate due to encroachments and land conversion for agricultural and non-agricultural use. The wetlands are threatened by activities like infrastructure development, mining, excessive fishery practice, and pollution in wetland areas. This lead to many changes in the ecology of Kole area due to various factors like saltwater intrusion, changes in water level, habitat changes like the invasion of species, sedimentation, effluents, wastewater, and sewage disposal, and floods in urban areas. A total of 120.19 sq. km. (26.86 %)of the Kole wetlands has already been converted for different type of development activities with now remaining to only 327.32 sq. km. of Kole area (Table 2.10). While at the district level the Kole area is reduced to consist only 10.80% of the total district area from 14.76%.

Kole wetlands also act as the flood plains with a total area of 256.87 sq. km. (57.50%) of total Kole area lies under the flood plains from which 66.75 sq. km. of area have built up as land cover and 190.12 sq.km. area have agricultural cover (Table 2.10). The majorly affected Kole areas are Thrissur Corporation and Puzhakkal, Mullaserry, Anthikkad, Cherpu, Irijalakkuda and Vellangallur Blocks. Paddy cultivation is one of the major activities that are co-existing with the wetland ecosystem which is also reduced in the past time due to different factors of conversion for cash crops and development projects, fallow paddy fields, poor irrigation due to the Siltation and deterioration of the canal system, and othersleading to the threatened wetland areas.

The Databank preparation and list of permitted and prohibited activities for regulating Kole area have to be prepared under The Kerala Conservation of Paddy Land and Wetland Amendment Act 2018 that is still in progress and incomplete as found during the physical survey. While some new sections like Regularization of Unnotified land with limited role of local level monitoring committees are also some of the major concerns that incorporates to lack of management and regulations in the ecosensitive Kole Area. The wetlands need scientific management coupled with socioeconomic considerations that will provide an effective tool to planners for recognizing wetlands as one of the prime life-sustaining ecosystems. To save this unique inter-tidal ecosystem from being endangered different wetland conservation and management as well as river basin management policies, programs, and guidelines need to be taken.

2.9 Pollution

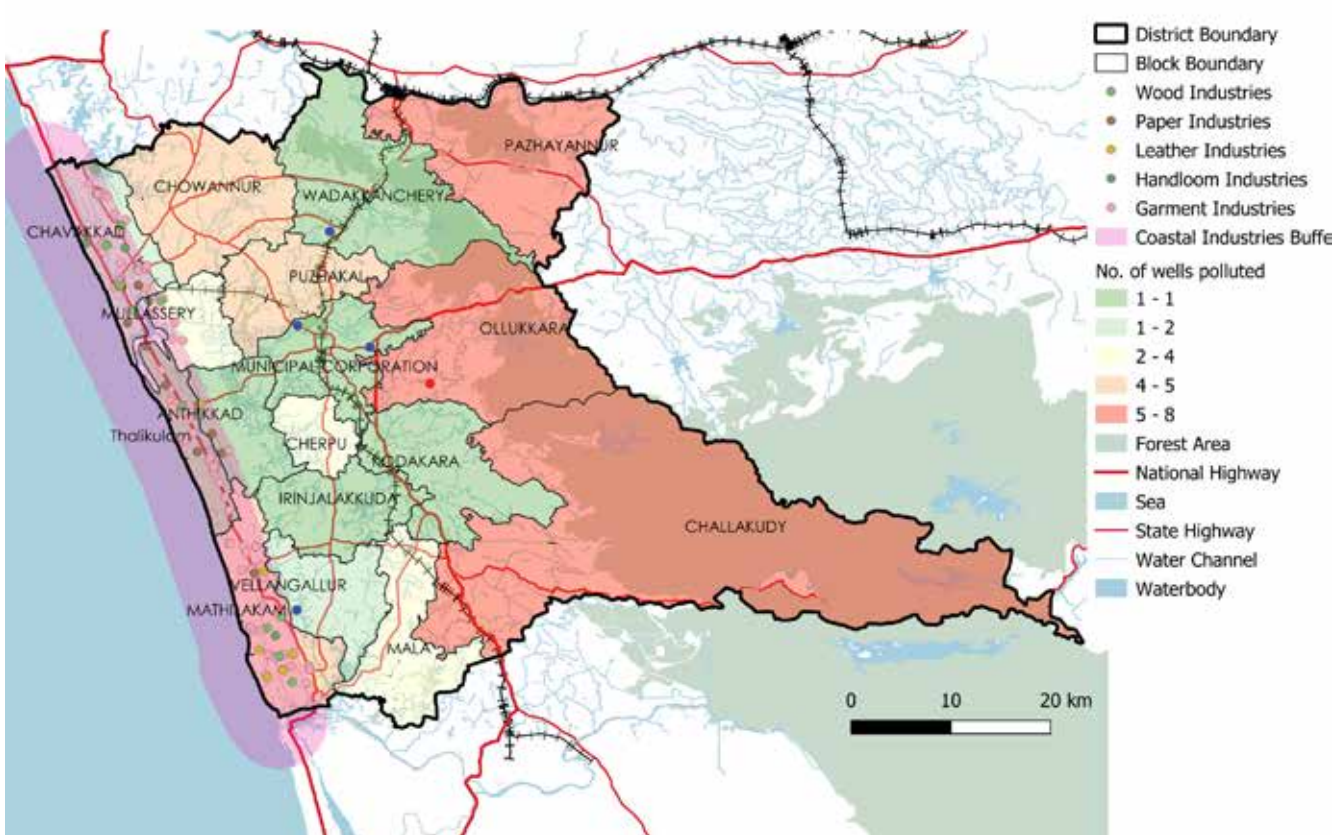
Pollution is an important concern as it is associated with urbanization. Mainly there are land (soil) pollution, water pollution, noise pollution and noise pollution. Thrissur city is one of the major cities of Kerala which exhibits growing trends of urbanization

2.9.1 Coastal pollution

Coastal pollution due to industries is a main cause of environment pollution in the state. Large and small scale industries release harmful chemicals and gaseous pollutants. In the case of Thrissur coastal area, coastal line is selected as study areas and the industries that are located at 5 kilometers buffer from the coastal line at the maximum high tide are analyzed on the basis of red, orange, green and white categorization at per CPCB to assess the impact of pollution on the area's coastal ecology. This is done in order to create an action plan to improve the quality of the sea water along the Indian Coastal regions.

Out of 155 industries identified in the buffer zone from the coastline, 21 industries lies in the red category (paper and wood), 7 in green category (leather) and 127 in white category (garments and handloom). Figure 2.14 shows buffer around coastline and industries in the buffer. The industries identified in the red category release maximum no. of pollutants and water discharged is also high. The direct release of pollutants from rivers, increasing surface run-off and drainage from growing port areas, oil spills and other contaminants from shipping, and household and industrial effluents are the primary causes of the global increase in coastal and marine water pollution. Due to contamination of inorganic and organic pollutants from large-scale domestic and industrial effluent discharges carried by rivers, disposal of contaminated mud from harbour dredging, intense shipping activities, agricultural runoffs, oil spills, deforestation, poorly planned river basin developments, as well as atmospheric depositions, a significant ecological change is pronounced in this coastal region.

Figure 2.14 Industries in 5 km buffer from costal line and Ground water quality



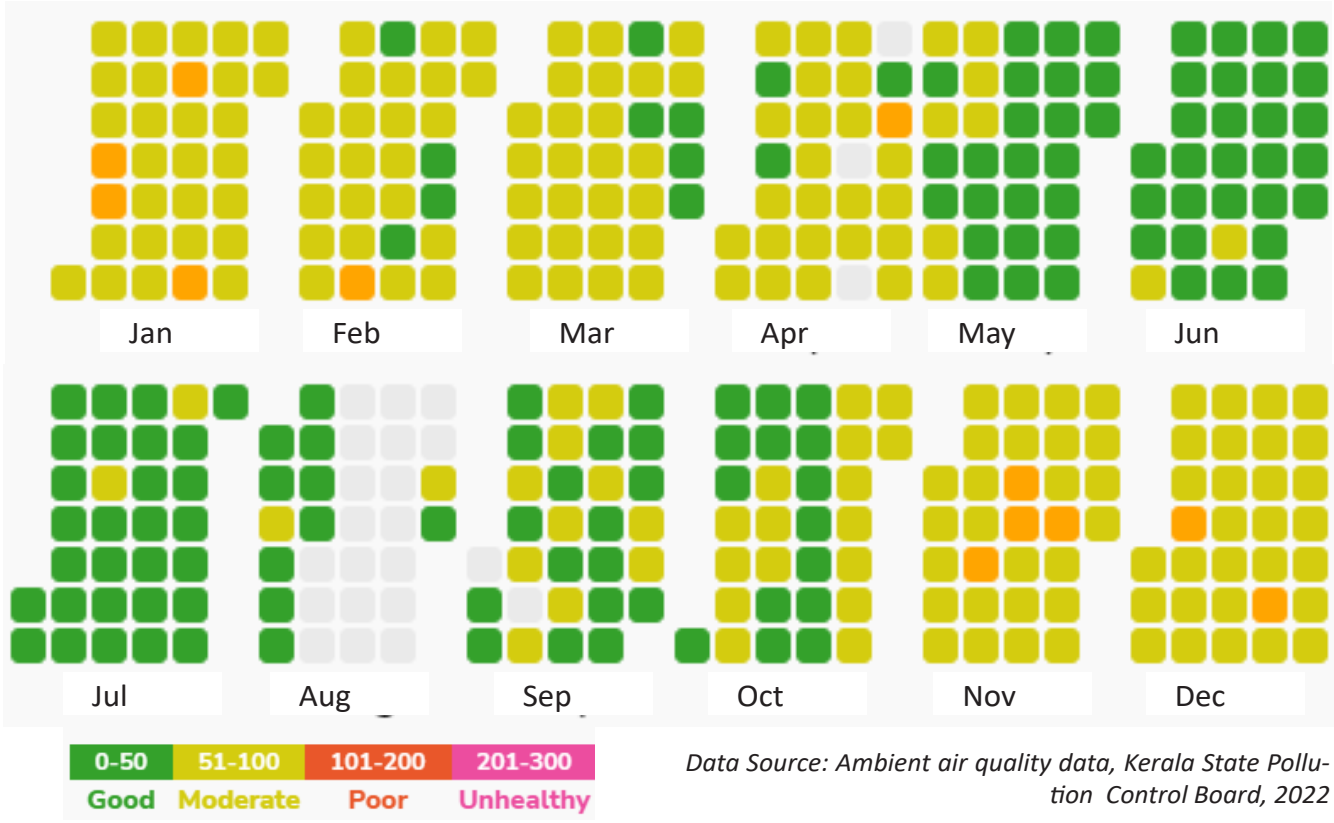
Source: Central Ground Water Board(CGWB), Thrissur, 2021

2.9.2 Ambient air quality

Air quality is measured based on the number of small particles in every cubic meter of air, specifically those smaller than 2.5 micrograms (PM2.5) or 10 micrograms (PM10). These particles are capable of entering the human blood stream directly through lungs and increase the risk of heart attacks strokes and lung cancer (CPCB, 2009).

There are 4 air quality monitoring stations in the city out of which 2 are automatic and 2 stations are manual. The CAAQMS are located at Paravattani and Nita Gelatin (private station). The manual stations are located in Poonkunnam and Peringadoor which are surrounded by residential and industrial land use respectively.

Figure 2.15: Daily average ambient air quality data for Thrissur distriit for year 2022.



Data Source: Ambient air quality data, Kerala State Pollution Control Board, 2022

The major air pollutants for the city are PM2.5 and PM10 which are found to be present in almost double the permissible limit by WHO. Figure 2.15 shows the ambient air quality data for the 2022 provided by Paravattani station. It shows that the starting months and ending months of a year experience moderate-poor air quality and middle months i.e. May to October experience good air quality days. This is mainly due to increase in footfall during Pooram and Vishu celebration during March-May and Diwali and New Year celebration during October –January.

2.9.3 Ground water quality

Water is valuable and essential for human survival and growth. Maintaining the quality that prevents contamination has become a crucial part of monitoring water supplies. The number and quality of supplies coming from various sources do impact water quality. As a result, comprehensive national planning and resource management for water are required, with a focus on allocating priorities among the various users (Alobaidy et al. 2010). The district's primary source of drinking water is groundwater. It is crucial to assess the groundwater quality to ensure a supply of clean water for drinking and other household uses in the face of rapid population expansion and growing pollution sources. Groundwater conservation, regulation of its extraction, and control of its usage in Kerala are all covered under the Kerala Ground Water (Control and Regulation) Act, 2002.

As pr ground water study of 72 wells out 77 wells located allover district, 4 blocks are identified namely Chavakkad, Mathilakam, Ollukara and pazhayannur that are facing ground water pollution in the district. Table 2.11 shows polluted wells in the district. The wells have been classified on the basis Ph, TDS, Turbidity, Sodium, HCO3 and Iron content. Maximum wells have been found with additional level of pH and Fe content compared to the permissible limit provided by WHO for drinking water.

To stop the overexploitation of the ground water, the critical and semi-critical blocks need to get rapid treatment. More public education and training programmes should be implemented in such regions to emphasise the value of groundwater conservation and recharge for future groundwater usage. Building ponds and tanks, check dams, gully plugs, subsurface dykes and rooftop rainwater gathering are examples of artificial recharge projects that may be undertaken in both urban and rural areas.

2.9.4 Best practices and way forward

Ground water recharge is the need of the hour. Various activities that are leading to ground water quality deterioration like mining, withdrawal of water for commercial purposes, discharge of untreated wastewater, dumping of solid waste and chemical effluents, setting up and expansion red and orange category indus-

tries etc should be looked upon and banned. The blocks falling critical and semi critical category should be notified by Central Ground water Authority and the State Ground water Authority. Mass Awareness Programme was should be organized in critical blocks to give awareness to the local people pertaining to rain water harvesting and optimum utilization of ground water particularly along the coastal areas.

The key components of action plan proposed by Central Pollution Control Board control board involves declaration of polluted blocks by Central Ground Water Board and ban on over abstraction of industries as per block status. State Pollution Control Board should levy fine on industries that are discharging industrial effluents illegally. Rain water harvesting policies should be introduced and adopted by Urban Local Bodies. The final step involves capping of contaminated tube wells and Potable water supply through alternate measures in the affected areas of groundwater by Water supply department.

Plan should be proposed to not only recharge ground water but to manage districts waste water in a way that it helps in improving ground water quality and quantity and also leads Thrissur towards its aim of achieving symbolic economy.

Table 2.11 Table showing Ground water quality data of wells in Thrissur.

Block/ Corporation	Total no. of wells	pH	TDS (mg/l)	Turbidity (NTU)	Na (mg/l)	HCO3 (mg/l)	Fe (mg/l)	Total polluted wells
Anthikad	2	-			-		1	1
Chalakudy	6	-	1		1		4	4
Chavakkad	1	1		1				1
Cherpu	8	1	1		1			3
Chowannur	7	1		1			3	4
Irinjalakkuda	2	-		1				1
Kodakara	7	-					1	1
Mala	2	2		1			1	2
Mathilakam	4	3		1			1	4
Mullassery	2	2	1			1		2
Ollukkara	7	1	1	2	2		2	6
Pazhayannur	8	1					5	5
Puzhakkal	7	-		2			3	4
Thalikkulam	2	-					1	1
Thrissur Corporation	3	1						1
Vellangallur	3	-					2	2
Wadakkanchery	3	-					1	1
District	**72**	**13**	**4**	**9**	**4**	**1**	**24**	**42**

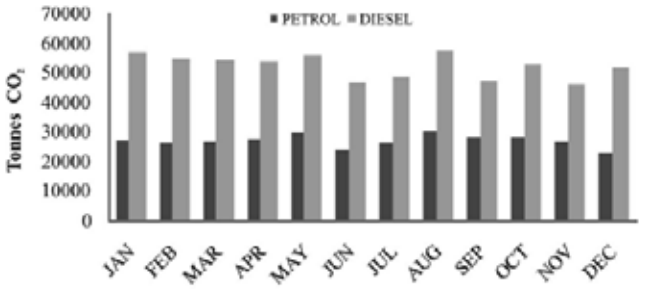
Source: Central Ground Water Board(CGWB), Thrissur, 2021

2.9.5 Carbon Mitigation via Water Transportation

Pollution is of a great concern to Environment. In India,transport is the third most CO2 emitting sector, and within the transport sector, road transport contributes more than 90% of total CO2 emissions in Thrissur. Since Thrissur district has abundance of water canals traversing through, it can be used as an asset to mitigate carbon emision by shifting cargo mobility to identified NW3 Stretch which is proposed extension to existing NW3.

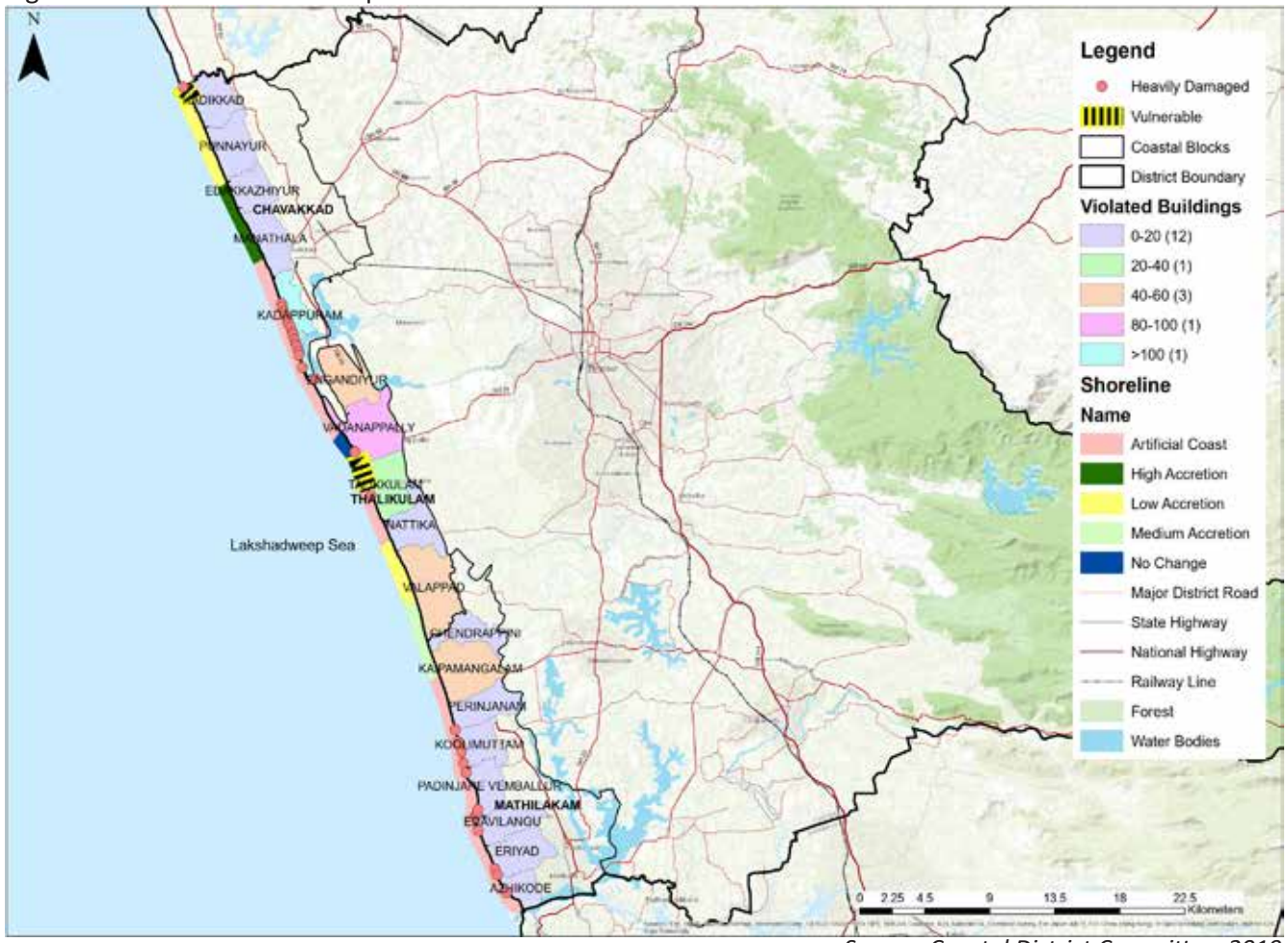
The present identified NW3 has transportation barriers which needs to be revived, disscused in chapter 3. We see fuel running fishing boats causing siltation in certain stretchs which smothers species, causes biodiversity loss, eco-

Figure 2.16: CO2 Emissions from Road Transport



Source: Climate Change and Environmental Sustainability in Thrissur, 2019

Figure 2.17 Coastal Hazard Map



Source: Coastal District Committee, 2019

system imbalance, vertical shrinkage & act as transport barrier. Certain policies needs to be planned for green and sustainable transportation and to preserve water channels by carbon pollution and sludge oil emissions.

Figure 2.16 shows Carbon emission via. road transportation from petrol and diesel fuel which accounts to GHG emission. The emission from diesel contribute 64% (6,28,871 tonnes of CO_2), whereas the remaining from Petrol. Emission Factor/litre for Petrol and diesel are 2.33 kg CO_2 and 2.69 kg CO_2 respectively which can be mitigated if switched to green IWT mobility. A modal shift to public transport indicates the same principle, a measure to restrict the passenger car use thereby reducing the fossil fuels burned and the emissions arising from their combustion. Per metric ton kilometer cost of different modes of logistics in India in 2021 (in Indian rupees) for Air 18 rs, Road 3.6 rs, Waterway 2 rs, Rail 1.6 rs which makes it an economic & sustainable mode of transportation considering its availability in Thrissur.

Reviving the NW3 can not only ease the chaos caused by the road transport but also reduce the pollution and the carbon dioxide emissions produced from the vehicles. Keeping in vision SDG 13 and Kerala maritime vision, the global carbon dioxide emissions need to be reduced by 45 per cent, and to achieve net-zero emissions by 2050.

2.10 Coastal Hazards

The problems of coastal zones are unique due to the continuous drastic morphological and shoreline changes. The total length of coastline in thrissur district is 81.193 Km along the three blocks namely Chavakkad, Thalikulam and Mathilakam. There are 18 coastal villages affected by coastal hazards. The existing population residing in the coastal villages is 2,91,343 within an area of 15762 hectare. The population density of the coastal villages is 18.48 pph. The total geographical area affected by coastal hazard in the district is 393 Sq.km, out of which agricultural land affected is 351 Sq.Km and Built-up land affected is 29 Sq.km.

2.10.1 Issues Identified

Coastal areas are prone to disasters and are highly vulnerable. Mining of beach sand for industrial purpose and land taken by private entrepreneurs in the name of tourism and development have fuelled the destruction of natural habitats and coastal community. The existing population residing in the coastal villages is

2,91,343 within an area of 15762 hectare.

Of the total coastline 17.22% of the coastline is affected by accretion, 79.74% is artificial coast and only 3.04% is stable coast. For Chavakkad block, 9.3 km of coastline is made of artificial coast, 7.1 km is affected by low accretion and 5.8 is affected by high accretion. For Thalikulam block, 7.8 km of coastline is artificial coast, 4.5 km is affected by low accretion, 2.9 km is affected by medium accretion and only 4.2 km of coastline is stable coast. For Mathilakam block, 17.5 km of coastline is artificial coast and 2.3 km is affected by medium accretion.

Though the state has prepared Coastal Zone Management plan, the interest of authorities is to relax the notification and accommodate development in the state. Destruction of mangroves and violations of provisions of CRZ in the name of creating avenue for development of tourism and economy worsens the plight of coastal communities. Figure 2.17 shows coastal villages with number of buildings violating the CRZ norms. Only 12 villages have buildings less than 20 being violated. Thalikum village has 26 violating the norms. Valapad, Kaipamangalam and Edangiyur have violated 50, 44 and 54 buidlings respectively violating the norms.

Vadanapally has 89 and Kadappuram has 120 buidlings violating CRZ norms. Figure 2.17 also shows the areas heavily damaged during coastal hazards and the most vulnerable areas which are near Kadikkad, Vadanappally and Thalikulam where the livelihood of coast dependent people get affected most.

Table 2.12 List of executed protection works

Block	Village	Length of Coastline protected (km)	Type of Protection work	Expenditure (Rs. Crore)
Thalikulam	Vadanappally	1	Geobag	0.955
	Vadanappally	0.107	Rubble mount	0.091
	Engandiyur	0.69	Geobag	0.500
	Thalikulam	0.612	Geobag	0.763
	Thalikulam	0.105	Rubble mount	0.073
Mathilakam	Edavilangu, Koolimutta, Padinjare		Geobag	1.705
Total		**4.284**		**4.087**

Source: Kerala Disaster Management Authority, 2021

2.10.2 Government Interventions

To regulate the coastal hazards, government is taking initiatives to mitigate the impacts. Table 2.12 shows the list of protection works executed at the block level and the amount spend in each project to protect the coastline. For Thalikulam 2.56 km length of coastline is proposed to be protected by Geobag and Seawall costing 20.19 crore. In Mathilakam a length of 9 km is proposed to protected by Seawall with project cost of 90 crore. For the existing situation, 20.023 km coastline is affected and only 5.723 is protected. For carrying out the block level works for coastal hazards every block has to map the disaster prone areas and survival plans. Special consideration has to be made for disaster relief and rehabilitation of victims. Every Gram Panchayat is supposed to prepare Disaster Management Plan. During the time coastal hazards, restoring livelihood should also be carried at block level. To prevent the risk construction should be done at a minimum distance of 200 m from the sea shores. Block panchayats has rights to directly issue permits for new construction and all the existing houses and shops that are violating the CRZ norms should be replaced. The State executive committee has declared coastal erosion as state specific local disaster and has approved norms for relief assistance. The funding for protection works is through State Disaster Mitigation Fund (SDMF) and State Disaster Risk Fund (SDRF).

2.10.3 Way forward and Best practices

Because of the great biological richness and productivity seen in coastal locations, they have developed into the hub of human activity. They offer a variety of options, including hosting ports, trading fish, and exporting shellfish. Additionally, the allure of these coastal areas draws visitors, fostering leisure time and tourism. On the other hand, cyclonic storms, erosion, and accretion are the primary natural threats to the land that cause coastal environmental problems. In addition to this, ongoing population increase along with increasing urbanisation and economic growth is having a negative impact on the en-

Figure 2.18 Mean yearly temperature, trend and anomaly, 1979-2023

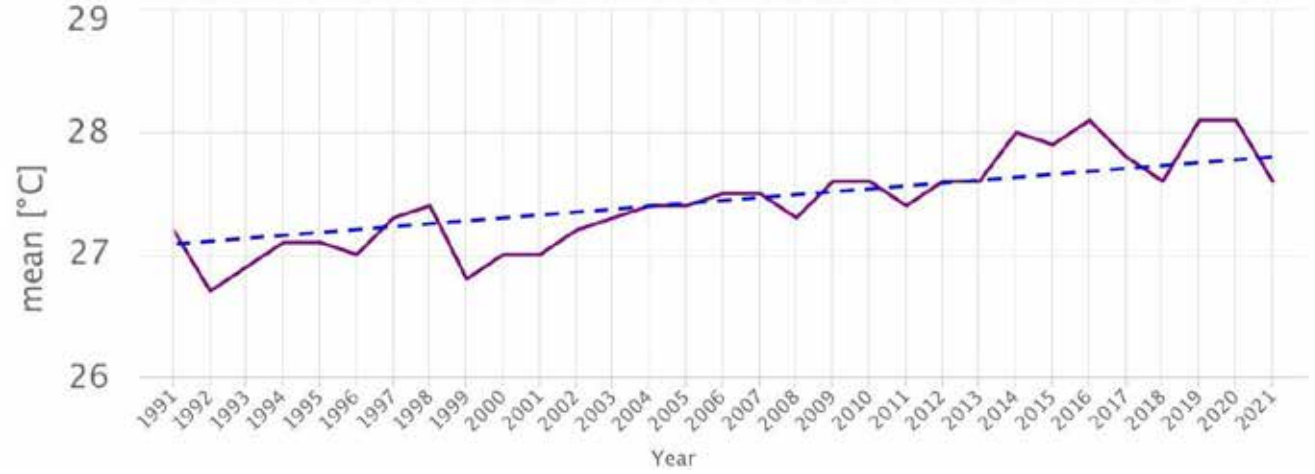
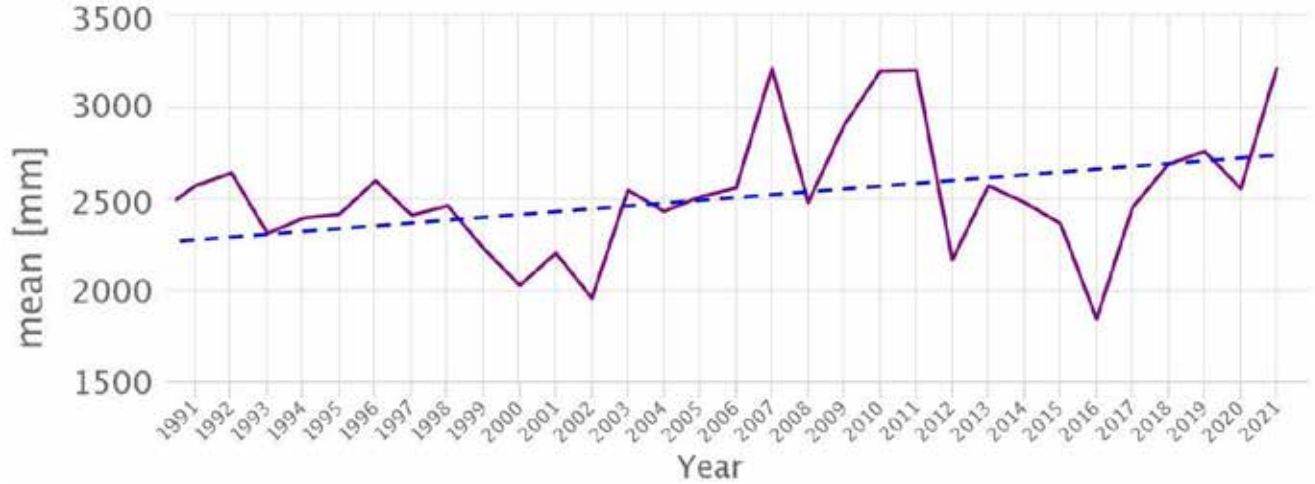


Figure 2.19 Mean yearly precipitation, trend and anomaly, 1979-2023



Source: www.meteoblue.com, 1991-2021

vironment by destroying habitats, depleting resources, and introducing exotic organisms.

A robust EIA and a disaster management strategy must be in place for the district. Coastal management involves habitat protection programmes like planting trees or creating mangrove shelter beds, regenerating aquatic plants, restoring holy forests to their natural state, etc. This is essential for the defence of coastal areas and aids in preventing flooding. The blue economy has a lot of promise to accelerate economic growth through the wise use of the waters. It involves building small infrastructural facilities, developing and maintaining beaches, and building infrastructure for the tourism industry. It will give many people jobs and better living conditions. This is crucial for promoting tourism in an eco-friendly manner.

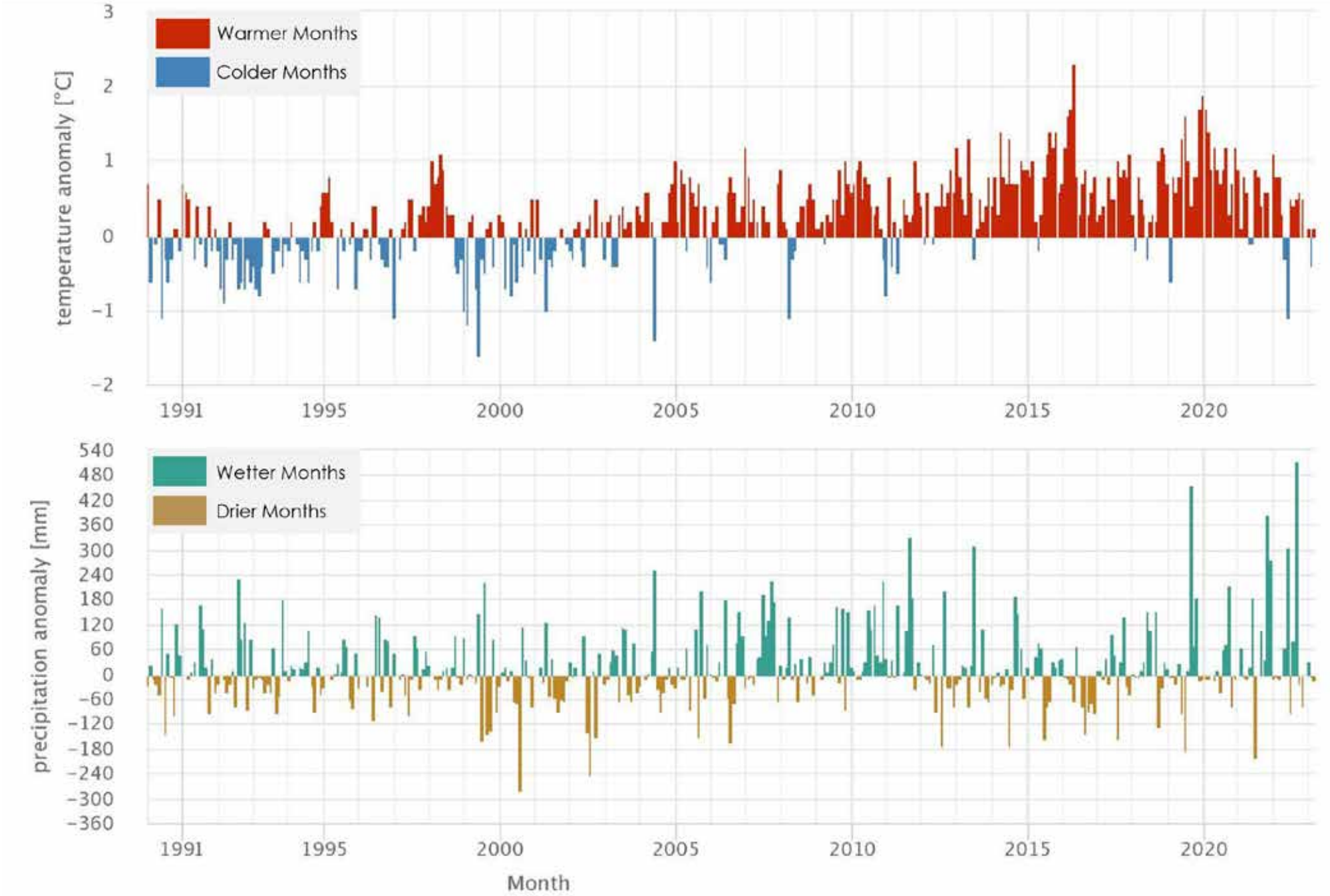
2.11 Climate Change

The scenic district is currently threatened by extreme climate events, despite being known for its moderate tropical climate. Among the most significant consequences of climate change is the increase in temperature. The district is experiencing higher temperatures than ever before, which can lead to heat waves, droughts, and other health hazards. This rise in temperature is also affecting agriculture and biodiversity in the region. Figure 2.18 represents the temperature trend by dashed blue line which is positive. This indicates that the district is getting warmer over the years due to climate change. The decadal mean annual temperature of 1991-2000, 2001-2010 and 2011-2020 are 27.04C, 27.36C and 27.82C respectively. There is a drastic rise in temperature by 0.76C.

The region is also witnessing changes in rainfall patterns. While Thrissur is known for its heavy monsoon rains, climate change is causing more erratic rainfall patterns (rainfall with more intensity in less duration of time), with some years experiencing more rainfall than others. This can lead to flooding in some years and droughts in others. As per Kerala State Action Plan on Climate Change 2.0, the rainfall variability is decreasing for Thrissur but the extreme rainfall events are projected to increase in 2030-2050.

Figure 2.19 represents the rainfall trend by dashed blue line which is positive. This indicates that Thrissur is getting wetter over the years due to climate change. The decadal mean annual rainfall of 1991-2000, 2001-2010 and 2011-2020 are 2401.71mm, 2596.06mm and 4450.94mm

Figure 2.20 Monthly Anomalies for Temperature and Precipitation, 1979-2023



Source: www.meteoblue.com, 1991-2021

respectively. There is a sudden rise in amount of rainfall by 2049.23mm. Also, the major rainfall was during June-July month but gradually it is shifting to August. It can be observed that the rise in temperature has caused in rise in amount of rainfall. The amount of rainfall received is not constant rather erratic in nature which has led to floods in the recent years.

Figure 2.20 shows the temperature anomaly indicates how much warmer or cooler it was than the mean temperature. As an outcome, the red months were warmer than usual, while the blue months were colder. Similarly, the lower graph represents the rainfall anomaly indicating how much drier or wetter it was than the mean rainfall. It is evident from the Figure that there is an increase of warmer months and wetter months over the years, which reflects the global warming caused by climate change. Similarly, there is an increase in wetter months.

During the period of 2015-16, the rise in temperature anomaly is the highest (0.8-1C) in summer and the similar can be observed in 2019-20 period where the anomaly was 0.9-1C. The annual precipitation anomaly during 2015-16 was 6 to -508 mm. The effect of El-Nino on India from the year 2000-2020 was intense during 2009, 2014-15 and 2018. The highest temperature anomaly was caused majorly due to global warming but a marginal part was due to El- Niño (El- Niño Southern Oscillations) effect. The amount of rainfall subsequently during these years has reduced but a significant rise in amount of rainfall anomaly during 2019, 2021 and 2022 monsoon. This can be a result of the first triple dip La-Nina effect which prevailed from 2020 to 2023.

Global temperatures continue to increase as an outcome of human-caused climate change, contributing to a gradual rise in sea levels. As per the projection by IPCC, by 2030, sea level may increase by 0.1 m. By 2100, it will have risen 0.71 m, and by 2150, it will increase up to 1.24 m. By 2130, about 150 square kilometers of land in the district would be inundated. Sea level rise poses a significant threat to coastal communities, as higher water levels increase the risk of flooding, erosion, and storm damage. Low-lying areas are particularly vulnerable to sea level rise and may face displacement and loss of infrastructure and livelihoods.

Climate change in Thrissur is a result of GHG emissions by transportation based on fossil fuels, increased urbanisation, construction processes, mining and manufacturing industries, electricity generation in power plants based on fossil fuels, untreated waste, pesticides and fertilisers used in agriculture and change in land use and land cover. These factors have hampered human health directly or indirectly; led to the destruction in water resources; damage in coastal ecosystems and fisheries; decline in tourism; loss of soil, forests and biodiversity; & depletion in productivity of livestock and agriculture. It is exacerbating existing social and economic inequalities & creating new vulnerabilities. It is disproportionately affecting the most vulnerable populations, including the poor, women, children, & marginalized communities. It can lead to displacement, migration, conflict, & loss of life. Climate change has significant economic impacts, including increased costs of infrastructure and disaster response, decreased agricultural productivity, and loss of tourism revenue. This can have long-term consequences on local economic development.

To mitigate the severity of climate change, there is a need to reduce the amount of greenhouse gases (GHGs) in the atmosphere, as these gases trap heat and contribute to global warming. Certain mitigation strategies to reduce greenhouse gas emissions, promote renewable energy, and implement sustainable practices are required. It is a challenge that requires coordinated action.

2.12 Disaster

The city of Thrissur is exposed to a variety of natural and man-made disasters due to its geographical location, weather patterns, and high population density. These recurring incidents have resulted in loss of life, damage to infrastructure and property, and economic disruptions. The vulnerability of the area has been exacerbated by factors such as rapid urbanization, environmental degradation, population growth, and climate change. The situation in Thrissur necessitates a paradigm shift from a reactive relief-centric approach to a proactive and comprehensive mindset towards disaster management, which covers all aspects from prevention, mitigation, preparedness, response, and recovery. The Kerala State Disaster Management Rules, 2007, and Kerala State Disaster Management Policy, 2010, were enacted to provide a framework for disaster management in the state. As per the National DM Act and state DM policy, the district is responsible for creating a Disaster Management Plan. The district administration

is tasked with coordinating and overseeing the implementation of national, state, and district disaster management plans. The Kerala State Disaster Management Policy, 2010 provides the guiding principles for the district's disaster management plan.

2.12.1 Vulnerability Mapping

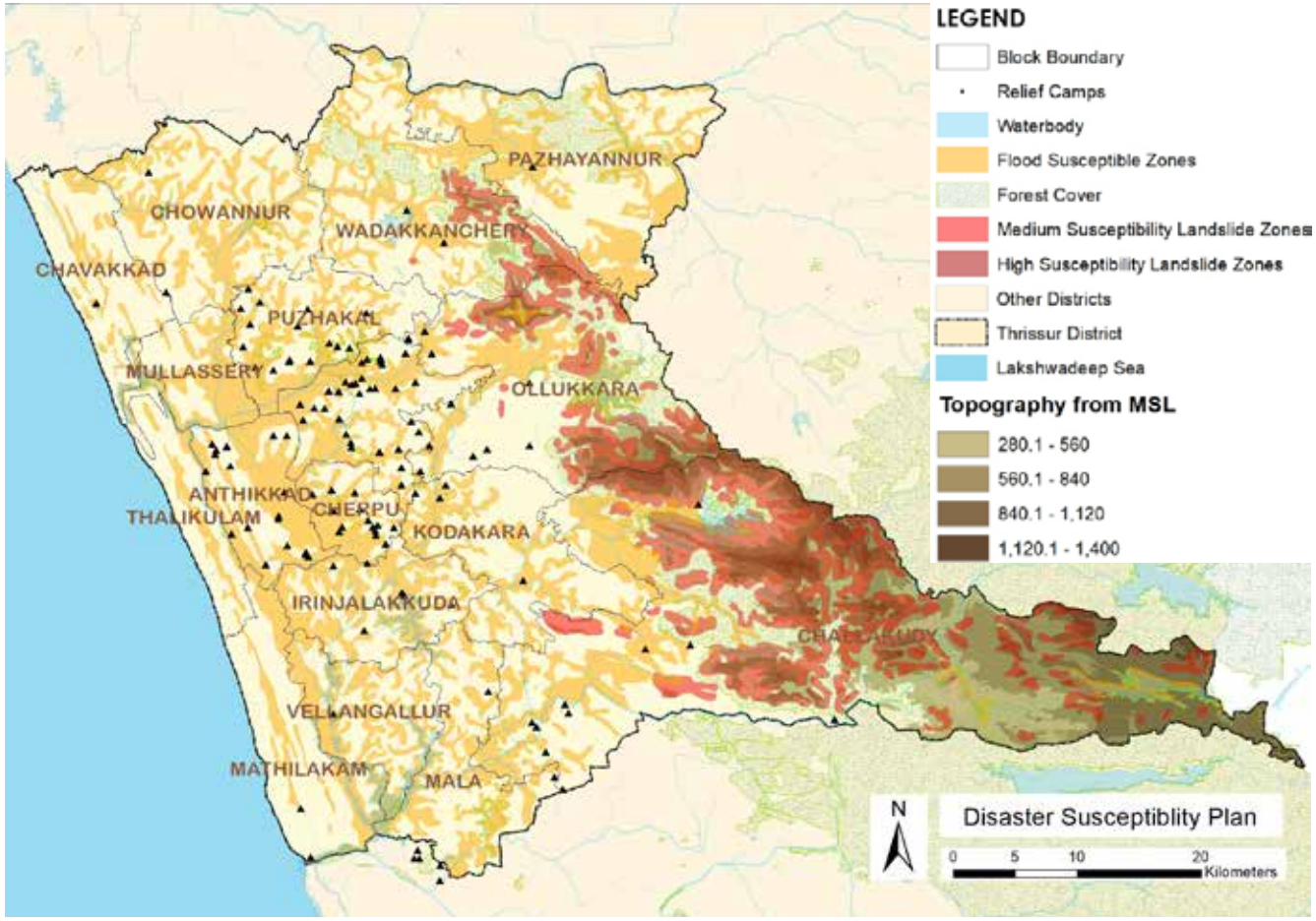
Vulnerability mapping is an important aspect of disaster risk reduction and management, which can be used in Thrissur to identify areas and populations that are most at risk. Through targeting interventions such as infrastructure improvement and emergency preparedness planning, vulnerability mapping can prioritize and allocate resources to areas that need them the most. For example, in this study, the vulnerability mapping has helped to identify blocks that are most affected by floods, such as Cherupu, Anthikad, and Mullaserry, as well as areas with vulnerable populations, including low-income agricultural workers.

Furthermore, by focusing on cost-effective interventions, there is a potential to use vulnerability mapping for ensuring efficient and effective utilization of resources to reduce flood risks and minimize damages. Ultimately, vulnerability mapping can help improve disaster resilience and social equity in Thrissur.

2.12.2 Disaster Vulnerability of Thrissur

The Thrissur region is susceptible to various natural hazards, including coastal erosion, floods, droughts, lightning, landslides, earthquakes, and tsunamis. Nearly all blocks in Thrissur are multi-hazard prone, with lightning, landslides, and floods being the most frequently occurring hazards. Droughts and minor earthquakes also occur occasionally, while the 2004 tsunami added a new dimension to the region's disaster profile. Lightning strikes are particularly prevalent during April, May, October, and November, causing around 70 fatalities annually. Flooding affects around 33% geographical area of the state, with mountainous regions experiencing landslides during the monsoon season. Between 1961 and 2009, 65 fatal landslides occurred in the state, claiming the lives of 257 individuals. Additionally, the 54 km coastline is vulnerable to erosion, monsoon storm surges, and sea-level rise. Slow hazards like land subsidence due to tunnel erosion or soil piping have gone unnoticed and can cause landslides, damage to infrastructure, and crop loss. The region is also prone to various anthropogenic disasters such as road accidents, rail accidents, boat capsizing, industrial accidents, epidemics, pest infestation,

Figure 2.21 Disaster susceptiblity plan



Source: Thrissur District Disaster Managemnet Plan, 2015

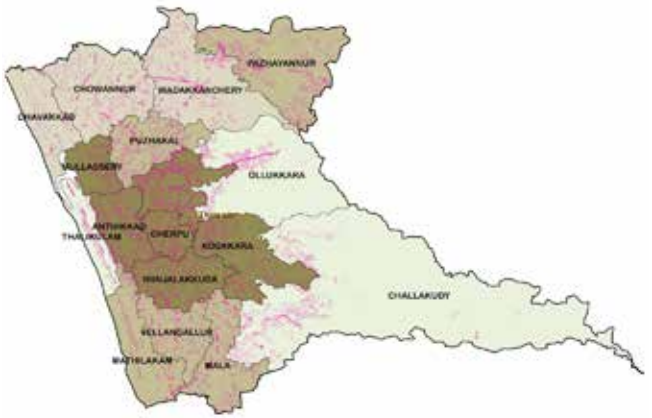
Table 2.13 Flood vulnerability assessment

**percentage based on block data*

Flood Vulnerability Assessment																		
Block → Parameter ↓			Kodakara	Wadakkanchery	Irinjalakuda	Mala	Mathikalam	Chowannur	Thrissur	Cherpu	Puzhakal	Chavakkad	Pazhayannur	Thalikulam	Ollukara	Anthikkad	Mullassery	Challakudy
Geographical area affected		Percent*	39	29	56	46	30	41	52	62	46	23	43	25	19	**64**	57	**16**
		Sq. Km.	61	71	62	59	39	81	58	31	53	24	101	16	56	58	36	129
Agricultural area affected		Percent*	32	12	50	38	20	22	52	62	34	23	**6**	25	19	**64**	57	11
		Sq. Km.	49	29	56	48	25	43	58	31	40	24	14	16	56	58	36	91
Population Affected		No.	245	122	220	181	124	174	211	**257**	186	105	183	100	78	256	244	**63**
Relief Camps		No.	4	2	6	1	2	2	33	16	16	2	1	0	12	20	0	11
		Suscept-ible area served in sq.km/ unit	15	36	10	59	20	41	2	2	3	12	**101**	**0**	5	3	**0**	12
Connectivity Affected	Rail Line Affected	Percent*	**71**	59	38	34	-	-	48	-	37	-	44	-	-	-	67	**14**
		Km	80	147	136	5	0	0	130	0	159	0	143	0	0	0	112	112
	NH Affected	Percent*	**55**	-	28	-	**3**	-	31	-	-	7	-	31	11	-	-	15
		Km	6	0	1	0	1	0	5	0	0	1	0	6	2	0	0	2
	SH Affected	Percent*	34	6	16	10	72	6	3	**48**	22	50	46	**1**	0	32	0	7
		Km	1	2	3	1	9	3	2	4	5	14	14	0	0	3	0	8
	Other Roads Affected	Percent*	60	65	**70**	68	68	54	19	11	54	**10**	19	11	49	68	15	34
		Km	534	520	527	524	525	523	53	52	522	53	51	52	529	520	52	527
	Total	Percent*	69	78	**86**	67	66	51	56	12	69	12	67	**11**	48	68	48	38
		Km	622	669	666	530	535	526	189	56	686	68	209	59	531	523	164	649
W.I.M. SCORE			**9.7**	**5.3**	**8.6**	**6.8**	**5.7**	**5.4**	**7.5**	**7.9**	**6.8**	**3.9**	**6.1**	**3.5**	**3.2**	**8.7**	**7.9**	**2.9**

Source: Thrissur DDMP 2015, and crowd sourced maps of Thrissur floods 2018

Figure 2.22 Blockwise WIM based WWFlood Vulnerability Map



Source: Thrissur DDMP 2015, and crowd sourced maps of Thrissur floods 2018

stampedes, building collapses, and fire accidents. Population pressure and unsustainable land use practices are the main reasons that many hazards become disaster events, while a lack of proper infrastructure and exceeding carrying capacity contribute to anthropogenic hazards. Drought represents a period of 'drier-than-normal' conditions that results in water related problems. As per the DDMA hazard analysist, the duration of draughts is only between 15-20 days. Hence the draught does not possess a major threat in Thrissur District. With a length of 54 km and covering about 1.42% of state's total area the coastal zone of Thrissur is an important physiographic unit. Hazards in the coastal zone are erosion, monsoon, storm surges, sea level rise etc. More than 26 km of sea shore is erosion prone. Extensive sea wall construction along with gabion-box and groins has failed to arrest the erosion in many cases. The tsunami of 2004 which was experienced along most of the coastal regions of the state has added a new dimension to the disaster scenario of the region.

2.12.3 Landslides

An area of approximately 1500 square kilometers in the Western Ghats is susceptible to landslides, which occur annually during the monsoon season. The main reasons for these landslides are population growth and heavy rainfall. The eastern part of Thrissur, situated on the western side of the Western Ghats, is recognized as one of the most landslide-prone regions in the country. The western slope of the Western Ghats has a steep incline with plateau edges that

are heavily indented, resembling landing stairs, with a slope greater than 25 degrees. The factor of safety of the slopes is less than two, with the soil being oversaturated due to prolonged rainfall. Challakudy and Ollukkara are identified as high susceptibility zones, and around 24 square kilometers of forest land are at risk.

The region experiences various types of landslides, including rock falls, rock slips, debris flow, and rotational slides. However, the most destructive type of landslide in Thrissur is the debris flow, known as urulpottal, characterized by the swift and sudden downhill movement of highly water-saturated overburden, ranging in size from soil particles to boulders, causing damage to anything in its path. The occurrence of these landslides is triggered by excessive rainfall and influenced by several terrain factors, such as slope, overburden thickness, land use, relative relief, disposition of streams, and micro-level landform.

2.12.4 Floods

Riverine flooding is a recurrent occurrence in Thrissur due to heavy rainfall that exceeds the absorptive and flow capacities of the soil and watercourses. This results in water overflowing onto floodplains, which are flat areas adjacent to natural watercourses composed of unconsolidated deposits from sediment transported by streams that are periodically flooded. Table 2.13 indicates that agriculture is particularly vulnerable to flooding in the region, with more than 730 square kilometers of agricultural land affected. Settlement and reclamation in flood-prone areas are significant causes of flood damage in Thrissur. Figure 2.21 shows the high susceptibility zones in the region include Irinjalakuda, Vellangallur, Cherpu, Anthikkad, and Mullassery, which account for over 33% of the geographical area. According to a hazard analysis conducted by the Thrissur DDMA, in the 2018-19 floods, 2000 houses were fully damaged, and 18,000 were partially damaged, with markets in Chalakkudy and Mala being fully destroyed. In Thrissur, 16 locations, including Ollur, experienced soil piping, resulting in 40 landslides. The combined floods and landslides affected a total population of 80,305 and resulted in 54 deaths in Thrissur, with 19 fatalities in Kurancherry alone. In addition, the floods and landslides caused significant economic losses, with the agricultural sector sustaining losses of 550 crores, animal husbandry 20 crores, poultry 5 crores, and sanitation facilities 20 crores.

2.12.5 Inferences

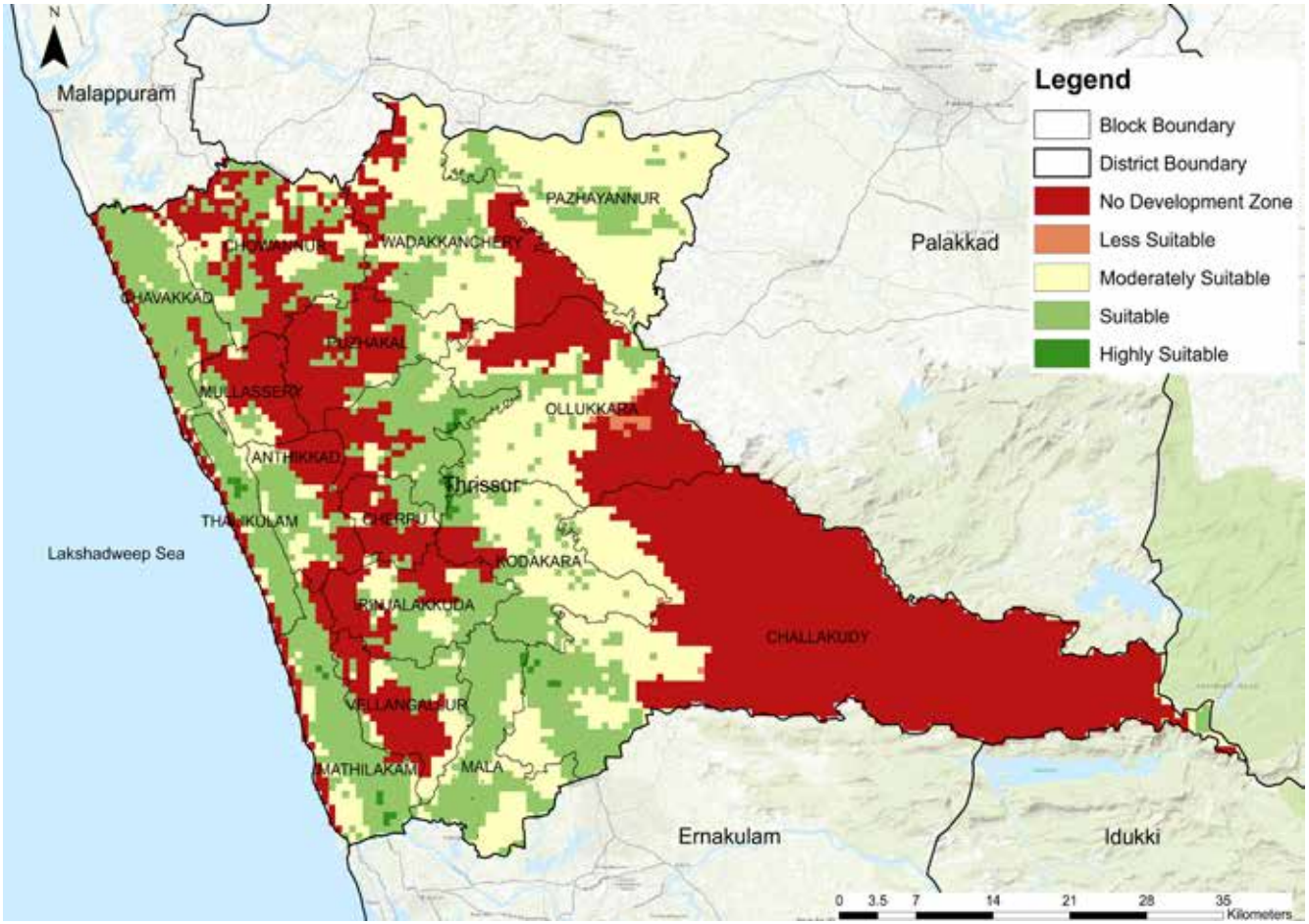
Thrissur is ranked among the top ten districts in India prone to landslides and has over 33% of its geographical area susceptible to floods, making it highly vulnerable to disasters. The 2018-19 floods and landslides affected a population of 80,305 and resulted in an economic loss of over 595 Crore INR. Records indicate that 4194 km (29.4% of the total road length of Thrissur) of roads were damaged during the floods, particularly in the blocks of Mala, Mathilakam, Challakudy, Anthikkad, Thrissur, Puzhakal, Mullassery, and Chowannur, which also had the highest concentration of relief camps (82 Nos.) in the district, leading to problems due to a lack of connectivity.

Therefore, it is crucial to plan and develop flood-resilient infrastructure, particularly roads. Roads are essential for emergency evacuation, relief operations, and the transportation of goods and services. Floods and landslides can severely damage roads, cutting off access to vital services such as hospitals, schools, and markets, which can lead to loss of life, prolonged suffering, and economic hardship. Hence, strategically locating roads can ensure connectivity, allowing the import of relief utilities such as food and medical help and enabling unhindered emergency operations.

2.13 Land Use Suitability

One of the key elements of land use planning is the assessment of the various phenomena and indicators that are associated to the land in terms of its possible uses, changes, and value. From the perspective of regional planning, there are several steps that can be distinguished in the assessment of land resources, including the investigation of issues, the discovery of opportunities for change, the choice of workable land use alternatives, the selection of suitable scenarios prior to implementation, and monitoring. The primary goal of the systematic assessment of land use is to identify and implement future alternative land uses that will best meet human requirements while safeguarding and maintaining the resources for the future. The goal of landuse appropriateness is to conserve environmentally vulnerable regions and govern how they are developed because Thrissur is a disaster-prone and environmentally fragile city. while discovering more prospective development locations for higher economic growth in a sustainable way.

Figure 2.23 Landuse Suitability Map



Source: Bhuvan , Irrigation Department, Kerala Forest Research Institute, Land Use Land Cover 2023, Earth Data NASA, District Spatial Plan 2011, Thrissur district disaster management plan 2015,

Eight paramters were taken into consideration to carry out land suitability analysis. **Proximity to roads** is the highest weighted parameter, i.e. 17. The area within the proximity of 0-500m is highly suitable as it provides good connectivity to infrastructure facilities and generates economy. As the proximity decreases, the area becomes less suitable. The second parameter with weightage 15 is **proximity to forest**. The area in Challakudy block is reserve forest area and no development is proposed in that area to conserve the biodiversity. The area within the proxomity of 200m is considered very less suitable for development and the area outside the buffer of 800m is considered highly suitable. The third parameter is **proximity to water bodies** with weightage 14. The area upto 250m is less suitable as waterbodies are generally prone to floods and development near them degrades the quality. The fourth parameter is **proximity to flood prone areas** with weightage 13. The areas closer to flood prone areas are highly vulnerable and very less suitable for development. As we move away from the vulnerable zones the area has high suitability for development. The fifth criteria weighted 12 is **proximity to coastline.**

The areas closer to the coastline are vulnerable to coastal hazards and thus within 200m the area is very less suitable for development. The sixth parameter is **proximity to Kole land** given the weightage of 11. The kole areas are environmentally sensitive areas thus development in the proximity of 50m makes it less suitable for development. The seventh parameter taken into consideration is the **slope** and assigned the weight of 10. The areas having slope greater than twenty is very less suitable for development. As these areas are more prone to landslides. As the slope gradient decrease the land becomes suitable for development. The last parameter considered is **proximity to urban settlement.** The areas closer to urban settlement are highly suitable for development as they provide imrpoved access to goods, services, infrastructure facilities, and potential for economic growth of the city.

Figure 2.23 shows the Landuse suitability map with areas classified as No development zone having an area of 1286 Sq.kms (42.**30%)**, **Less suitable** having an area of **8.61 Sq.kms (0.20%)**, **moderately suitable** having an area of **888.79 Sq.kms (29.30%)**, **suitable** having an area of **840.10 (27.70%)** and **highly suitable** having an area of **12.23 Sq.kms (0.40%)**. The

Table 2.14 Land Suitability and Developable Area Distribution

Name	No Development Zone Sq.kms	Less Suitable Sq.kms	Moderately Suitable Sq.kms	Suitable Sq.kms	Highly Suitable Sq.kms
Anthikad	82.40		39.70	61.80	0.37
Challakudy	652.83	0.75	241.96	139.33	2.25
Chavakkad	41.95		0.89	2.87	
Cherpu	53.93		9.36	20.97	
Chowannur	126.97		58.05	122.10	
Irinjalakkuda	84.65		31.46	103.37	1.12
Kodakara	65.55	0.37	167.80	91.01	3.00
Mala	20.97		94.01	171.66	2.25
Mathilakam	92.14		41.57	129.97	2.62
Mullassery	67.79		20.60	26.22	
Ollukarra	175.29	7.87	185.40	73.79	5.24
Puzhayannur	68.17		258.06	61.43	
Puzhakkal	117.23	0.37	44.20	74.91	2.25
Thalikulam	29.96		33.71	80.53	1.87
Thrissur M.Corp	95.51		82.03	120.23	5.62
Vellangallur	60.68		40.45	112.25	0.75
Wadakkanchery	125.10	0.37	263.30	105.25	
Total	**1286.56**	**8.61**	**888.79**	**840.10**	**12.36**

Source - Analysis using GIS Mapping, March 2023

Reserve forest areas, Kole land and coastal hazard areas coming under eco sensitive areas have been marked as no development zone. Table 2.14 shows the land suitability and developable area block wise distribution. Challakduy block has highest area under no development zone which is 652.83 Sq.kms. Wadakkanchery block has 263.30 Sq.kms of moderately suitable land, which is highest in the district. 172.66 Sq.kms of land is suitable in Mala Block which is the highest. Ollukara has highest portion of highly suitable land around 5.24 Sq.kms. Nearly 57.4% of the land is suitable for development which is to be used in efficient manner to guide sustainable developement in the district.

Table 2.15 shows the permissible and non-permissible activities in the developabe zone. Low density settlement is allowed in less suitable areas and high density in suitable areas. Only household and small scale industries are permissible in low suitable areas and large industries in highly suitable areas. Agro Forestry is promoted in low suitable zone and commercial markets, godowns in Suitable areas. In no development zone Eco-tourism is promoted and full fledged tourism circuits in areas with high suitability. The main aim is to promote guided sustainable development taking into consideration the environmental sensitivity and vulnerability of the area and to promote economic development. The areas identified suitable for development should act as hub for economy generation and areas with low suitability should allow preservation of natural resources.

2.14 Conclusion

The sectoral analysis reveals both potentials and critical areas of concern in the district. While looking at the land use analysis of the district, major land use is agricultural land (43%) and forest land (42%) indicating rich natural resource potential. The urban development is more focused along the coastal areas as it has improved connectivity with NH66. When we compare the current land use with the previous trend, there is a significant increase in the built-up area due to influx of migrant population because of employment opportunities available. This has led to a decrease in agriculture land and in some instances, it is even sold for financial incentives decreasing agricultural production. The district has a unique topography resulting in five

Table 2.15 Permissible and Non-Permissible activities in developable zone

Activity	No Development Zone	Low Suitability	Moderately Suitable	Suitable	High Suitability
Settlements	Only for Native/Local Community	Very Low Density	Low Density	Medium Density	High Density
Industry	Household Industry	MSME	Medium Industries	Large Industries	Large Industries
Agriculture	Agro Forestry	Animal Husbandry	Agriculture Markets	Agriculture markets, Storage and Godowns and Milk Chilling Plants	Agriculture markets, Storage and Godowns and Milk Chilling Plants
Tourism	Eco-tourism	Home Stay in restricted manner	Eco-tourism, Amusement park	Tourism Circuits	Tourism Circuits

Source - Analysis using GIS Mapping, March 2023

natural divisions with varied characteristics but the land is being degraded due to water erosion, waterlogging, etc. The district has four geological belt and is rich in construction minerals like granite stone, laterite stone, tile and brick, and sand. The region is also reported to have iron ore, allanite, and gold. But it has resulted in rapid degradation of Kole land and decline of ground water level. The district is also threatened by increasing temperature and heatwaves. This has led to changing in rainfall patterns and gradual sea level rise. It would pose a significant threat to coastal communities, increase risk of flood and storm surges. The vast forest area is rich in natural resources like rosewood, timber, coffee, etc, and has great economic potential. It includes 207 Sq.km of reserve forest area which is considered as ecologically fragile. The major issue is the increasing human wildlife conflict due to rapid urbanization and encroachment in the forest areas. Dumping of solid waste and unauthorised discharge of sewage is degrading the water quality. Chowanur block is developing at a fast pace, due to this Kechery river passing through it faces encroachment and growth in built-up areas. Kole lands are the unique identity of the district and act as life supporting ecosystem supporting local economy.

The district has eleven blocks covered by Kole lands covering an area of 132.85 Sq.kms which help in mitigating floods. But these unique wetlands are now being converted for development of infrastructure activities and real-estate projects. The government is taking initiatives to conserve the wetlands for a sustainable eco-system. Another major concern in the district is increasing pollution. The presence of red and orange category industries near the coastline leads to discharge of chemical effluents, oils spills and hazardous waste causing significant ecological change. The major air pollutants of the city are also seemed to be present in almost double the permissible limit by WHO. Due to the growing population and increase in water demand by industries some blocks like Chavakkad, Ollukara, Pazhayannur lie in the critical zone and needs immediate attention to stop the exploration of ground water. The district is also prone to various disasters like coastal hazards, floods, cyclone, landslides, forest fires, etc. Thrissur has a coastline of 81.193 km which is continuously changing. Coastal areas are vulnerable to cyclone, erosion, and accretion. The land is now been taken up by private developers in the name of tourism and the CRZ regulations are being violated. Though government is taking initiatives to mitigate the impacts every block should carry out hazard mapping and prepare disaster management plan. Challakudy and Ollukara blocks are highly susceptible to landslides usually triggered by excess rainfall. Riverine flooding is a recurring event causing maximum harm to agriculture sector. Reclamation and settlement in floodplain areas is a major cause of flood affecting 33% of the area. The need is to plan for flood resilient infrastructure. Thus land use suitability analysis was carried out to identify land for future land uses while safeguarding the natural resources. The results show 27.70% of land as suitable for development. The aim is guided and sustainable development to promote economic growth.



Demography

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3. Demography

3.1 Introduction

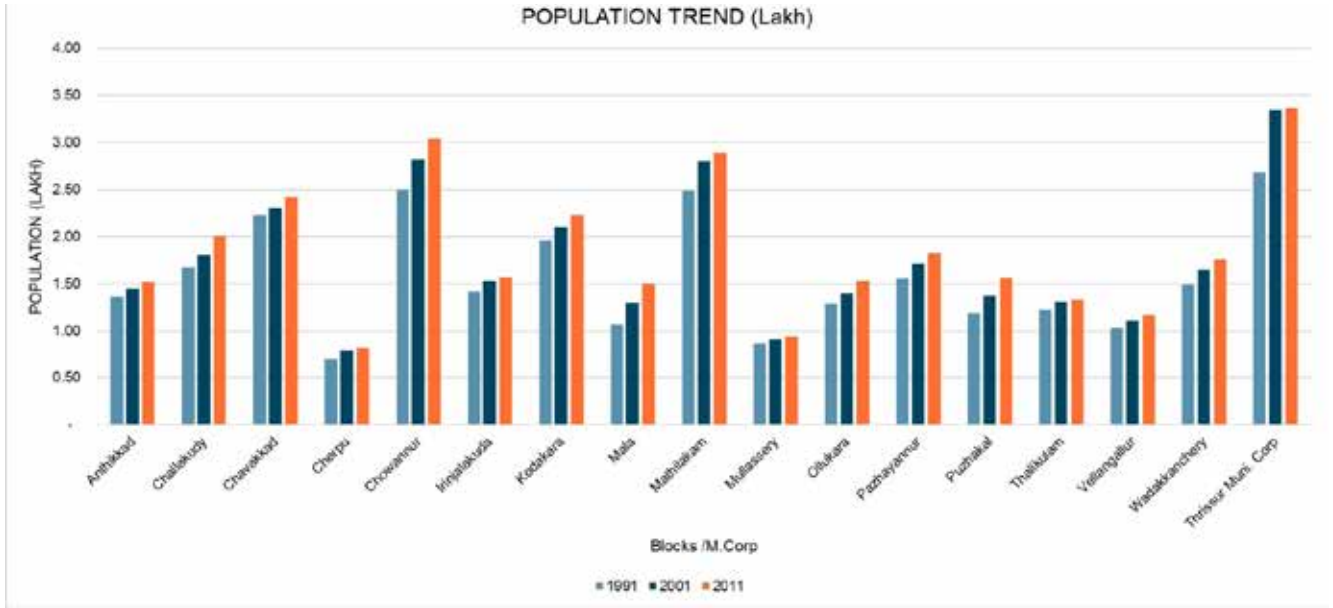
Thrissur is a district with a rich heritage of cultural, historic, and traditional features and with a well-planned development in Kerala. Despite the growth in various aspects, the district has witnessed significant changes in terms of its demography. Demography deals with related social characteristics such as population, age- sex ratio, work force participation rate, literacy rate, etc. for the purpose of enabling a comprehensive knowledge of demographic change. Utilising Census data, the demography section is largely conducting analytical studies on migration, settlement hierarchy, identification of Growth Centre and other hierarchal arrangements. So, measures of wellbeing differ based on age, gender, and other demographic factors. In order to maximise opportunities and prepare for new challenges brought on by the demographic transition, societies should adopt policies that anticipate population dynamics. As a result, progress towards achieving the Sustainable Development Goals (SDGs) is inextricably linked to population trends. The distribution of resources between and between age groups by families, governments, and the market will also have an impact on how the Sustainable Development Goals are implemented. Programmes to allocate resources over the life cycle may need to be adjusted in light of these significant demographic shifts in order to finally alleviate inequality levels and ensure the successful implementation of sustainable development. Hence, Capturing and making good use of demographic data for sustainable development will be the focus of the Thrissur regional plan 2047.

3.2 Population

Thrissur is the fourth largest district in Kerala. It covers 3023 km², or 7.8%, of the State's total area. The district had a population of 31.5 lakh in 2011 as per the Census of India and a population density of 1031 people per square kilometer, which is higher than the state average (819 people/sq km). There were 16.3 lakh of female population and 15.2 lakh of male population.

Population was 29.5 lakh according to the preliminary Census 2001. There was a change of 4.94 percent in the population compared to 2011 and 2001.

Figure 3.1 Population Trend 1991-2011



Source: Primary Census Abstract (1991, 2001, 2011)

Thrissur M. Corp, Chavakkad Municipal Council, Kunnamkulam Municipal Council, and Guruvayur Municipal Council are higher than those in the LSGs next to the urban LSGs, indicating that there may be both outmigrations from the urban areas to the immediate hinterland and immigration into the urban areas with the intention of settling in the nearby Grama Panchayat.

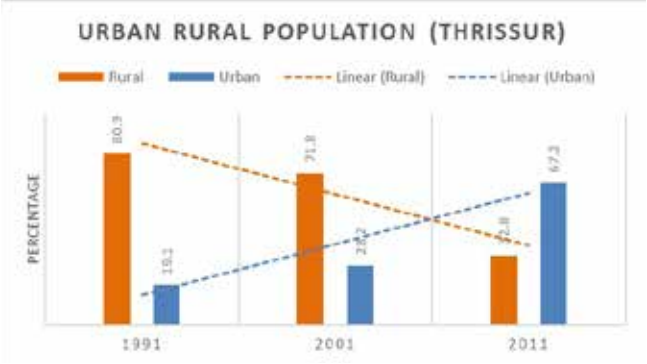
Population of Thrissur Muni. corp, Chowannur, Chavakkad and Mathilakam block shows the constant increase in population from 1991 to 2011. Thrisur M.Corp is growing fast because of urbanization, economic, infrastructure, tourism, effective governanceand planning, and presence of quality education and health facilities.

Thrissur's urban population was spreaded among 7 Statutory towns, 128 Census towns, and one outgrowth in 2001, for 2011 rural villages were changed to 135 census towns.

Rural population was 2.70 lakh in 1991 and

have increased to 10.20 lakh in 2011, urban population has also increased from 0.63 lakh to 20.89 lakh from 1991 to 2011.

Figure 3.2 Rural - Urban population of Thrissur



Source: Primary Census Abstract (1991, 2001, 2011)

3.3 Urbanization

Kerala's recent urban growth rate has presented the state government with a challenge to cater to the needs of the urban population and design programmes to provide basic facilities for a good standard of living. Based on Census of India data, the growth trends in Kerala's urban population, the tempo and degree of concentration, and changes in development indicators.

The recent increase in Kerala's urban growth rate of 92.8% is due to area reclassification. Higher-order towns (Classes I and II) in Kerala show a decline in population growth, whereas lower-order towns (Class III towns) grow. Between 2001 and 2011, urban density decreased while labor participation increased slightly.

This stage of urbanization is distinguished by the expansion of a more dispersed population rather than concentrated urban centers.

Table 3.1. Population Blockwise/Muni.Corp (1991-2011) – Thrissur

Block/M. Corp.	1991 (in lakh)	2001 (in lakh)	2011 (in lakh)
Anthikkad	1.36	1.45	1.52
Challakudy	1.67	1.81	2.01
Chavakkad	2.23	2.30	2.42
Cherpu	0.70	0.79	0.82
Chowannur	2.50	2.82	3.04
Irinjalakuda	1.42	1.53	1.57
Kodakara	1.96	2.10	2.23
Mala	10.78	1.30	1.50
Mathilakam	24.93	2.80	2.89
Mullassery	0.86	0.91	0.94
Ollukara	12.95	1.40	1.53
Pazhayannur	1.55	1.71	1.82
Puzhakal	1.19	1.37	1.56
Thalikulam	1.23	1.31	1.33
Vellangallur	10.39	1.11	1.17
Wadak-kanchery	1.49	1.65	1.76
Thrissur Muni. Corp	2.68	3.34	3.37
TOTAL	**27.37**	**29.74**	**31.21**

Source: Primary Census Abstract (1991, 2001, 2011)

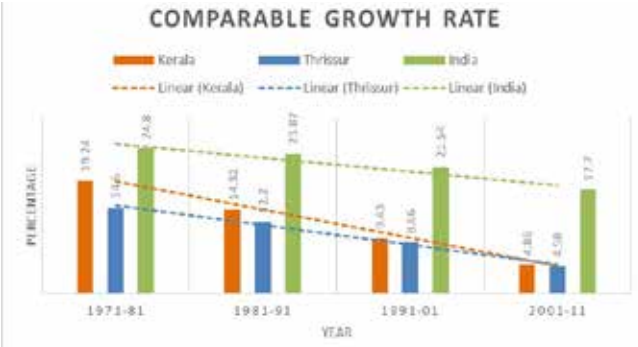
However, the steady increase in the rate of urbanization in Kerala is accompanied by a slow pace of development, particularly in basic amenities, which is cause for concern and requires policy attention. In thrissur 32.83% of the total population is rural, while 67.17% is urban (census 2011). There was change of 4.94 percent in the population compared to population as per 2001 and an increase of 8.66 percent to its population compared to 1991.

As per census 2011, the child population in the age 0-6 is 1.009 lakh in rural areas of which males were 51,631 and females were 49,346. The child population comprises 10.57 % of the total rural population of Thrissur.

3.4 Rural- Urban Population of Thrissur

According to the 2011 census, 67.17 percent of the total Thrissur population lives in district urban areas. In total, 20.96 lakh people live in urban areas, with 9.92 lakh males and 11.03 lakh females. According to 2011 census data, the Thrissur district urban region has a sex ratio of 1112.

Figure 3.3. Comparable growth rate



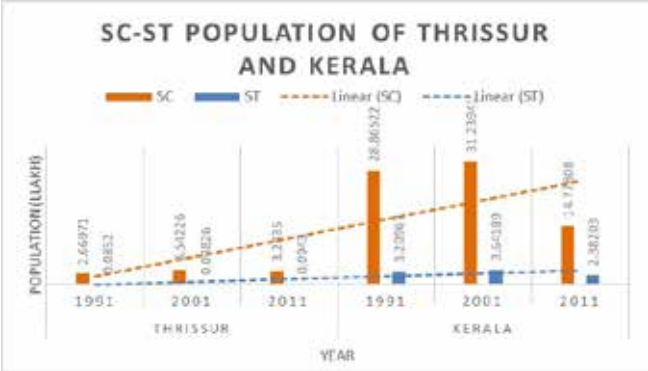
Source: Primary Census Abstract (1991, 2001, 2011)

3.5 SC ST population of Kerala and Thrissur

According to Census 2011, the SC population in India is 16.6 percent and the ST population is 8.6 percent, accounting for a quarter of the total population. Kerala's Scheduled Caste population is 30 lakh people, accounting for 9.10% of the total population. Kerala's Scheduled Tribe population is 4.8 lakh, accounting for 1.45% of the state's total population. The decadal growth of the ST population in Kerala during the 2011 census was 26.62%, 11.86% higher than the growth of the ST population in the 2001 Census.

According to 2011, there are 10.39% Scheduled Caste and 0.3% Scheduled Tribe of the total population in Thrissur district.

Figure 3.4. SC ST population of Thrissur and Kerala



Source: Primary Census Abstract (1991, 2001, 2011)

3.6 Population Density

According to preliminary data provided by Census India 2011, the population density of the Thrissur district in 2011 is 1,031 people per square kilometer. Thrissur district density was 981 people per square km in 2001. The district of Thrissur covers an area of 3,023 square kilometers.

3.7 Sex ratio

Studies have shown that Kerala is the only state in India where the sex ratio is above the equality ratio with a sex ratio of 1058 and 1084 in 2001 and 2011 respectively. The overall sex ratio of Thrissur was 1092 and 1108 in 2001 and 2011. From figure.4.6, we can see that the sex ratio was the highest in Chavakkad and Mullassery with a sex ratio of 1153 females per 1000 males for both and the lowest was in Ollukara

Figure 3.5. Population density

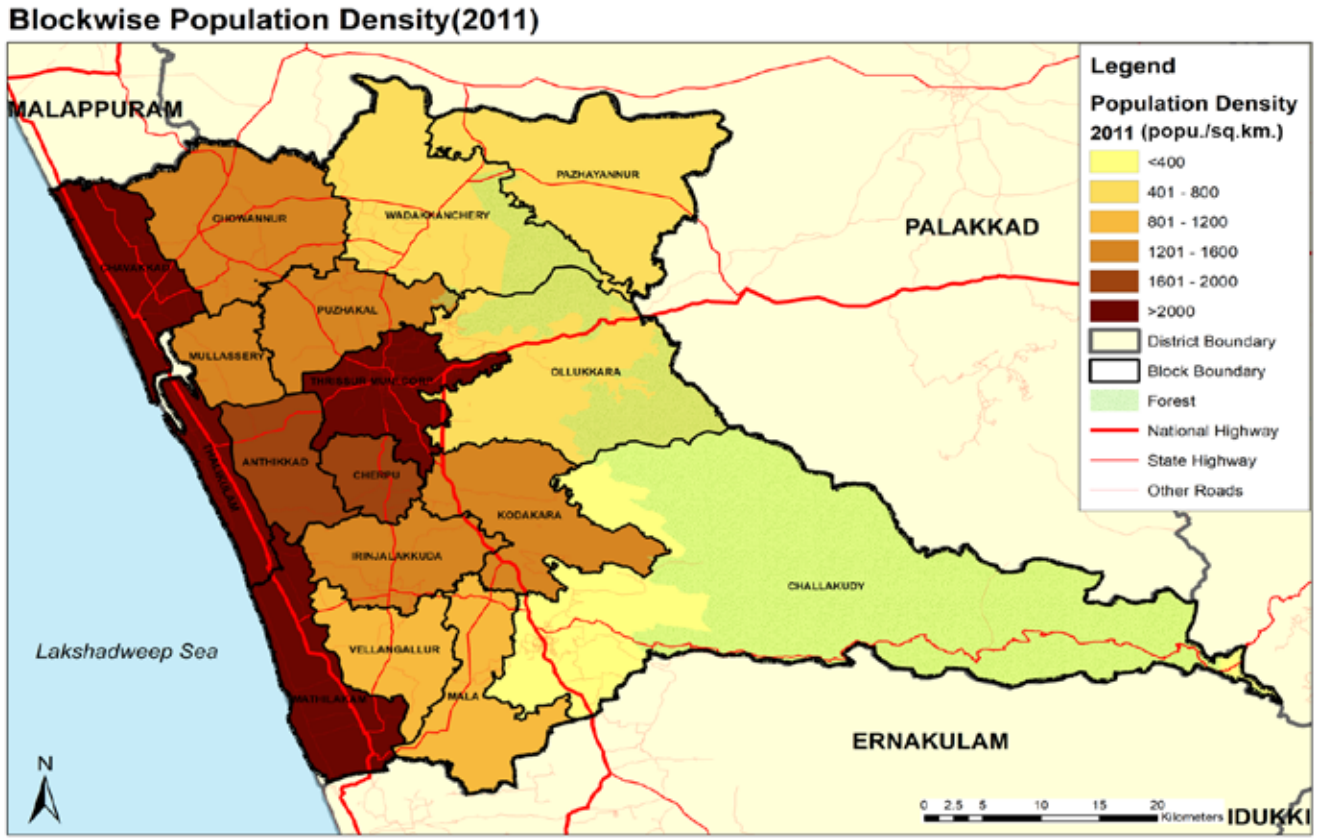
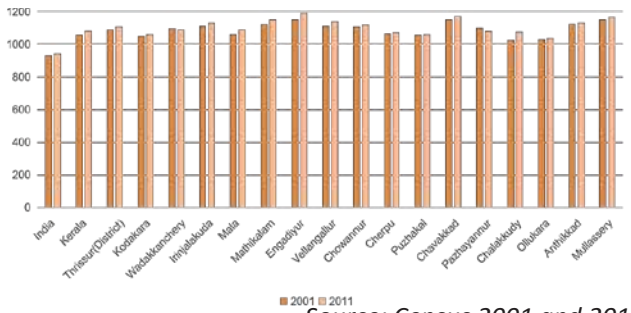


Figure 3.6 Sex ratio blockwise



Source: Census 2001 and 2011

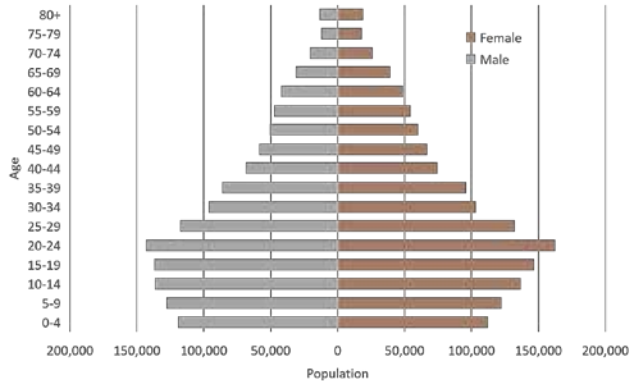
with 1029 in 2001. As for 2011, the highest was in Engandiyur with a sex ratio of 1195 and the lowest was in Ollukara with a sex ratio of 1036.

The sex ratio is seen to be higher in females in both the years.

3.8 Age sex Composition

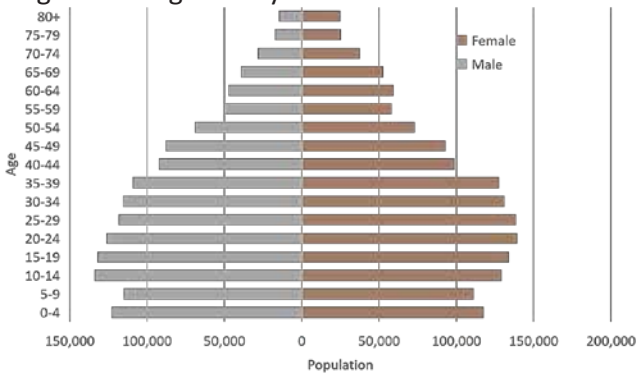
The age-sex pyramid shows the distribution of the population by age and sex and its structure shows the demographic characteristic of a region or area. By comparing the age-sex pyramid (Figures 3.7, 3.8, and 3.9) of Thrissur district.

Figure 3.7. Age Sex Pyramid of Thrissur district 1991



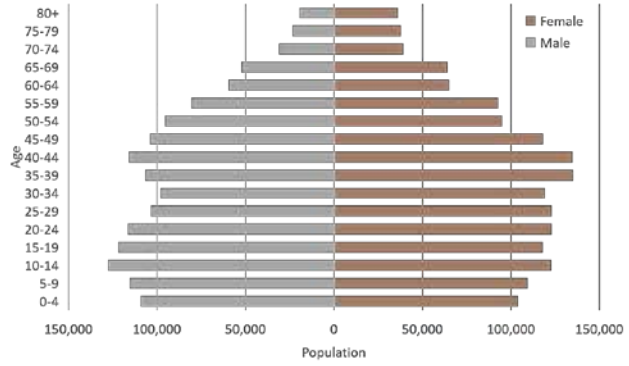
Source: Census 1991

Figure 3.8. Age Sex Pyramid of Thrissur district 2001



Source: Census 2001

Figure 3.9. Age Sex Pyramid of Thrissur 2011 distric



Source: Census 2011

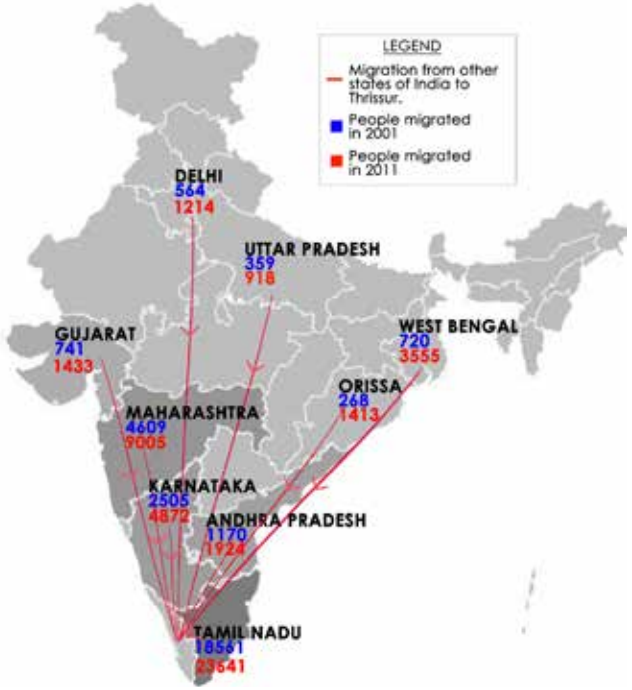
Over two decades starting from 1991, the birth rate is high in all three years and the birth rate in 2011 has become higher significantly as compared to 1991 and 2001. The percentage of economically dependent people combining both the young and the old aged is 38%, 36%, and 35% in all three years respectively. We can also see that the percentage of the working-age population is higher in all the years so it would mean that the age-sex composition has been stable over the decades and they are likely to be more productive and contribute more to the economy. It shows a positive indicator of economic growth and development, as it suggests a strong workforce that can support economic growth and development. From the years 1991, 2001, and 2011, the percentage of the ages 0-14 is 28%, 24%, and 23%, the percentage of the working age group from ages 15-59 is 62%, 64%, and 65% and the ages above 60 is 10%, 12%, and 12% respectively.

3.9 Migration

When a person moves away from his/her place of birth and settles either temporarily or permanently in some other district, state, or nation away from his/her place of residence in search of work, for educational purposes, or for marital reasons, it can be termed as migration.

In Thrissur, by place of last residence among the main, marginal, and non-workers, Tamil Nadu had the highest number of migrants in 2001 and 2011 with a total of 18,561 and 23,641 respectively. The lowest number of migrants in 2001 was from Daman and Diu and Dadra and Nagar Haveli with each having 1 migrant. In 2011, the lowest was from Dadra and Nagar Haveli with a total number of 3 migrants. However, in 2023, there are a large number of migrants from West Bengal and Assam. They indulge in work mainly in the construction sector

Figure 3.10. Map showing the flow of highest number of migrants from other states of India



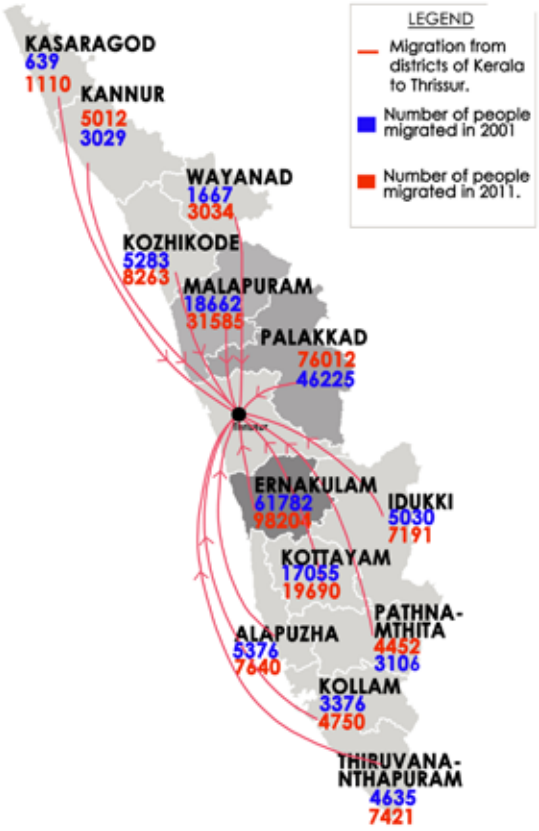
Source: Census 2001, 2011

and the handloom sector. Within the district, the number of migrants coming from Ernakulam, Palakkad, and Malapuram is the highest for both the years 2001 and 2011 consecutively.

According to the labour workforce department, currently in 2023, the majority of the migrants reside in Thiruvilwamala in Pazhayannur block, Kodakara and Kalletumkkara in Chalakkudy block, Kotakara and Chazoor in Thrissur M. Corp. The reason for such kind of migration may be the availability of jobs in the

construction, handloom, agriculture, mining, and quarrying sector. The construction sector holds and attracts a large number of migrants followed by the manufac turing sector, agriculture, quarry

Figure 3.11. Map showing the flow of migrants from other districts of Kerala of 2001 and 2011.



Source: Census 2001, 2011

ing, and mining respectively. The total population of Thrissur is 27.3L, 29.7L, and 31.2L in 1991, 2001, and 2011 and the total percentage of migrants is 7.6%, 34.2%, and 57.6% for these significant years.

The period between 1991 and 2001 saw a substantial increase in the percentage of migrants. Between 2001 and 2011, the rate of migration to Thrissur seemed to increase although at a slower pace compared to the previous decade. Overall, it shows that Thrissur has been experiencing significant population growth over the past few decades, largely driven by a massive influx of migrants.

3.9.1 Youth Migration

Kerala, an Indian state, has experienced major youth migration for many years. Migration to foreign countries is an extremely common phenomenon in modern Kerala society. The Middle East and European and North American countries are like their own homelands for Keralites today. The Ministry of external affairs reports that 30,948 students migrated from kerala in 2019, according to the unofficial figures 35,000 students migrate to different countries from Kerala every year. This trend is influenced by a number of factors, including social, economic, and educational ones. While there are certain advantages to young migration, such as better career possibilities and higher income, there are also difficulties and issues that the state as well as the migrants must deal with.

A primary survey was conducted among the younger population of Thrissur, and it was found that 63.6% of respondents have migrated elsewhere for their education and jobs. Of the remaining respondents currently studying in Thrissur, 78.9% wanted to move out of the city for further education and career. When further enquired about the reasons for wanting to move out, the respondents gave varied reasons such as the need for better exposure and opportunity, better standard of living, the experience of diverse culture and work environment, and lack of preferred course.

Remittances have helped fuel economic progress, but they have also created problems including a skilled labour shortage and social unrest. Policymakers and other stakeholders must address these concerns by emphasizing skill development, providing youth with possibilities in the city, and encouraging a sense of cultural preservation and identity among the young people.

3.10 Literacy

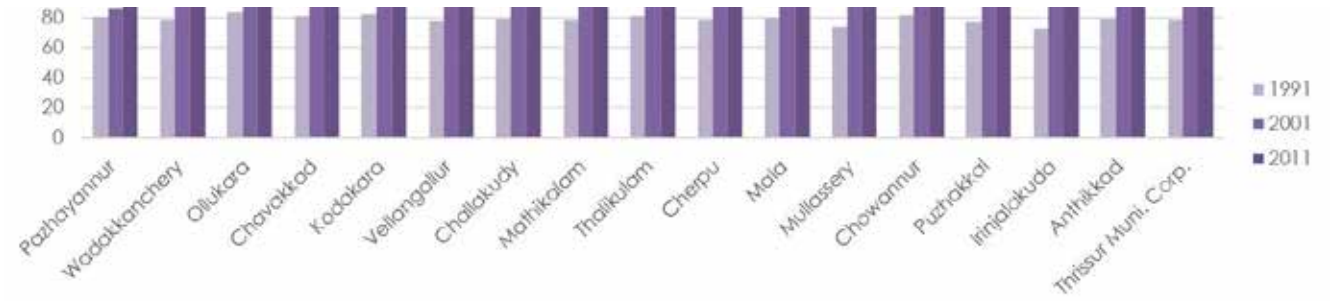
Literacy is a critical indicator of the level of education and development in a region or country. Thrissur, located in the state of Kerala, known for its emphasis on education and high literacy rates.

Over the decades, Thrissur known for its quality of education it has witnessed a steady rise in literacy rates can be seen. In 1991, the literacy rate in Thrissur was 79.1%, which increased to 92.2% in 2001, and further to 95% in 2011, indicating a steady increase in literacy rates over the years.

In the state of Kerala, literacy rates have been consistently high. In 1991, the literacy rate was 77.9%, which further increased to 90.9% in 2001, and reached 94% in 2011, where in in india overall literacy in India is 74% in 2011 showcasing a continuous rise in literacy levels in Kerala.

Blockwise literacy of Thrissur (Figure 3.12.)- Thrissur M. Corp., Anthikkad and Irinjalakkuda has the highest literacy. Thrissur M.Corp, also known as Thrissurpuram, is the administrative body responsible for governing the city of Thrissur.

Figure 3.12. Blockwise decadal rise of literacy



Source: Primary Census Abstract (1991, 2001, 2011)

When we compare literacy rates between urban and rural areas of Thrissur, no significant difference can be seen. However, on average, there is a gap of approximately 3% in every decade, with urban areas having slightly higher literacy rates compared to rural areas. In rural parts of Thrissur, the literacy rate was 78.1% in 1991, 91.5% in 2001, and 93.6% in 2011. In urban parts of Thrissur, the literacy rate was 81.7% in 1991, 94.2% in 2001, and 95.7% in 2011.

These trends indicate that overall literacy rates in Thrissur have improved over the years, with efforts toward promoting education and literacy. However, there is still a need to address the slight gap between urban and rural literacy rates and ensure access to education and literacy for all segments of the population.

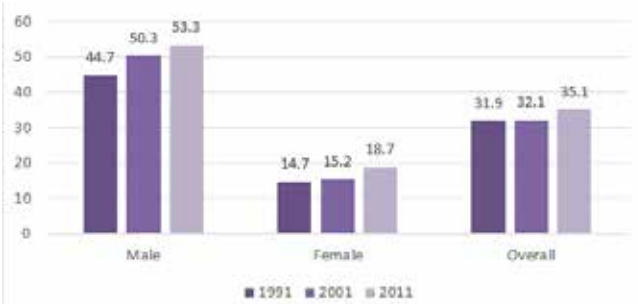
When considering the gender-wise literacy rates in Thrissur, the data reveals that males have a higher literacy rate compared to females. As per the census of 2011, the literacy rate for males in Thrissur was 96.8%, while the literacy rate for females was slightly lower at 93.5%. The overall literacy rate, combining both males and females, stood at an impressive 95.1%. This indicates that while both males and females in Thrissur have high literacy rates, there is a slight gap between the genders, with males having a slightly higher literacy rate than females. It highlights the need for continued efforts to promote literacy among females to bridge the gender gap in education in Thrissur.

3.11 Work Force Participation Rate

According to census the percentage of people in the working-age group (15 age to 60 age) who are employed or actively seeking employment is known as the Workforce Participation Rate (WPR). WPR can be impacted by elements such as monetary conditions, educational attainment, cultural perspectives on work, and governmental regulations. A high WPR typically denotes an active labour market, whereas a low WFPR could denote a dearth of employment opportunities, a low level of labor force attachment, or a high proportion of people who are unable to find work.

The declining child birth rate and stable working-age population indicate a potential decrease in overall dependency ratio, whereas the rising percentage of elderly population indicates an increased need for social welfare programmers and ageing population support. The decadal trend of WFPR in Kerala is 31.4% in 1991, 32.3% in 2001 and 34.7% in 2011. The decadal growth trend from 1991 to 2011, the Workforce Participation Rate (WPR) in the Thrissur district increased on average, according to the Census data. The WPR increased slightly between 1991 and 2001, rising from 31.9% to 32.1% in 2001 and 35.7% in 2011. With a higher percentage of the working-age population employed or actively seeking employment, this rise in WPR suggests that economic activity in the Thrissur district has increased over the past two decades.

Figure 3.13 Male- female WFPR



Source: Primary Census Abstract (1991, 2001, 2011)

When we see male and female participation in work according to the census 2011 over the decades, there has been a significant disparity in the workforce participation rate (WFPR) between men and women in Thrissur. In 1991, the WFPR for males was 44.7%, rising to 50.3% in 2001 and then to 53.3% in 2011. In comparison, the WFPR for females was significantly lower. It was 14.7% in 1991, increased slightly to 15.2% in 2001, and then rose to 18.7% in 2011.

Rural-Urban WFPR

The workforce participation rate (WFPR) in rural areas of Thrissur remained stable at

32% in 1991 and 2001, but increased to 37% in 2011. In contrast, urban areas saw a slight increase in WFPR from 31% in 1991 to 32% in 2001, and further rose to 34.1% in 2011. These trends suggest a relatively consistent level of workforce participation in rural areas, possibly influenced by agricultural activities, while urban areas experienced a modest increase in workforce participation, likely due to urbanization and employment opportunities. These changes highlight the need to consider the unique dynamics of urban and rural areas when formulating policies and strategies related to workforce participation and economic development in Thrissur.

These changes highlight the need to consider the unique dynamics of urban and rural areas when formulating policies and strategies related to workforce participation and economic development in Thrissur. Table 3.2 shows the blockwise urban-rural workforce participation rate projections for 1991,2001,2011. It is observed that the work participation rates in both rural and urban areas are almost equal which indicates the parity between urban and rural.

This indicates the equal opportunity of working in both rural and urban areas is increasing in proportion to the growth of population in the district. When the WPR of urban areas are compared, WPR of Thrissur M.Corp. is greater than all the other blocks. This maybe because Thrissur Municipal Corporation acts as a growth centre for the Thrissur District and provides home to a large number of workers. Amongst the blocks Mullassery, Chavakkad, Vellagallur,

Table 3.2. Decadal change of WFPR

Year	1991				2001				2011			
Block	Urban	Rural	Total	WPR	Urban	Rural	Total	WPR	Urban	Rural	Total	WPR
Kodakara	18.16	31.95	25.06		34.29	34.8	34.76		36.31	38.42	35.37	
Wadakkanchery	0.00	30.48	30.48		0	33.19	33.19		36.61	35.66	32.79	
Irinjalakuda	9.29	27.94	18.61		30.69	32.64	34.7		35.36	36.66	34.13	
Mala	0.00	32.53	32.53		0	36.56	36.56		35.5	31.17	32.3	
Mathilakam	40.72	23.32	32.02		32.63	31.85	32.15		32.61	34.71	31.68	
Thalikulam	0.00	19.92	19.92		0	26.82	26.82		29.8	30.67	30.36	
Vellangallur	0.00	27.27	27.27		0	28.44	28.44		33.24	33.18	29.62	
Chowannur	12.74	28.73	20.73		33.79	31.66	32.44		32.66	34.12	32.94	
Thrissur Muni. Corp.	52.90	35.13	44.02		32.51	36.1	32.52		34.12		34.12	
Cherpu	51.27	13.78	32.53		33.76	34.12	41.89		36.21		32.21	
Puzhakal	50.18	30.65	40.42		31.42	31.2	30.97		36.34	35.78	33	
Chavakkad	42.32	16.95	29.63		29.14	29.12	29.09		26.85	25.9	25.54	
Pazhayannur	0.00	42.70	42.70		0	28.51	28.51		33.96	39.16	33.67	
Challakudy	42.45	32.80	37.63		27.72	31.06	29.57		37.02	38.35	35.48	
Ollukara	50.18	37.11	43.65		30.51	29.34	29.88		40.74	40	33.16	
Anthikkad	0.00	24.08	24.08		0	32.17	32.17		33.56	35.91	32.39	
Mullassery	0.00	22.54	22.54		0	22.54	22.54		31.16	30.64	31.05	

Source: Primary Census Abstract (1991, 2001, 2011)

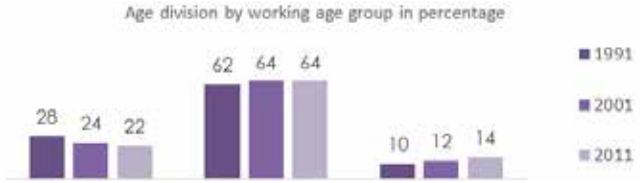
Chowannur, Thalikulam and Mathilakam have WPRs lesser that the total WPR of the district as estimated over the three decades.

3.11.1 Economically dependent Age group

From 1991 to 2011 (Figure-3.14), the decadal changes in economic dependency in Thrissur, India, reveal interesting trends. In 1991, the population under the age of 15 constituted 28% of the total population, while the population aged 15 to 59 years constituted 62%. The elderly aged 60 and up made up 10% of the total population. Notably, child birth rates have been declining over time. In 1991, 28% of children under the age of 15 were present, which fell to 24% in 2001 and 22% in 2011.

The working-age group, which includes people aged 15 to 59, has remained relatively stable over the last three decades. It accounted

Figure 3.14 Decadal change of economic dependency



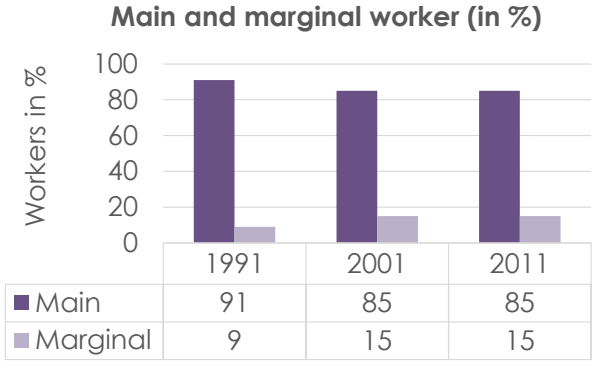
Source: Primary Census Abstract (1991, 2001, 2011)

for 62% of the total population in 1991, increasing slightly to 64% in 2001 and remaining constant at 64% in 2011. However, the percentage of the elderly population aged 60 plus has consistently increased in each decade. It was 10% in 1991, increased to 12% in 2001, and then to 14% in 2011. These shifts in economic dependency reflect changes in population dynamics and demographic trends in Thrissur over the last two decades.

3.11.2 Main and marginal workers

The composition of the workforce in Thrissur underwent noticeable changes over the span of two decades. In 1991, main workers accounted for 91% of the workforce, while marginal workers comprised 9%. However, by 2001, main workers decreased to 85%, while marginal workers rose to 15%. These proportions remained constant in 2011, indicating a consistent shift in employment patterns. These shifts have significant implications for policy interventions aimed at addressing the diverse needs of workers in the region. It suggests a potential need to adapt policies to cater to the requirements of both main and marginal workers, recognizing the evolving dynamics of the labor market in Thrissur. These shifts in main and marginal workforce proportions reflect evolving employment patterns in Thrissur and may have implications for policy interventions aimed at addressing the needs of different types of workers in the region.

Table. 3.15 Main and Marginal workers (in %)



	1991	2001	2011
Main	91	85	85
Marginal	9	15	15

Source: Primary Census Abstract (1991, 2001, 2011)

Figure 3.16 Blockwise four-fold classification of workers



Source: Primary Census Abstract (1991, 2001, 2011)

3.12 Settlement Hierarchy

Settlement hierarchy seeks to identify the function of settlements in a district. It groups and categorises settlements according to the size, economic and retail role, as well as the services and facilities available in the settlement.

The bigger the settlement the more services it tends to have, although this is not always the case. Over time a settlement hierarchy has been established in the District with the towns providing many of the services and facilities for the whole District. It is widely accepted that settlements can be differentiated in terms of rural and urban, mostly by considering the population size.

3.12.1 Hierarchy of Urban settlements

Based on the population size the following five urban hierarchies are Megalopolis, Conurbation, Million City or Metropolis city, City and Town.

The town has further divided into the following hierarchy:

Class 1: Population greater than 1 lakh

Class 2: Population between 50,000 to 1 lakh

Class 3: Population between 20, 000 to 50,000

Class 4: Population between 10, 000 to 20,000

Class 5: Population between 5, 000 to 10,000

3.12.2 Hierarchy of Rural settlements

The rural areas or the villages, also have different characteristics according to their population size, proximity to and dependence on urban centre respectively, topography, economic activities, social customs and traditional values.

The basis of qualifying to such categorization for village shall be:

I. More than 75% of population depended on primary activity

II. Isolation from urban areas in terms of distance and accessibility.

Here, categorisation of villages according to population size, has been discussed –

Class 1: Population more than 10000

Class 2: Population between 5000 to 9999

Class 3: Population between 2000 to 4999

Class 4: Population between 1000 to 1999

Class 5: Population between 500 to 999

Class 6: Population between 200 to 499

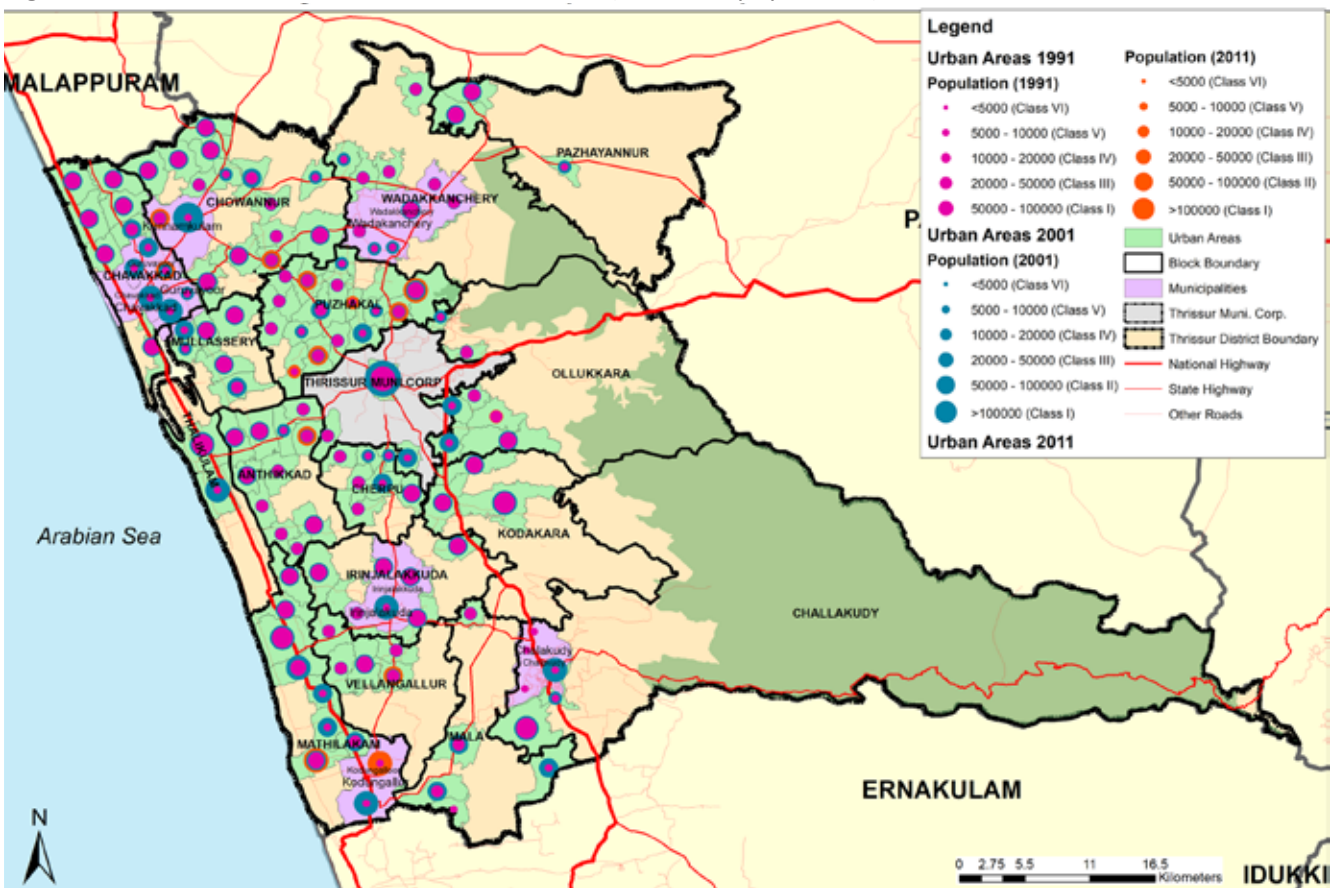
Class 7: Population Less than 200

3.12.3 Hierarchy of urban settlements in Thrissur district

While being one of the most urbanized districts of the state of Kerala just after Ernakulam district, the number of urban settlements of Thrissur district started increasing from 1971 to 1991. In 2001, Thrissur Municipality was upgraded to Thrissur Municipal corporation, so the adjoining outgrowths and census towns were inlcuded in the Thrissur Municipal Corporation. The urban areas did increase from 2001 to 2011 but statisically, they saw a dip in numbers from 1991 to 2001. Thrissur Municipal Corporation showed a decent amount of growth from 2.66 lakhs to 3.15 lakhs from 1991 - 2011, and thus becoming the growth centre of the district.

The other major towns like Irinjalakkuda, Kodungallur, Chavakkad, Kunnamkulam etc. have seen growth lately between the years 2001 and 2011. The district has the most number of census towns, i.e, 128 (as per Census 2011) in the state. The district showed a big jump in number of Census Towns from 21 in 2001 to 128 in 2011. As shown in Figure 3.17, the census towns are generally located near and around the statutory towns (municipalities & municipal corporation).

Figure 3.17. Classification of urban areas of 2011 (based on population) in Thrissur District



Source: Primary Census Abstract (1991, 2001, 2011)

Specifically, the blocks of Chavakkad, Mala, Puzhakal and Cherpu have most number of census towns. The reason behind this is that these are located near the municipalities and municipal corporation which are attracting the population. Pookode (CT), an OG in the 2001 Census, changed its size class from Class IV to Class V, whereas all other Census Towns of the 2001 Census kept their size class. Iringaprom

(CT), Kolazhy (CT), and Puranattukara (CT) of the 2001 Census have altered their size class from Class V to Class IV in the 2011 Census. Census Towns which came under Class VI in 2011 Census are new towns. The percentage of Class III and Class IV towns increased in numbers gradually over the years as shown in Table 3.3.

Also, if noticed, there wasn't any significant increase in the number of census towns from the year 1991 to 2001.

Table 3.3 Classification of urban settlements

Class	Population	1991	2001	2011
I	>1,00,000	-	1	1
II	50,000 – 1,00,000	1	2	2
III	20,000 – 50,000	10	5	13
IV	10,000 – 20,000	16	11	64
V	5,000 – 10,000	13	9	49
VI	<5,000	-	-	6
Total		40	28	135

Source: DCHB and primary Census Abstract (1991, 2001, 2011)

The reason behind it being that as many as twelve census towns existed around the then Thrissur Municipality which were included in the jurisdictions of the municipality as it expanded its area during Census 2001, which affected the growth in numbers of towns in the district too.

Though there were no new census towns or statutory towns coming up in that particular year, the total number of urban settlements in Thrissur in 2001 dropped, while Thrissur municipal corporation switched its class from Class II to Class I due to its natural increase and another reason being the inclusion of the census towns in the municipality jurisdictions. The two class II towns are Kodungallur and Kunnamkulam.

3.12.4 Hierarchy of rural settlements in Thrissur district

Rural settlements in Thrissur district are majorly located in blocks like Pazhayannur, Chalakkudy and Kodakara while the population of rural settlements in blocks like Wadakkanchery,

Table 3.4. Classification of rural settlements

Class	Population	1991	2001	2011
I	>10,000	70	89	40
II	5,000 - 10,000	77	84	31
III	2,000 – 5,000	59	30	23
IV	1,000 – 2,000		1	1
V	500 - 1000	2	-	-
VI	200 - 500	-	-	-
VII	<200	1	-	1
Total		209	204	96

Source: DCHB and primary Census Abstract (1991, 2001, 2011)

Chowannur and Kodakara have increased at faster pace and are continuing to do so (as shown in Figure 3.18), due to specific locational advantages like their proximity to statutory towns and their upcoming prospects which attracts the population to these villages which get converted to urban area.

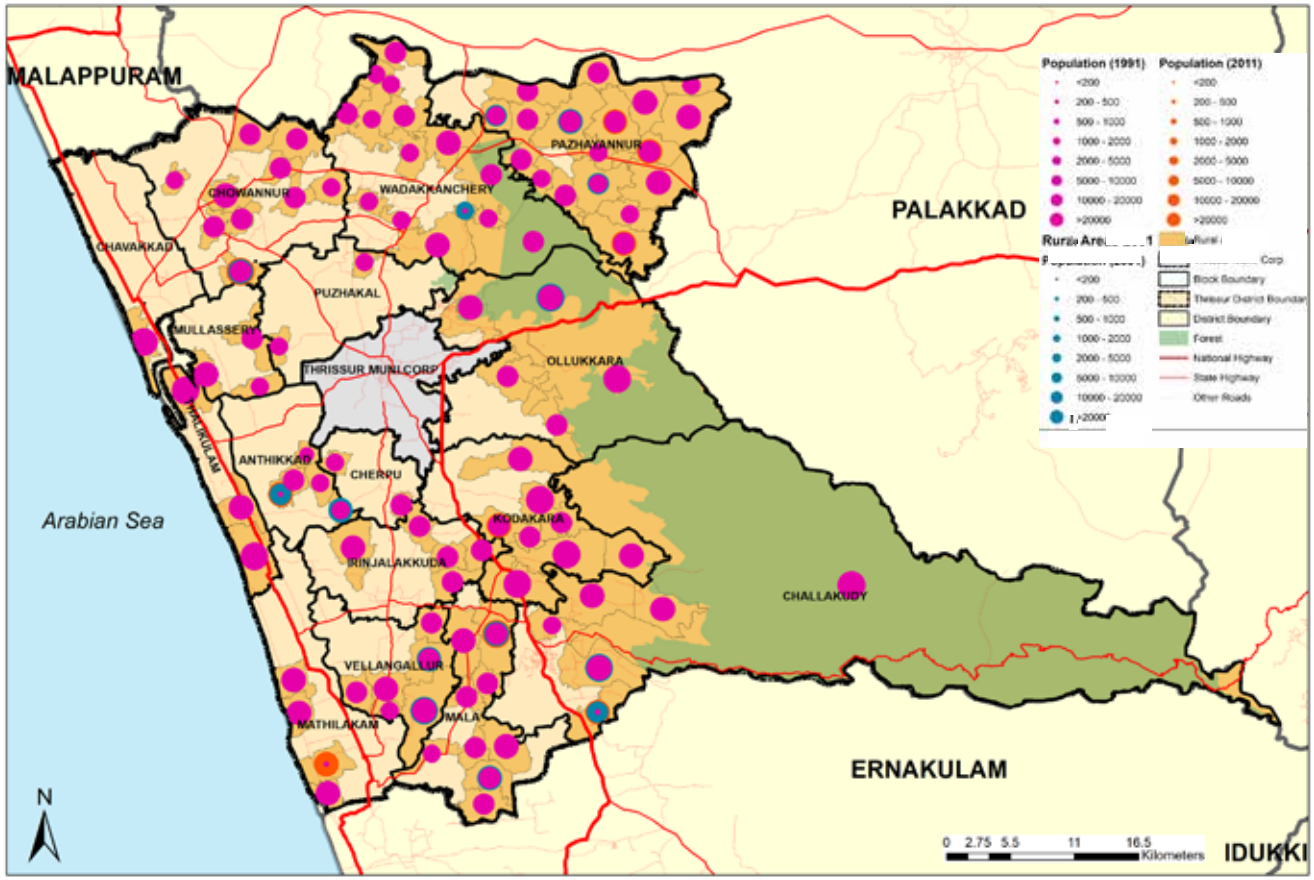
Villages in Mathilakam, Chavakkad and Chalakudy blocks have shown growth over the years and have increased in population. They still hold the rural characteristics, while the population has grown over 10,000 and in some cases more than 20,000 till 2011.

Inferring from Table 3.4, it is evident that the urbanization rate increased at a rapid pace as villages decreased from 204 to 96 from 2001 to 2011. The classification of the villages as well as towns show that villages directly turned into towns of Class IV, V as well VI by 2011. While the shift from rural to urban is evident, Table 3.9 shows that blocks like Wadakkanchery, Chowannur, Puzhakal, Chavakkad and Anthikkad showed major shift of settlements from rural to urban between the years 2001 and 2011. These blocks showed slight changes in the previous decades too. While the blocks like Pazhayannur, Ollukara, Chalakkudy and Velangallur have showed slight changes between the years 2001 to 2011. These blocks still have potential rural areas and its characteristics at present too.

Table 3.5 Shift of settlements from rural to urban

Years		Kodakara		Wadakkanchery		Irinjalakuda		Mala		Mathilakam		Thalikulam		Vellangallur		Chowwannur		Thrissur Muni. Corp.		Cherpu		Puzhakal		Chavakkad		Pazhayannur		Chalakkudy		Ollukara		Anthikkad		Mullassery		Total
1991	Urban	1		0		0		0		2		0		0		2		0		1		1		5		0		2		1		0		5		23
	Rural	11		25		12		14		11		5		11		24		1		10		17		10		21		9		11		16		5		210
	Total	12		25		12		14		13		5		11		26		1		11		18		15		21		11		12		16		10		233
2001	Urban	2	1	0		0		0		2		0		0		2		1	1	4	3	3	2	6	1	0		2		2	1	0		6	1	31
	Rural	10	-1	25		12		14		11		5		11		24		0	-1	7	-3	15	-2	9	-1	21		9		10	-1	16		4	-1	202
	Total	12		25		12		14		13		5		11		26		1		11		18		15		21		11		12		16		10		233
2011	Urban	5	3	10	10	8	8	5	5	10	8	2	2	5	5	17	15	1		9	5	16	13	14	8	4	4	5	3	7	5	11	11	6		135
	Rural	7	-3	15	-10	4	-8	9	-5	3	-8	3	-2	6	-5	9	-15	0		2	-5	2	-13	1	-8	17	-4	6	-3	5	-5	5	-11	4		98
	Total	12		25		12		14		13		5		11		26		1		11		18		15		21		11		12		16		10		233

Figure 3.18. Classification of rural areas of 2011 (based on population) in Thrissur District



3.13 Growth Centres

3.13.1 Introduction

The concept of Growth centres was developed to elucidate the disparity in regional growth and the need for regional planning to dissipate growth in different regions. In both established and developing nations around the world, the growth centre strategy is now a crucial component in the creation and execution of regional plans.

Dr. R.P. Mishra, an Indian geographer, combined the growth poles and centres notion with the population concept and modified Growth foci approach focusing on Indian context. The growth foci in developing nations like India should not only emphasize industrial development;

a)they also need to serve as centres of innovation and growth promotion in addition to serving as service centres and providing for the daily needs of the communities they serve.

b) they must engage in processing and manufacturing, and they must be able to create jobs. According to R.P. Mishra, larger countries should have five tiers of growth location for regional planning. The five tier hierarchial arrangements are - Growth pole, Growth centre, Growth point, Service centres and Central villages. (Source: R.P.Mishra, Regional Planning: Concepts, techniques, Policies and Case studies , 2002)

There are 255 settlements in Thrissur and here the task is to identify the the four tier hierarchy (Growth Centre, Growth Point, Service Centre, Central Village) from these settlements. This study is primarily predicated on the existing pattern and functional characteristics in the district, are a result of the shifting socio-economic, cultural environment.

Methodology

The analysis will be based on primary data which has been collected at the urban and rural level during field survey and secondary level data have been collected for resources and infrastructure development from various departments. The primary data which includes personal interview, data collected during field survey and secondary data from Census of India (2011) and the District Census Handbook of Thrissur have been employed.

The process of distinguishing growth centres requires to have all the settlements of the district categorized into four-tier hierarchy which is based on the Centrality Index (CI) as nature of the present study demands, distribution and pattern of the information about population, social amenities like educational facilities, health facilities, communication facilities, and other utilities has been analyzed.

Table 3.6. Facilities with their weightage score in Thrissur

Name of the facilities	Weightage score
1.Connected to state highways (SH)	2.97
2. Connected to national highways (NH)	8.79
4. Connected to major district road (MDR)	2.11
5. Bus services: stops (public and private)	1.00
6. IPT Services (Auto stand and Taxi Stand)	8.30
7. Railway station	25.50
8. Primary health centre	8.30
9.community health centre	15.94
10.General hospital	85.00
11.Private hospital	10.63
13.District hospital	255.00
14. Primary school	4.64
13. High school	2.97
14. Engineering colleges	10.63
15. Research Institutes	21.25
16. Art, Science & Commerce	6.07
17. Banks (Public and private)	2.20
18. Post offices	2.24
19.Electricity supply-Substation	5.93
20.Dump yard	36.43
21. STP	63.75
22. MSME Industries	48.39
23. Agro Based-Industries	1.25
24. Animal husbandry	155.83
25. Veterinary Poly Clinic	8
26. Fisheries	30
27. Fish Landing Centre	18
27. Dominant Markets	11
28. Regular Markets	125
29. Weekly Markets	13
30. Forest based products market	11
31. Tourist Spot	12
32. Stadiums and other sports Infrastructure	5

By this method we can understand the ability of a place to service the surrounding area effectively with the importance of its location. It is based on two factors like number of different functions offered by a settlement and the level of various functions available in a settlement. It is based on two factors like number of different functions offered by a settlement and the level of various functions available in a settlement. For this method different parameters have been analysed, such as- Demography (population, literacy rate etc.), economy (MSME Industries, Agro-based Industries etc.), Infrastructure (Physical and Social). After reviewing the initial steps, by considering 32 facilities (Table- 3.6) in the total settlements of the district the centrality idex can be calculated. For determining Centrality Index (CI) the weightage for each facility have to be computed and then the total value of CI will help help to find out the hierarchial arrangements of the settlements.

Table 3.7. Hierarchical arragements of the settlements in Thrissur

Blocks/ M Corp.	No. of Growth Centres	No. of Growth Points	No. of Service-Centres	No. of Central Villages
1. Thrissur Muni. Corp	1	0	0	0
2.Wadakkanchery	0	1	0	2
3. Irinjalakuda	0	0	1	3
4. Mala	0	0	0	2
5.Mathikalam	0	0	1	5
6. Thalikulam	0	0	1	2
7. Vellangallur	0	0	0	2
8. Chowannur	0		0	9
9.Kodakara	0	0	1	3
10.Cherpu	0	0	0	3
11.Puzhakal	0	0	0	6
12.Chavakkad	0	0	1	3
13. Pazhayannur	0	0	0	4
14.Challakudy	0	0	5	3
15.Ollukara	0	0	0	1
16. Anthikkad	0	1	0	1
17.Mullassery	0	0	0	1
Total	1	3	7	70

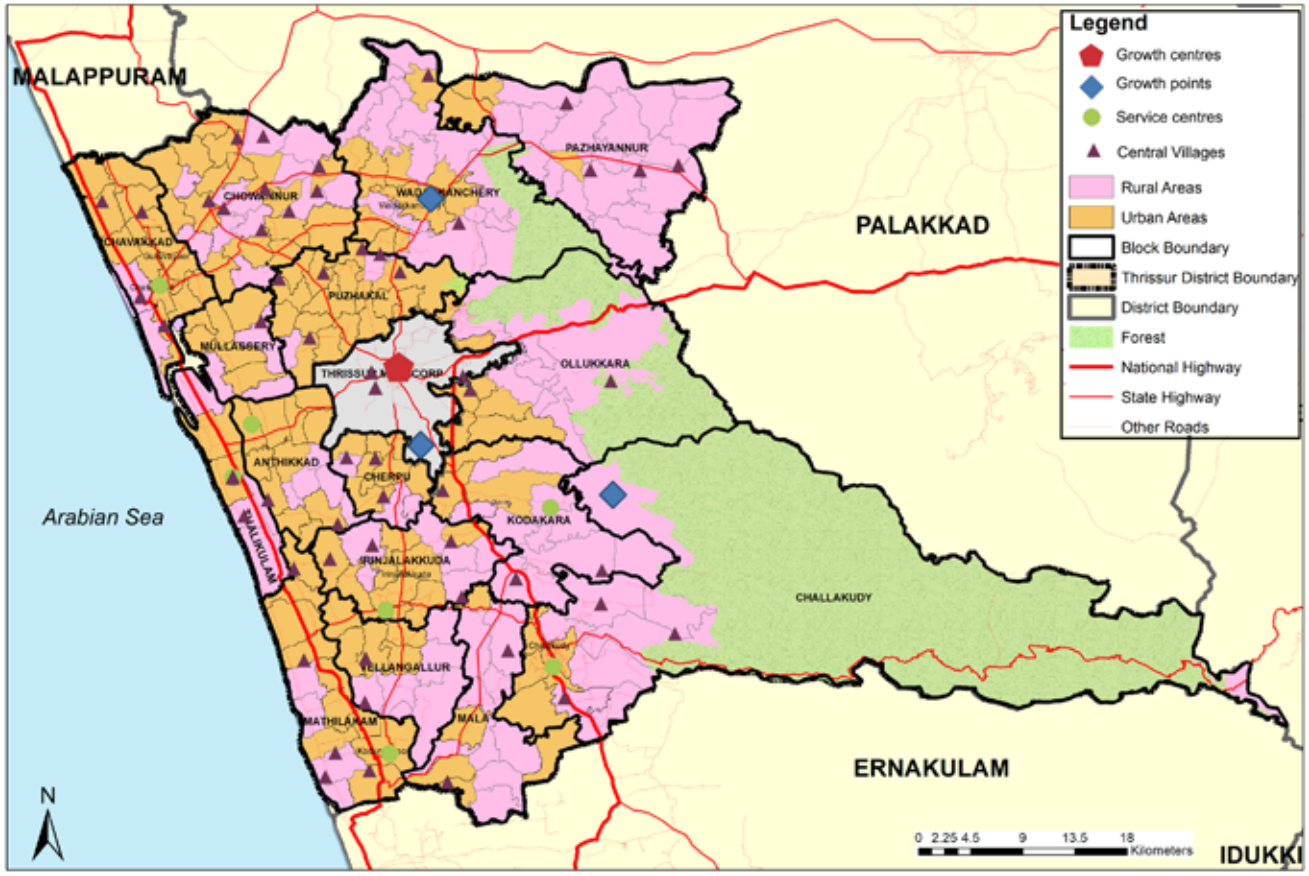
Now, the settlements which are having Centrality Index above 28.71 are considered to be the growth centres; Scale value between

20.13 - 28. 70 are found to be the growth points and score ranges between 11.54 - 20.12 are the Service Centre.W One Growth centre is found in Thrissur Municipal Corporation (Table- 3.7) or its availibility of resources and its proximity to other key settlements. Total no. of growth points in thrissur district are three and seven are the service centres. Seventy settlements are considered to be the central villages.

3.14 Conclusion

From the above conducted analysis it can be concluded that population of Thrissur has increased by 8.66% in 2001 from 1991's and 9.2% in 2011 from 2001's. Population of Thrissur Muni. corp, Chowannur, Chavakkad and Mathilakam block shows the constant increase in population from 1991 to 2011. The literacy rate in Thrissur has been consistently rising over the years, with a rate of 79.1% in 1991, 92.2% in 2001, and 95% in 2011. This indicates a positive trend towards better education and development in the region. Presently child is 22% (6.88 Lakh) and the elderly is 14% (4.28 Lakh) and it keeps changing continuously, affecting WFPR. Workforce participation of the district rated 29.6% in 1991, 32.1% in 2001, and 35.1% in 2011. It was found that the main urban settlement in the Thrissur district is Thrissur M. Corp. which saw a constant growth in terms of population and being the growth centre of the district. With the development of Thrissur, other towns in other blocks came up and grew in form of different classes and categories of towns. Irinjalakkuda, Kodungallur, Chavakkad, Kunnamkulam etc. have seen growth lately between the years 2001 and 2011. The urban population and no. of urban settlements saw a significant increase in the meantime, while the rural settlements and population started seeing a decline after the year 2001. With only 96 villages remaining by the year 2011, the district is projected to be approximately 80% urban by the year 2023. The hierarchy of settlements clearly shows an increase in Class IV and Class V towns by the year 2011, which shows early signs of urbanisation and conversion of rural areas to freshly transformed urban areas. Thrissur M.Corp. because of its resource availability and proximity to other significant communities, is considered as a growth centre. There are three growth points overall and seven service centres in the district of Thirissur. There are seventy settlements regarded as central villages.

Figure 3.19. Identification of Growth Centre, Growth Points, Service Centres, Central Village (2021)





Credits: Sajal Chauhan

Housing

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4. Housing

4.1 Introduction to housing

Shelter is a basic need and housing is a human right. It is a social responsibility to provide adequate housing. The new global agenda places housing at the centre. Almost every government faces challenges in providing housing for all. It may be due to an ever-increasing population on one hand and resource scarcity on the other. However, the effective implementation of decentralised planning at the state level has resulted in significant relief for the sector. Habitat is no longer regarded as merely a roof over the inhabitants' heads. It has acquired new dimensions in terms of efficiency and utility.

Being one of the basic aspects, it resultantly needs continuous attention upon its provision, access and condition by the government and its authorities. Many housing-related activities are known to contribute directly to achieving broader sustainable development goals, particularly mentioning the SDG 11 which targets making sustainable cities and communities and SDG 1 which focuses on eradicating poverty. These indicators specifically direct how housing and its provision can facilitate a sustainable community development and provide solutions of different aspects in the sector.

4.2 Housing - Context of Kerala and Thrissur

Housing in the state has registered enormous growth both in terms of quality and quantity. Its government has been working on housing issues since the early 1950s when the land registration act made land available to the landless and homeless. During that time it was looked at in terms of site and services, co-housing, incremental housing, etc. Kerala set an international model for housing development through the one lakh housing scheme (Kerala Thirteenth Five Year Plan, 2017-22).

Since then, construction sector has been a huge industry in the state, employing and generating income for a huge number of skilled, semi-skilled, and unskilled workers. During 2019-20, it contributed 12.42% as sectoral contribution to GSDP of the state (Building Statistics Report , 2019). As a result, the average growth of housing units which was 16% as against population growth rate of 9.42% during 1991-2001 increased to around 17% in the next decade even when population growth declined to 4.86 percent. (Kerala Thirteenth Five Year Plan, 2017-22). It seems that housing problem in the state has almost entirely been solved at an aggregate level. However a significant proportion of underprivileged and poor sections of society still don't have a reasonable shelter. Housing data from the Census 2011 indicates that the proportion of households belonging to the Scheduled Tribe communities residing in dilapidated houses is 8.3% which was almost 1.5 times the national average i.e. 5.3%.

In addition to the housing problem for the aforementioned communities, there are approx 3700 households (Table 4.1) in all the blocks of Thrissur district living in extreme poverty as per the extreme poor survey conducted by the poverty cell in the district . Wherein, Chavakkad, Mathilakam, Thrissur M. Corp, and Irinjalakuda have the highest number of households in extreme poverty with more than 300 households in extreme poverty. Puzhakal, Cherpu, and Vellangalur have the lowest with less than 150 such households.

Table 4.1 - Blockwise number of extreme households and extreme poor

Blocks	No. of extreme poor Households	No. of extreme poor
Mathilakam	556	970
Chavakkad	514	902
Irinjalakkuda	306	603
Chowannur	290	437
Ollukkara	257	421
Challakudy	232	380
Kodakkara	216	329
Pazhayannur	191	320
Mullassery	184	327
Wadakkanchery	180	304
Mala	172	342
Anthikkad	158	282
Thalikulam	144	211
Cherpu	117	201
Puzhakal	98	151
Vellangalur	88	154
Total	3703	6334

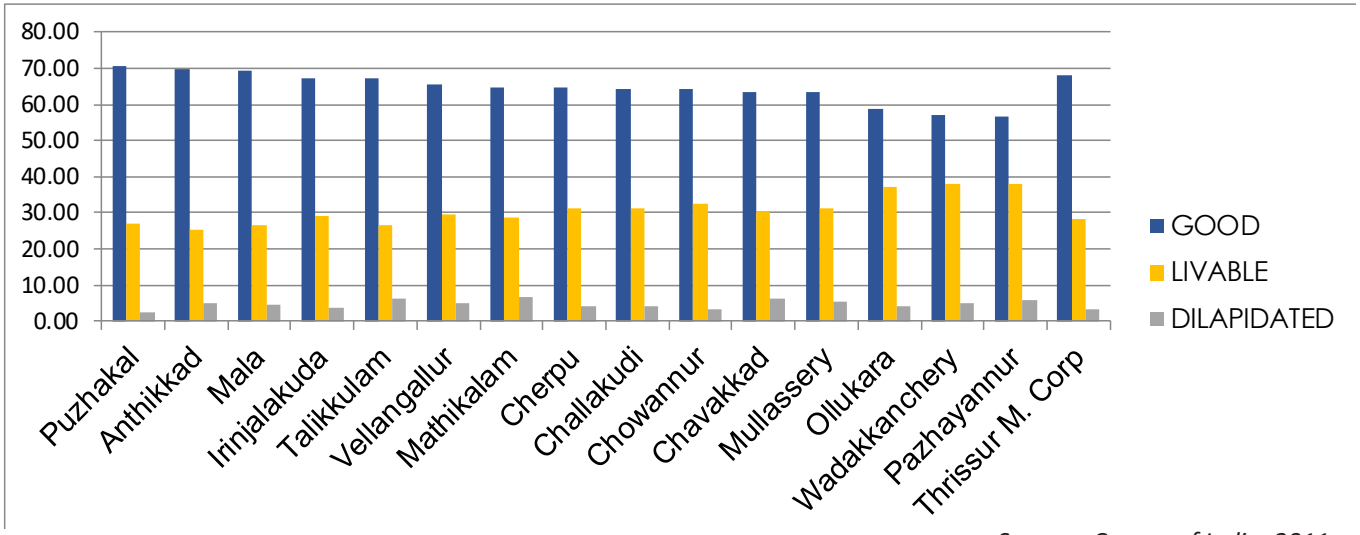
Source: Poverty cell, Collectorate, 2023

These sections might not be able to construct good houses due to relative scarcity and high prices of building materials. Since it is a fundamental human right, it is the responsibility of a civilized society to ensure that the housing needs of all are satisfied. In order to deal with this, certain schemes like PMAY, LIFE Mission, and Poverty Free Kerala have been adopted by the centre and the state. Certain employment schemes like the MGNREGA have also been adopted and the scholarships are been given under this to the students for their education.

Households are stratified under structure into 'good', 'livable' and 'dilapidated' by the Census of India in terms of the condition of houses. The housing condition in Thrissur district (as per Census of India, 2011) indicates that the percentage of houses in good condition is 65%, livable is 31% and those in dilapidated are 4.40%. It indicates that Thrissur district is at par with India in terms of housing conditions. However it lags behind in camparision to the state average where the percentage of houses in good condition is 66.3%, livable is 28.40% and that in dilapidated is 5.30% . Housing condition for all the sixteen blocks which constitute the Thrissur district are represented in Figure – 4.1.

Among the blocks, Cherpu, Puzhakal, Anthikkad and Mala have highest percentage of houses in good condition. The houses are generally pakka houses which translates into a good condition of housing. It may be driven because they share boundary with the only existing growth centre that is Thrissur Municipal Corporation. While Mathilakam and Chavakkad have highest percentage of houses in dilapidated condition. Kodakkara and Wadakkanchery have the least percentage of houses in good condition. This can also be inferred from Figure 4.1.

Figure 4.1. Blockwise percentage (%) distribution of households by structure in Thrissur, 2011



Source: Census of India, 2011

4.3 Ownership Status in Thrissur

During the year 2019-20, approximately 28,000 buildings were newly constructed in Thrissur. Out of these, 22,862 were build for residential purposes which include out-houses and shelter homes. 5,670 non – residential buildings were constructed in the same time frame. Among these residential houses 17,690 were constructed in the rural areas which constitutes of 77.3% of the total built. 4,913 were constructed in the urban areas which constitutes the remaining 21.48%.

Out of the 28,000 buildings built in the time period, 27,930 buildings are owned by private parties, 19,478 out of these are owned.

Nowadays, female ownership is mandatory for applying the assistance of government housing schemes. So this may be an indication of the achievement of the slight progress of gender equality in ownership of buildings. Among the blocks, Kodakkara and Mathilakam had the highest number of dwelling units constructed while Chavakkad and Chalakkudy have the least number of dwellings constructed. This can be inferred from table 4.3. When the density of buildings newly constructed during 2019-20 is computed with the geographical area (excluding forests), it can be seen that, an average of 15 buildings have been constructed per square kilometer in the state during the year 2019-20 as per Building Statistics Report 2019-20. Thus, the

density per sq kilometre is 15 which is slightly less than the state average.

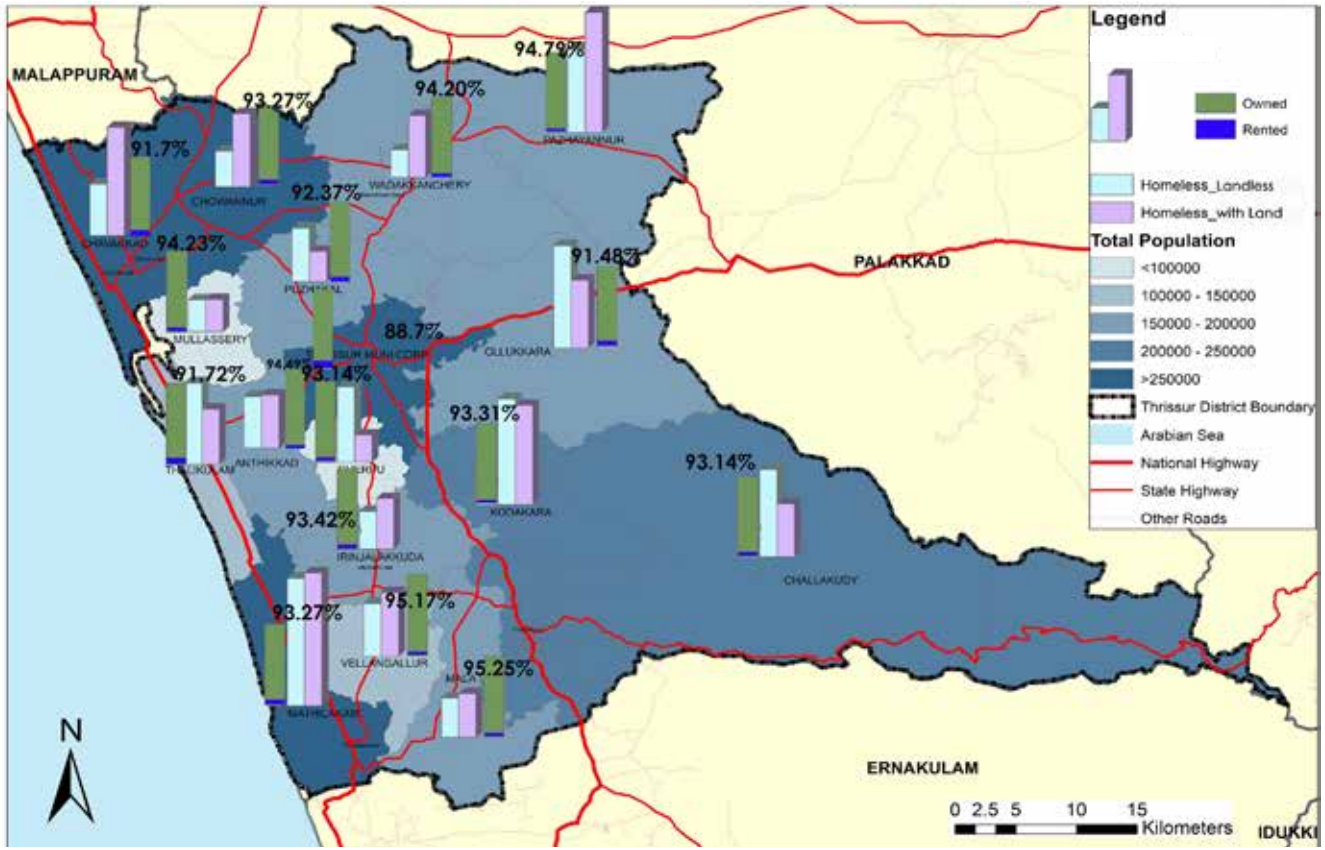
As per the Kerala Thirteenth Five Year Plan, 2016, the number of households in Thrissur district is 7,50,702, houseless households are 20,018, landless households are 7,719 and housing gap is 18,292.

Table 4.2 - Residential and Non - Residential buildings in Thrissur, Census 2011

Blocks	Residential	Non - Residential
Mathilakam	1786	2285
Kodakara	1688	2164
Pazhayannur	1556	1840
Chowannur	1532	2042
Challakudy	1345	1639
Chavakkad	1143	1305
Puzhakal	1126	1422
Anthikkad	1071	1306
Ollukkara	1000	1239
Thalikulam	896	1077
Mala	873	1189
Vellangallur	800	1017
Mullassery	733	810
Irinjalakkuda	732	967
Cherpu	642	833
Wadakkanchery	488	637

Source - Census of India, 2011

Figure 4.2. Blockwise ownership status and LIFE Mission beneficiaries w.r.t population



4.4 Government Schemes and Policies

Apart from Central Government schemes, the State Government and Local Self-Governments (LSGs) have been active in the housing sector with several innovative schemes and programmes to help the economically weaker sections as part of its social security and support programmes. Some of the major schemes are the Pradhan Mantri Awas Yojana – Gramin (PMAY-G) , the Rajiv Awas Yojana (RAY), Pradhan Mantri Gramin Awas Yojana (PMAY), Basic Service for the Urban poor (BSUP), Integrated Housing and Slum Development Programme (IHSDP), EMS Housing Scheme, Indira Awaas Yojana (IAY), etc.

In order to suffice to the needs of the homeless population in the state, the government introduced an umbrella scheme as a total mission on housing or the LIFE Mission. LIFE – Livelihood Inclusion Financial Empowerment also works to provide employment for all homeless people in the state within next five years, and to take decent role in social activities. beneficiaries under LIFE mission fall under four categories - homeless with land, those who

cannot complete housing construction/have unlivable housing , offshore or in the coastal zone, those who have temporary housing in the plantation area and the landless homeless.

As per the LIFE Mission Report, 2022, the number of Households in Thrissur District is 7.50 lakh. The total number of households without housing is 18,814. Out of these 18,814 , houseless households are 9,539 , landless households are 9,725. Figure 4.2 represents the spread of homeless population without and with land according to the list of beneficiaries identified by the LSGs under Life Mission Project. It can be deduced from the map that the majority of the homeless both with and without land have maximum concentration in Mathilakam followed by Pazhayannur, Ollukkara, Kodakkara and Chavakkad blocks. When this layer is studied along with the layer of poverty, it becomes evident that Mathilakam and Chavakkad blocks have maximum concentration of poor in the blocks. Therefore it may be stated that poverty and housing are not individual entities but are interconnected with each other. Therefore provision of housing can also help eradicate poverty to some extents. Hence it becomes more than just a roof.

Some of the major stakeholders who work together to create a responsible built environment are the Central Government, State Government, Local self - government institutions, public sector agencies, housing finance institutions, private, cooperative and community sectors, research and technology transfer agencies.

4.5 Critical Gaps in Housing

Thrissur district's housing situation is not homogenous all over the blocks. There are many pockets with substandard living conditions (urban slums, coastal areas, SC/ST-dominated areas, plantation hills, etc.) that require immediate attention and specific measures. The issues of the following sections need to be addressed through appropriate shelter-level interventions - poor est of poor - Homeless, Landless, etc, those in Coastal Areas, Old, differently abled, chronically ill, women-headed households, and SC/ST and other marginalized sections of the society.

Currently, there are no schemes that specifically cater to the vulnerable sections that are to be prioritized. Apart from these some other aspects need to be looked at from the lens of housing areas – Migrant Housing, Plantation Housing, Vacant Houses, and Heritage and Culture Sensitivity.

4.6 Housing Shortage

Housing shortage at any point in time is the sum total of (a) the absolute number of houseless households; (b) the number of households residing in dilapidated or obsolete houses and (c) congestion factor, i.e., the number of additional households residing in each oc cupied residential household.

However, due to delay in India's decennial census which was set to be held in 2021 due to Covid pandemic. Therefore, projected poulations have been used to calculate the housing shortage by considering that each household would require a dwelling unit.

The population and housing statistics were analysed using the Census of India statistics from 1991 to 2011. Based on the learnings from the analysis the population has been projected for the years 2021, 2031, 2041 and 2047 respectively.

Table 4.3 - Estimated blockwise shortage of houses in Thrissur

Blocks	Shortage 2021-31	Shortage 2031-41	Shortage 2041-47
Chowannur	15,961	16,496	11,106
Mala	7,019	8,305	8,376
Challakudy	6704	6769	4294
Chavakkad	3,809	4,304	4,600
Puzhakal	6216	7200	8252
Ollukkara	6184	6769	4294
Pazhayannur	5594	5705	3702
Kodakara	5530	5428	3661
Wadakkanchery	5394	5498	4142
Anthikkad	4,540	4,994	4,405
Mathilakam	3746	3889	3461
Irinjalakkuda	2591	2677	2050
Vellangallur	2521	2623	2105
Cherpu	1992	2221	2457
Thalikulam	1826	1872	1437
Mullassery	1341	1503	1700

The population is 35.36 Lakh , 39.09 lakh, 43.05 lakh and 46.32 lakh approximately. Considering the household size constant i.e. 4.5

persons per household, the projected households would be 7.85 lakh, 8.68 lakh, 9.56 lakh and 10.29 lakh respectively and thus the total housing shortage in the district by 2047 would approximately be 70,000.

4.7 Conclusion

Thrissur district, being the most urbanized district in the state has developed in housing in certain aspects because of schemes and programs like LIFE Mission, Rebuild Kerala initiatives, etc. but there are several facets which still need attention and appropriate mechanism to look upon. While, we see the condition of housing in the district is at par with the national averages, the provision of housing for migrant workers, disaster resilient housing, land for housing and utilization of vacant houses still remain a puzzle for the administration. As, the district is on its way of further urbanization in the coming years, these shortcomings can become a huge issue if not looked upon.

According to the Kerala State Planning Board, the number of houseless households sum up to 9,539, while landless households are 9,725. The maximum concentration of these households are in Mathilakam, Pazhayannur, Ollukara, Kodakara and Chavakkad blocks. As the density of population is more in Chavakkad, Thalikulam and Mathilakam blocks, and as these blocks are coastal areas of the district, disaster-resilient housing as an infrastructure provision should be proposed. The increasing density in the blocks of Anthikkad, Cherpu and Puzhakal presently will also need resilient housing. The upcoming urban centers as well as developing towns will need specific migrant workers housing/rental housing schemes to cater to the population which will be migrating from other districts and states. While these are being addressed presently, an estimation of the future housing shortage has also been carried out to understand how many housing units need to be provided in the future to cater to the increasing population in the region as well as maintain a streamlined growth in housing as a dimension of social infrastructure as well as development.



Transport

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Sajal Chauhan 2022MURP006
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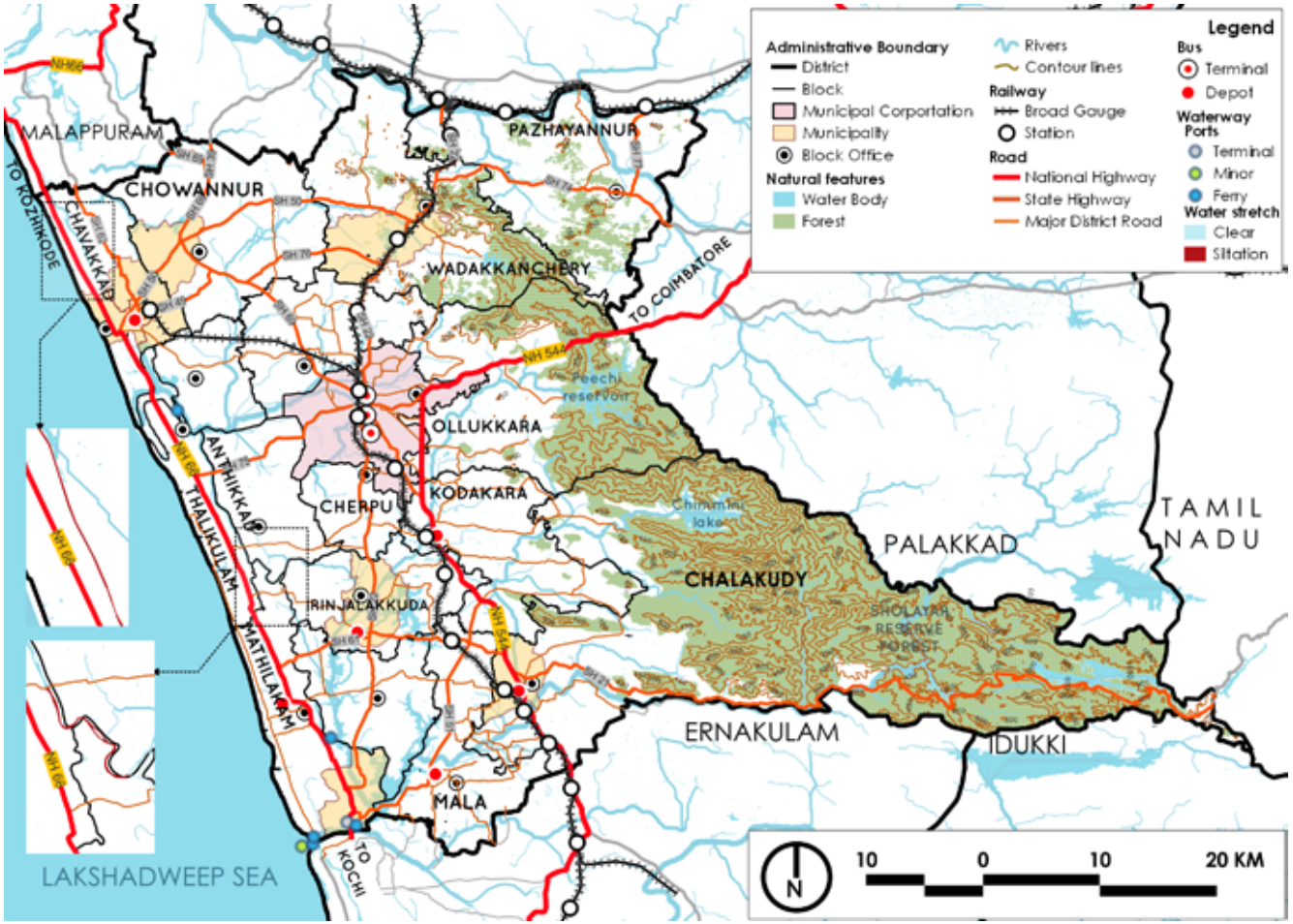
Credits: Sajal Chauhan

5. Transport & Connectivity

5.1 Introduction

Transportation plays a crucial role in the socio-economic development of any region ("Road Transport Year Book," 2019). The state of Kerala is known for its thriving economy, with a significant contribution from the service and tourism sectors. The state's transportation system is a critical enabler of this economic growth, facilitating the movement of people and goods across the state ("District Spatial Plan, thrissur," 2011). The district is well connected through an extensive network of roads and railways. Thrissur's road network serves as a significant link between the northern and southern parts of the state. The National Highways 544 and 66, which runs through the district, connects it to major cities like Kochi and Palakkad. Apart from these national highways, the district has a well-developed network of state highways and district roads, connecting different parts of the district, nearby towns and cities. The SHs and MDRs are connected in a radial pattern within the district merge at Thrissur M.Corp. The railway network is also well developed, with several important railway stations like Thrissur, Wadakkancherry, Chalakudy, and Guruvayur Junction, with total track length of 107 km and 13 working stations located within the district. In addition to these traditional modes of transportation, water transport is also an important means of the connectivity. The Waterway in thrissur consists of Periyar river, Kodungallor Backwater, Karuvannur river and man made Canolly Canal, which is collectively identified as the NW3 (68 km). This waterway is maintained by the Irrigation department, IWAI and the Kerala State Water Transport department (KSWT).

Figure 5.1 Transport Connectivity



Source: MIT GeoWeb ,PMGSY National GIS

Public transport in Thrissur district is an essential component of the region's transportation system, providing a convenient and affordable means of transportation for the local population. The district has a well-developed network of public transportation, including buses, taxis, and auto-rickshaws. The public bus transport system in Thrissur district is operated by the state-run Kerala State Road Transport Corporation (KSRTC) and private operators. The buses connect different parts of the district and nearby cities and towns, making it easy for people to commute. In addition to buses, taxis and auto-rickshaws are popular modes of public transport in district. They provide last mile connetivity to users. Overall, public transport plays a crucial role in the daily lives of the people of Thrissur, providing them with access to essential services and facilities. A

well-connected public transport system is also essential for promoting sustainable growth and development in the region.

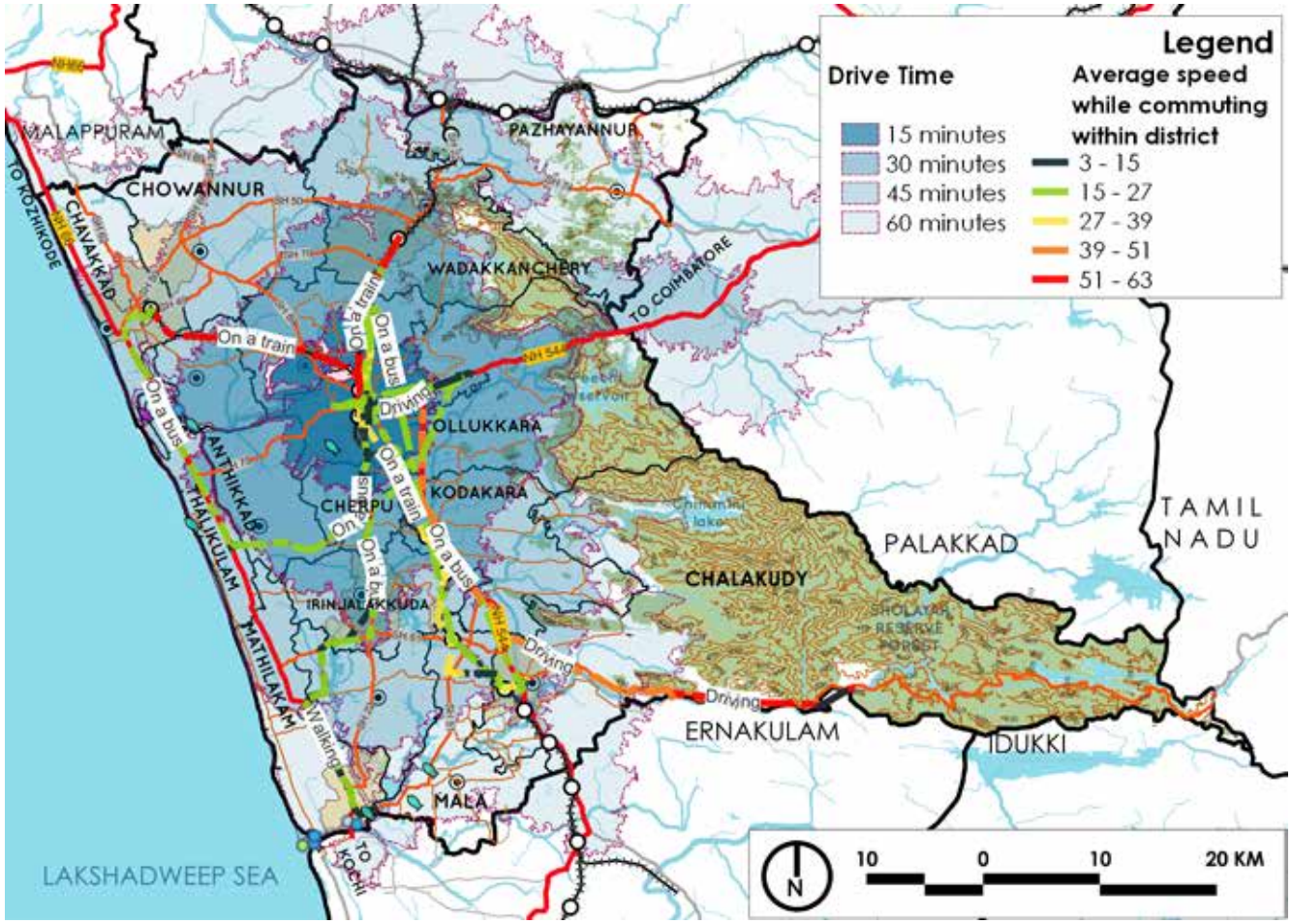
5.2 Connectivity

Understanding the efficiency of transportation relies on evaluating the level of connectivity within a region, the state of intra-region travel, and the diverse modes of commuting available. It is crucial to comprehend the connectivity within a district to accurately assess any gaps present in the existing infrastructure.

Through GIS based analysis of drive time was obtained; data obtained is based on personal vehicle in the non-peak hour of afternoon. It is been observed that the district can be covered to within 45 minutes from the Thrissur railway station which is in centre of the district. Only Chalakudy block in south-eastern part of the district can reached within 3 hours. While commuting the travel time was being tallied from mobile based navigation application and was found to be matching with the value taken from the analysis. Thus it demonstrates that the connectivity from Thrissur M. Corp. to other part of district is efficient from private vehicle and can be covered within a day.

During site visit, it was observed that time varies while travelling in different routes and modes of public transportation system. Travel time via train is shorter than bus in the same route, for example travelling from KILA, Mulagunnathukavu to Chalakudy station takes 55 minutes from train but from bus it takes more than 1 hour and 30 minutes. Although the roads

Figure 5.2 Drive time within district from Thrissur city



Source: Analysed in GIS Drive time, Data from Google location history

conditions are pretty well due to presence of urban rural continuum, the state highway and major district roads are going through different built environment and topography therefore there are variations and delay in speed. The data of commuting from Google navigation application has been taken on daily basis during the visit and presented in the figure__ ,it shows the different mode used to travel and speed taken; it is been overlapped on the drive time analysis.

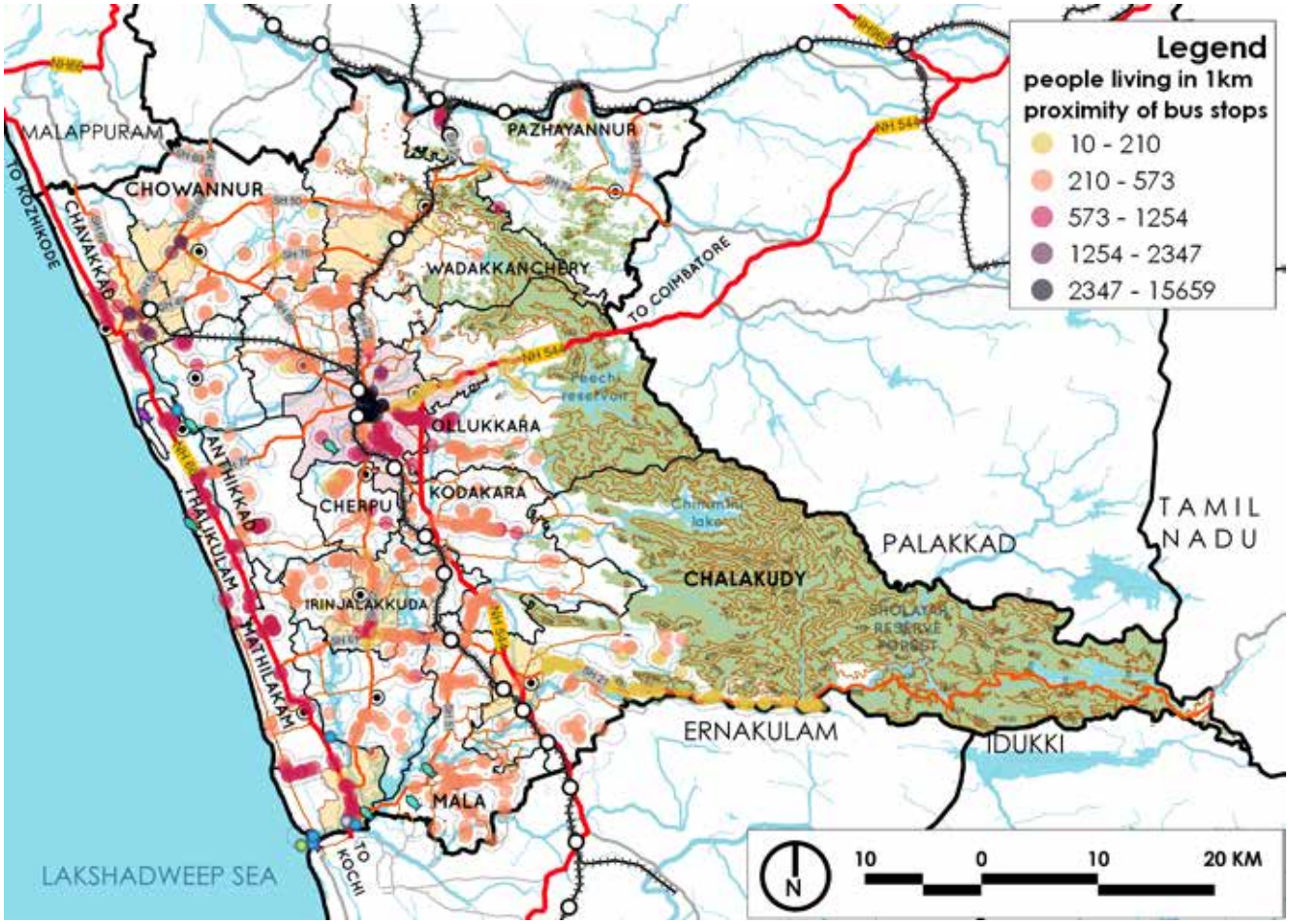
Presence of bus stops along the roads in frequency of 1km it can be interpreted that the travelling in bus is efficient but due to lack and irregular time schedule of buses there is issue of getting buses on particular time. It was observed that the 32 percent of the entire district is covered by 1km buffer of bus stops in the low and midland lying area. About 23 percent of people are residing in that proximity and thus a disparity can be observed in the figure 5.2.

Although the district has a complex public transportation system, it lacks end-to-end connectivity. This means that commuters are often required to switch between different modes of transportation, which can be costly and inefficient. In contrast, during off-peak hours, one can travel from the center of the district to its outermost edges within 45 minutes by using a van or private vehicle. Overall, it can be concluded that while public transportation may not always be the most convenient option, careful consideration of the different modes of transportation and travel times can result in a more efficient and cost-effective commute.

5.3 Road Network

Kerala has the highest road network density in India at 5.48 km/sq.km while in Thrissur it is 3.87 km/sq.km. Thrissur has four categories of roads, which include the National Highways, State Highways, Major District Roads, and Other District Road. The Other district roads consists of all village roads and urban roads. The total length of roads in the district is 14,602 km, with NHs covering 128.31 km, SHs covering 374.03 km, MDRs covering 1690.18 km, and ODRs, covering 14609.55 km. The NHs are developed and maintained by National Highway Authority of India (NHAI), while the development and maintenance of Other District Roads are implemented by the local self-governments. The Public Works Department (PWD) of Kerala manages the SHs and MDRs. Out of the total road network, 77 Percent of the roads come under Local Self Government, 22 Percent come under PWD, and 1Percent comes under NHAI.

Figure 5.3 People living within 1km proximity of Bus Stops



Source: Population as per Census 2011

Thrissur district's road network serves as a significant link between the northern and southern parts of the state, with roads connecting in a radial pattern that merges at the Swaraj round in Thrissur corporation. The district is traversed by two national highways, namely the NH66 and NH544. The NH66 spans a total length of 1608 km, originating from Panvel (Mumbai) to Cape Comorin (Kanyakumari) and entering the district at Moothokkunam before exiting at Palapetty. It passes through all the coastal regions, covering a length of 64 km in the district. On the other hand, NH544 (Salem, Tamil Nadu to Kochi) has a length of 340 km, entering the district from Karukutty and exiting at Vaniyampara, covering a distance of 60 km in the district. Additionally, there are 13 state highways, namely SH21, SH22, SH49, SH50, SH51, SH58, SH61, SH62, SH69, 7SH4, 75, 76, and SH77, that facilitate road connectivity within the district as shown in Figure 5.1.

The district comprises of sixteen blocks

which are efficiently linked through a network of NH, SH, and MDR. The block panchayat offices are located within 45 km from Thrissur Central Business District, making them easily accessible as shown in Figure 5.2. The inter-district connectivity is established via NH66 and NH544. The SH22 with a length of 70.5 km, runs from Kodungallur in the south to Shoranur in the north, passing through the Swaraj round road. The SH75 connects NH66 directly to Swaraj round and facilitates the transportation of goods from the coastal area to the central markets. The SH51 and SH61 link both national highways via Mala panchayat and meet NH544 at Kodakara. The Kochi international Airport and the Coimbatore international Airport are conveniently accessible via NH544, whereas Calicut international Airport can be reached via NH66. The SH21 provides connectivity between the hilly region of Challakudy block and NH544 as shown in Figure 5.1. The NHs in the district have a width of 12-45 meters, SHs have a width of 9-25 meters, MDRs have a width of 6-15 meters, and ODRs have a width of 5-12 meters, which are lower than the IRC standard. The district has other roads that fall under the ownership of different departments such as District Panchayats, Gram Panchayat, Forest Departments, Irrigation Departments, Electricity Boards, Water Authorities, Corporations, Municipalities, and Agricultural University, with varying lengths.

5.4 Vehicle Registration

In India, there were 2.39 million registered vehicles as of 2021, with annual growth of registered vehicles averaging 9.9 percent during the past ten years (2009-2019). The majority of vehicles on the road are cars and two-wheelers, which make up around 88Percent of all individualised means of transportation.

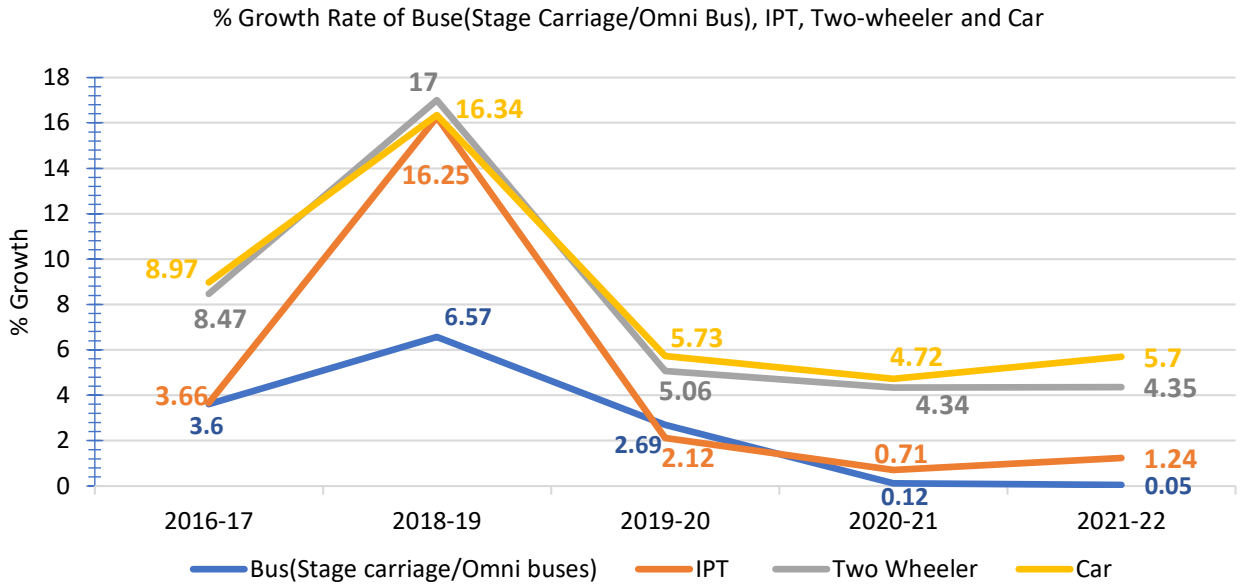
As of 2022, there are 1,572,478 registered vehicles in Thrissur district, and the average growth rate of registered vehicles is 6.83Percent. The number of registered motor vehicles per 1000 population has increased from 311 in 2016 to 462 in 2022, indicating an improvement in public accessibility to means of transport. Among the registered vehicles, two-

Table 5.1 Vehicular Registration Statics and Road Accident of Thrissur District

Year	Vehicular registra-tion	Car/1000 ppl	Two Wheel-er/1000ppl	NMT/ 1000ppl	Bus/1000 ppl	Accident	Fatality
2018	1248317	70	249	27	4	3443	304
2019	1374438	76	272	28	4	4464	320
2020	1444479	80	286	29	4	2869	222
2021	1504867	84	299	29	4	3524	349
2022	1572478	90	313	29	4	4748	395

Source: Thrissur Crime Branch Urban and Rural Police, Accident data (2018-2022)

Figure 5.4 Growth rate of vehicles from 2016 to 2022



Source: RTOs, Economic Review Kerala (2016-2022)

wheelers have the highest number with 313 per thousand population, comprising 68Percent of the total registered vehicles, while cars have 90 per thousand population, comprising 20Percent of the total registration as shown in table 5.1 and Figure 5.3.

The growth rate of both cars and two-wheelers has declined from 8.97 in 2016-17 to 4.72 for cars and 8.47 to 4.34 for two-wheelers until 2020-21. However, it started increasing from 4.72 to 5.7 for cars and 4.34 to 4.35 for two-wheelers in 2020-2021 as shown in Table 5.1 and Figure 5.3. The growth of cars is higher than that of two-wheelers this year, and it is expected to increase in the future due to the increasing demand for cars and the prosperity of the population. This growth in vehicles will likely cause traffic problems and contribute to road accidents in the future.

5.5 Bus Transport

Buses play an essential role in the public transportation system of any area facilitating the connectivity and travel for all residents. Thrissur district possesses a well-established public transport system, with the public bus network being the backbone of this system. The state-owned Kerala State Road Transport Corporation (KSRTC) and the Thrissur Private Bus Operators (TPBO) are the major bus organizations operating buses throughout the district.

The district's public bus system has been known for its reliability, frequency, affordability, and convenience. The buses used to run on a wider range of routes than the current schedules, connecting different parts of the district and

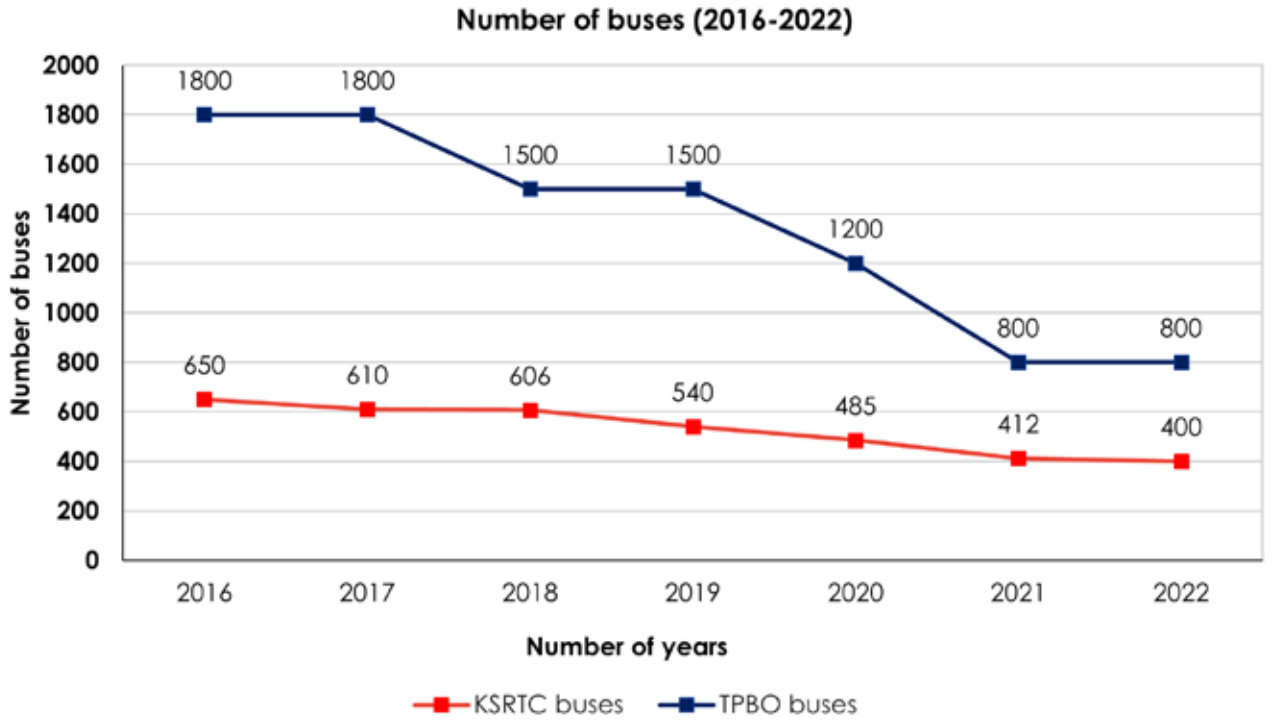
Figure 5.5 (a) KSRTC Bus Depot, (b) Sakhtan Thampuran bus depot Thrissur Municipal Corporation



(a) (b)

Pictures credits: Rajdeep Chanda

Figure 5.6 Growth rate of KSRTC and TPBO buses



Source: KSRTC Annual report 2021, TPBO Annual Report, 2022

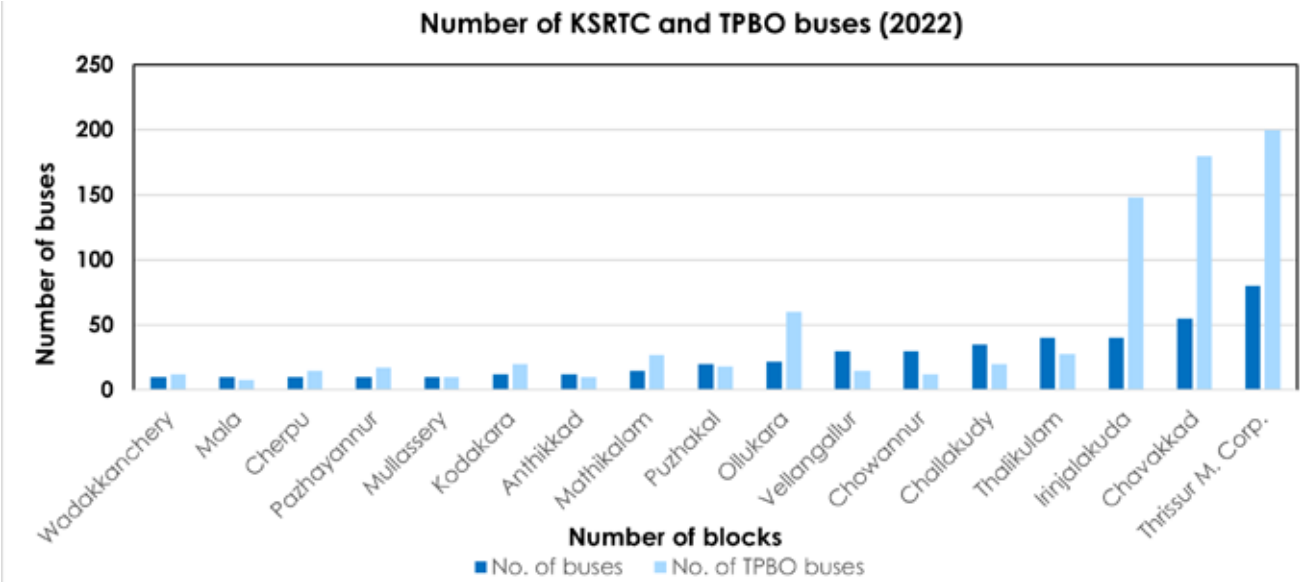
state. The buses were available round the clock with reduced services after dark and a higher frequency during peak hours. However, despite the many benefits of the public buses services in Thrissur, there are several challenges that are faced by the system, resulting in a drastic reduction of the bus fleet, passenger occupancy and a in the rise in the use of private vehicles in the district (KSRTC, 2021).

5.5.1 History of KSRTC and TBPO buses

The history of bus services in the district began with the establishment of the KSRTC. The Kerala State Road Transport Corporation (KSRTC) began whilst the development of the transportation industry in the state of Kerala was not advanced enough as it is currently. Since the district was then a part of the Travancore-Cochin state, the Travancore State Transport Department (TSTD) was constituted by the erstwhile Travancore Government with a view to reorganize the transport service. After the formation of the Thrissur district by merging 6 taluks, the enactment of Road Transports Corporation Act in 1950 by the government of Kerala formulated the KSRTC rules in 1965 and the department was converted into an autonomous corporation in the year 1965 (K.C, 2016).

At the time of transfer there were only a limited number of bus schedules running within the district - 261 bus schedules and 16 lorry schedules. The KSRTC within the district of Thrissur possessed a fleet of 501 buses 21 lorries and 9 other vehicles. The new working of the corporation started with 30 new buses and 8 new lorries while 10 old buses and 7 old lorries and one tractor trailer were converted for other uses.

Figure 5.7 Distribution of Public and Private buses in Thrissur District



Source: KSRTC Annual Report, 2021

The first private bus service in Thrissur was started in 1921 by a man named V.T. Bhattathiripad. The service was started with a single bus, operating between Thrissur and Chavakkad. From the year 1930 to 1940 the private bus services saw a exponential increase in bus fleet, and the industry began to grow rapidly. By the year 1945, Thrissur had become a hub for private bus services, with operators like Kallada Travels, Atlas Travels, Sharma Transport etc. dominating the market. The 1950s saw a major change in the private bus industry in Thrissur. Many operators started importing buses from foreign countries, mainly from Japan and Germany. These buses were much more comfortable and spacious than the previously used bus models, and they quickly became popular with passengers (TPBO, 2021).

In the year 1965, the private bus industry in Thrissur started to face a major challenge from the newly inaugurated state-owned autonomous corporation of KSRTC, which started providing bus services at lower fares. However, private bus operators in Thrissur were quick to respond and started introducing luxury buses with air conditioning, which became very popular with passengers.

5.5.2 Existing scenario

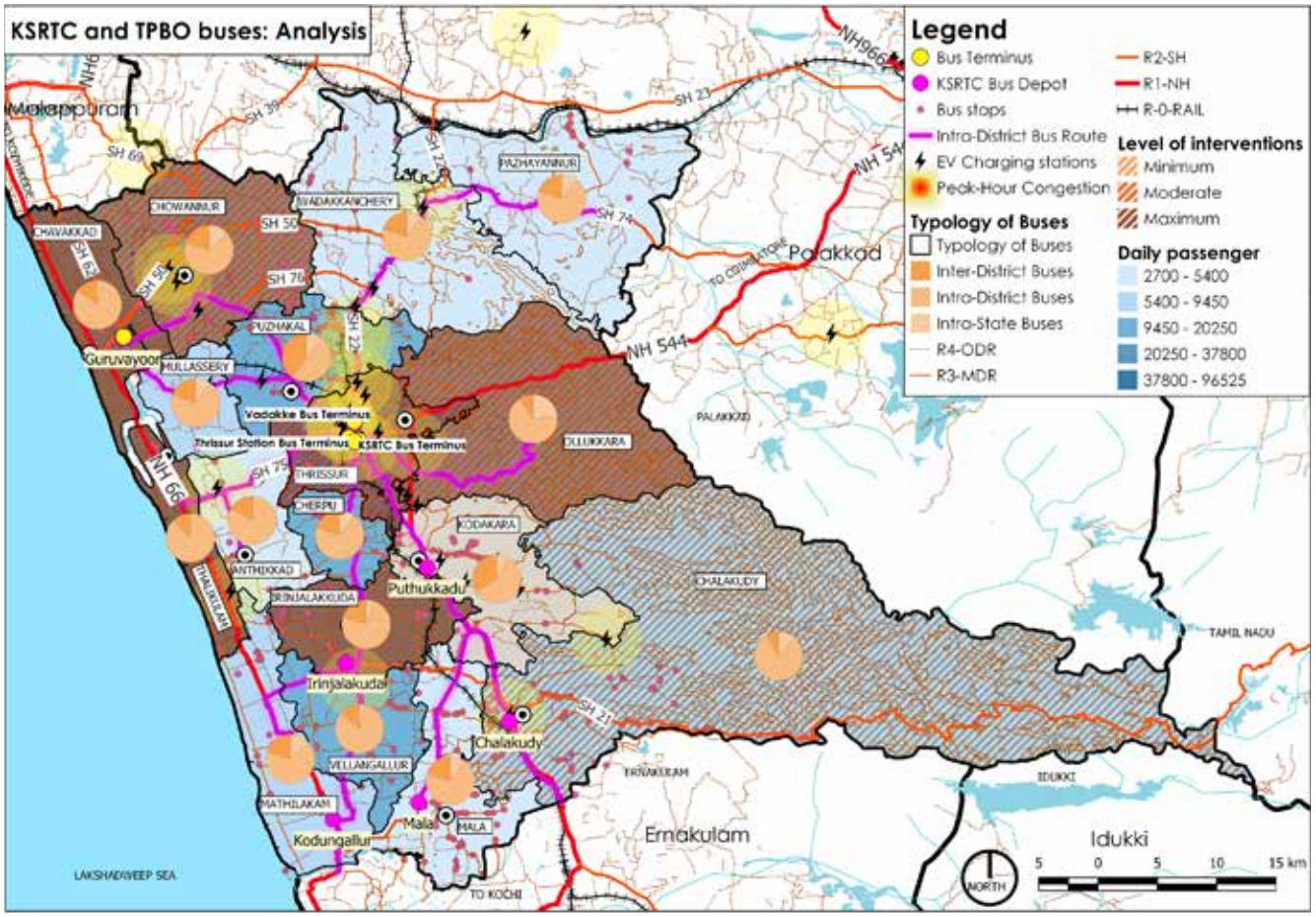
As previously mentioned, there are two major organizations operating buses across the district, namely the Kerala State Road Transport Corporation (KSRTC) and the Thrissur Private Bus Operators (TPBO). The KSRTC operates from it's headquarter in Thiruvanthapuram while the TBPO operates from its headquarters in Thrissur City (KSRTC, 2021).

The KSRTC bus is of great cultural significance, having appeared in over 3000 films and being the central theme of 2. The bus 'T16' is the oldest bus in the district which after being decommissioned was brought back on public demand. As mentioned before, as of the year 2023, KSRTC has 400 buses operating within the district with 268 bus schedules functioning over 12 operational bus routes. It connects the district to the rest of the state with maximum travel occurring to the districts of Palakkad, Ernakulam and Thiruvanthapuram. For inter-state travel there the maximum bus schedules connecting the district to major cities such as Bengaluru, Mangalore, Mysuru, Chennai, Salem, Pondicherry etc. (KSRTC, 2021).

There are 12 functional Intra-State bus routes carrying buses to the different parts of the district. Out of the 12 aforementioned bus routes, 7 bus routes travel exclusively within the Thrissur district, whereas the rest 5 bus routes travel to the different district across the state, travelling mainly to Palakkad, Ernakulam, Thiruvanthapuram, Kozhikode, Kollam, Kottapuram and Idukki. Most of the villages within the district do not have connectivity directly via bus sub-routes, instead passengers have to depend either on private vehicles, Intermediate Public Transport systems such as autorickshaws and shuttle taxis, or on modes of Non-Motorised transport such as cycles (KSRTC, 2021).

There are 7 bus depots having a total capacity of 250 and a total of 75 bus bays with Thrissur city having the maximum bus capacity of 100 and bus bays of 15 (KSRTC Annual Report 2021). The bus depots are present in the Thrissur M. Corp., Guruvayoor, Irinjalakuda, Mala, Challakudy, Kodungalloor and Puthukaddu. There are five major bus terminuses in the district namely the Vakadde Bus Station, KSRTC Bus Station and the Thrissur Station Terminus. Apart from that, there are three other bus stations located in Challakudy and Guruvayoor.

Figure 5.8 Existing Scenario of Buses, Thrissur district



Source: KSRTC Report 2021_TPBO Office reports_analysed by author)

The major bus depot for the TPBO private buses is in Thrissur city at the Shaktan Thampuran Bus Stand having a capacity of 200 buses. It operates 800 private buses within the district with 450 bus schedules covering intra-district, inter-district and inter-state with maximum buses travelling to Bengaluru, Hyderabad, Chennai and Tirupati. The different types of buses operated by the TPBO are the Super Fast buses, Limited Stop buses, Fast Passenger buses ,Ordinary buses, Mini buses, City buses, Town-to-Town buses, Express buses and Luxury buses (TPBO, 2021).

Currently there are 10 electric E-Buses

Table 5.2 Performance Efficiency of Bus System's blockwise

S.No.	Block	Projected Population of 2021	No. of buses	No of bus schedules	No of trips/day	Route length (Kms)	1. No of passengers/day= No. of buses*No. of rounds*100% occupancy	2. Total Effective kms (Route length*Number of trips*number of passengers)	3. Daily passengers/vehicle	4. Daily passengers/effective kms	5. Annual ridership (No. of daily passengers*30*12)	6. Annual ridership/Bus station	7. Annual ridership/Bus	8. No. of buses/trip	9. No. of buses/1000 population	10. Occupancy ratio (No. of passengers/seats)	Need of interventions
1	Kodakara	247238	12	20	20	45	6480	5832000	540	0.0011	2332800	388800	194400	0.6	0.05	240	
2	Wadakkanchery	198443	10	21	20	68	5400	7344000	540	0.0007	1944000	324000	194400	0.5	0.05	200	
3	Irinjalakuda	168410	40	15	40	76	43200	131328000	1080	0.0003	15552000	2592000	388800	1.0	0.24	1600	
4	Mala	178349	10	5	10	38	2700	1026000	270	0.0026	972000	162000	97200	1.0	0.06	100	
5	Mathikalam	306001	15	6	20	56	8100	9072000	540	0.0009	2916000	486000	194400	0.8	0.05	300	
6	Thalikulam	141937	40	14	60	85	64800	330480000	1620	0.0002	23328000	3888000	583200	0.7	0.28	2400	
7	Vellangallur	158157	30	21	25	73	20250	36956250	675	0.0005	7290000	1215000	243000	1.2	0.19	750	
8	Chowannur	374105	30	19	40	69	32400	89424000	1080	0.0004	11664000	1944000	388800	0.8	0.08	1200	
9	Thrissur M. Corp.	345304	80	35	70	223	151200	2360232000	1890	0.0001	54432000	9072000	680400	1.1	0.23	5600	
10	Cherpu	90670	10	8	40	67	10800	28944000	1080	0.0004	3888000	648000	388800	0.3	0.11	400	
11	Puzhakal	180735	20	15	25	68	13500	22950000	675	0.0006	4860000	810000	243000	0.8	0.11	500	
12	Chavakkad	257259	55	24	65	129	96525	809362125	1755	0.0001	34749000	5791500	631800	0.8	0.21	3575	
13	Pazhayannur	207534	10	5	10	49	2700	1323000	270	0.0020	972000	162000	97200	1.0	0.05	100	
14	Challakudy	231331	35	22	40	110	37800	166320000	1080	0.0002	13608000	2268000	388800	0.9	0.15	1400	
15	Ollukara	180129	22	17	40	75	23760	71280000	1080	0.0003	8553600	1425600	388800	0.6	0.12	880	
16	Anthikkad	171319	12	6	10	54	3240	1749600	270	0.0019	1166400	194400	97200	1.2	0.07	120	
17	Mullassery	100057	10	15	35	57	9450	18852750	945	0.0005	3402000	567000	340200	0.3	0.10	350	

Source: Column 4-7: KSRTC Annual Report 2021, column 8-18: Analysed by Author

operating within the district as opposed to the proposed 600 buses that the district aspires to have running by the year 2030. The Electric Bus Route 2 travels from Pathanamthitta to Kozhikode travelling through Thrissur city (Thrissur M. Corp. website).

5.5.3 Analysis

The number of KSRTC buses have reduced from 514 buses in the year 2016 to 400 (Refer Figure 5.5) buses in the year 2023 (KSRTC Annual Report 2021), this decline can be attributed to the rising prices of bus tickets, a reduction in the quality of service, an inflow of money raising aspirations of the public to own private vehicles etc.

It was found that the maximum number of KSRTC and TPBO buses travel within the Thrissur city at a number of 80 and 180 buses respectively while the least buses operate in the Mala block at 10 KSRTC buses and 7 TPBO buses in the Pazhyannur block as shown in Figure 5.6. It was found that there is a sharp decline in the growth rate of vehicular registration of buses in modal share from a rate of 3.6 in the year 2016-2017 to 0.05 in the year 2021-2022 (Annual Vehicular Registration Report, RTO Thrissur)

For the private buses there has been a reduction of bus fleet from 1500 buses in the year 2016 to 800 buses in the year 2023 as shown in Figure 5.5. It was found that the maximum number of private buses travel to the blocks of Irinjalakuda, Chavakkad, Ollukara and Challakudy and within the Thrissur M.Corp. area. For travel to the other districts, maximum buses travel to the districts of Thiruvanthapuram, Ernakulam and Palakkad.

There are 12 operational bus (KSRTC ,2021) routes travelling to every block during the day with maximum bus schedules in Thrissur city, Chavakkad, Challakudy, Vellangalloor, Wadakancherry, Thalikulam and Chowannur. At night the number of bus routes decreases to 8 operational routes, servicing the blocks of Thrissur city, Chavakkad, Challakudy, Vellangalloor, Wadakancherry, Thalikulam, Mullaserry and Chowannur. This can be attributed to the absence of a vibrant night life within the district leading to a drastic reduction of passenger volume hence forcing the closure of bus routes for night travel (KSRTC, 2021).

It was found that daily passengers travelling via buses within the district is approximately 5.4 lakhs passengers/day where passengers travelling outside the district stands at an approx. of 3.5 lakhs passengers/day. The maximum intra-district passengers travel in the Thrissur city at 1.5 lakh passengers/day, followed by the blocks of Chavakkad, Irinjalakuda, Thalikulam and Challakudy. The lowest passengers travel to the blocks of Pazhayannur, Mala and Anthikkad.

The state of Kerala aspires to have 100percent electric buses running on non-conventional sources of energy (District Development Perspective Plan, 2021) hence a total of 20 existing EV charging stations were identified. As per the Ministry of Housing

and Urban Affairs (MoHUA) guidelines for EV stations, a minimum of one EV charging station must exist within a grid of 3km*3km. Currently only Thrissur city has EV charging stations within a 3km buffer area around its bus depots and terminals showing that there is a need of providing more EV charging stations for the total electricfication of buses to occur by the year 2047.

Indicators of Efficiency of Bus Transport systems

1. Number of buses per 1000 population:

The minimum requirement of buses for sufficiency of passenger travel, there should be at least 1 bus provided for each 1000 to 1500 population. This is to ensure that there is sufficient buses available for the travel of daily passengers (MoHUA, 2013). The national average ration of India is 1.33, while it is 0.25 for the state of Kerala.

As mentioned;

No. of bus/1000 population= Bus Fleet/Total population × 1000

For the district population of 3536978 (2021) there are 1200 buses present. Hence, No. of bus/1000 population (2021)= 1200 / 3536978 × 1000= 0.33

Hence, it can be understood that although the No. of bus/1000 population of Thrissur district is higher than that of Kerala, it is still far below the national average.

2. Bus Depot

As mentioned earlier in section 4.4.1, there are 7 bus depots having a total parking space of 250 and a total of 75 bus bays with Thrissur city having the maximum bus capacity of 100 and bus bays of 15 (KSRTC, 2021). The bus depots are present in the Thrissur M.Corp. area, Guruvayoor, Irinjalakuda, Mala, Challakudy, Kodungalloor and Puthukaddu.

Bus Capacity formula= Total Number of Buses/ (Avg Capacity of each bus*Maximum Utilisation rate of each depot) (Kadiyali, 2017)

Maximum Utilisation rate= (Total Number of Buses/Total Number of parking spaces)*100

From the calculation, it was found that existing conditions (2023), Maximum Utilisation rate: 75 percent, Bus Depot number required: (1200/ (40×0.75)/3)=13

Hence, it was found that although there is a requirement of 13 bus depots, only 7 are currently present for servicing of buses.

3. Bus Terminus

As mentioned earlier in section 5.4.1, there are 3 major bus terminuses in the district namely the Vakadde Bus Station, KSRTC Bus Station and the Thrissur Station Terminus. Apart from that there are three other bus stations located in Challakudy and Guruvayoor.

Calculating the number of Bus Terminus (Kadiyali, 2017)

N = [(1 + P) × (L / C)]/100, where: N = Number of bus termini, P = Percentage of buses that terminate at each terminus, L = Total number of bus trips per day, C = Capacity of each bus

Assuming a capacity of 44 passengers per bus, assuming each bus making average trips of 10 trips/day and assuming percentage of buses that terminate at each terminus as 75 percent, number of terminus required for 1200 buses, using the formula

So, L = 1200 × 10 = 12000

Substituting this value into the equation, we get:

N = [(1 + 0.75) × (12000 / 44)]/100 = 4.77

From the equation it was found that an approximate number of 5 bus terminuses are required whereas there are 3 major bus terminus within the district as mentioned in Figure 5.7.

required whereas there are 3 major bus terminus within the district as mentioned in table 5.2.

An analysis of the performance efficiency of the bus system in the district was found based on certain indicators of performance efficiency (Jain, 2016) such as: No of passengers/day, Total Effective kms, Daily passengers/vehicle, Daily passengers/effective kms, Annual ridership/ Bus station, Annual ridership/Bus, No. of buses/ trip, No. of buses/1000 population, Occupancy ratio (No. of passengers/seats). The blocks were divided on the basis on need of interventions ranging from minimum, moderate to maximum. From the analysis it was identified that the blocks requiring most interventions were the Thrissur city, Challakudy, Chavakkad, Puzhakal, Irinjalakuda, Chowannur and Mala require maximum interventions as mentioned in Figure 5.7. From the analysis several problems were identified such as inadequate infrastructure for bus depots, insufficient bus fleet, lack of sufficient bus routes and sub-routes connecting all the sixteen blocks within the district, lack of sustainable bus transport for Net Zero Carbon emissions and 100 percent Carbon Neutrality, inadequate infrastructure for bus terminus

service the population, lack of inclusivity in bus fleets where there is a lack of low fleet buses and buses equipped with disable friendly mechanisms, lack of women and child friendly buses.

5.6 Intermediate Public Transport(IPT)

IPTs in Thrissur provide flexibility to passengers by serving the mobility needs of the lower and middle classes while allowing them the convenience of boarding and alighting anywhere along the trip. They play a significant role in providing affordable and accessible transportation services to the residents of Thrissur, especially in rural areas.

IPTs can be classified into two types in the district - Contract Carriages and Informal Public Transport. Contract Carriages are demand-based services that offer flexibility in terms of origin, destination, and routes. Auto-rickshaws are a common example of contract carriages in Thrissur. Informal Public Transport refers to shared fixed route services with multiple stops in between the origin and destination, including stage carriers.

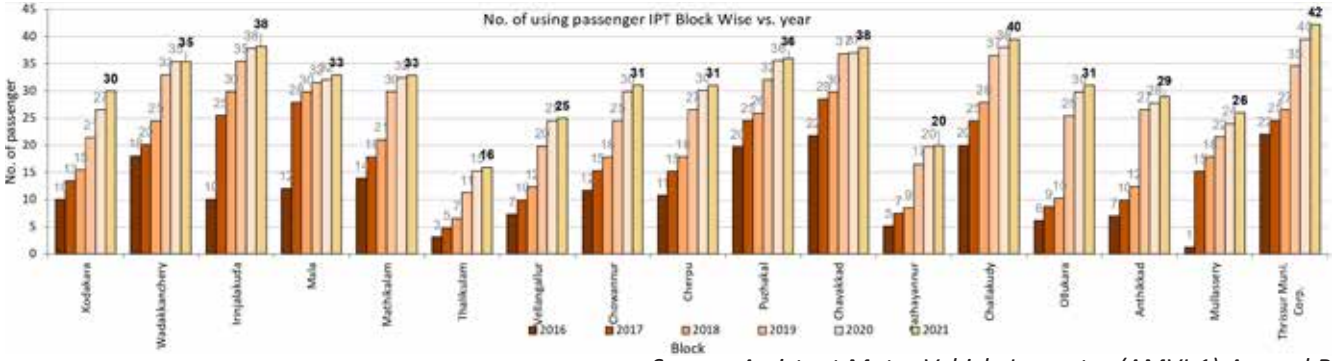
The IPT sector requires proper attention and support from the authorities to bridge the gaps in the public transport system of Thrissur. It is essential to regulate and monitor these services to ensure passenger safety and avoid illegal operations.

Growth Trends and Statistics of IPT Usage in Thrissur

In Thrissur, city buses and IPTs are extensively used by commuters. Buses carry 18 percent of total trips in the district, with road access to city bus services at 32 percent of the road network. IPTs carry 9 percent of the total trips, with road access to IPTs being only 15 percent. All the road links with access to IPT also have access to city buses, which creates a state of competition between the services. A comparison of the number of IPTs to the number of passengers in various blocks of the district shows that the IPT system is more used in the blocks of Chavakkad, Irinjalakuda, and Challakudy, while the blocks of Kodakara, Chowannur, Ollukara, and Mathikalam have systems.

However, despite the importance and benefits of the IPT sector, it remains largely neglected in the district. Due to the high demand for their services combined with restrictions in the number of permits granted

Figure 5.9 IPT Usage Patterns in Thrissur District Blocks Over Time



Source: Assistant Motor Vehicle Inspector (AMVI-1)-Aromal.R

Table 5.3 Understanding the Role of IPTs in the Transportation Mix of Thrissur District Blocks

Understanding the Role of IPTs in the Transportation Mix of Thrissur District Blocks						
S.No.	Block	Projected Population of 2021	No. of IPT stand	No. of IPT useses 2021	Mode of transport share= = (No. of passengers using a specific mode of transport / Total No.of passengers) x 100%	Travel demand= Population x Trip rate x Modal Share
1	**Kodakara**	247238	11	3000000	8.2	4075114
2	**Wadakkanchery**	198443	2	3542000	5.6	2223579
3	**Irinjalakuda**	168410	13	3821000	4.4	1484526
4	**Mala**	178349	13	3294500	5.4	1930992
5	**Mathikalam**	306001	14	3287900	9.3	5695839
6	**Thalikulam**	141937	3	1600000	8.9	2518278
7	**Vellangallur**	158157	9	2500000	6.3	2001101
8	**Chowannur**	374105	13	3102500	12.1	9022063
9	**Cherpu**	90670	11	3100000	2.9	530390
10	**Puzhakal**	180735	11	3600000	5.0	1814720
11	**Chavakkad**	257259	11	3795800	6.8	3487121
12	**Pazhayannur**	207534	5	2000700	10.4	4305530
13	**Challakudy**	231331	11	3954200	5.9	2706694
14	**Ollukara**	180129	5	3102500	5.8	2091637
15	**Anthikkad**	171319	6	2901200	5.9	2023307
16	**Mullassery**	100057	2	2600000	3.8	770106
17	**Thrissur Muni. Corp.**	337887	48	4201500	8.0	5434613
Total				49,202,300	106.7	46680997

Source: Transportation Engineering: An Introduction by C. Jotin Khisty and B. Kent Lall, 2021

by the authorities, many IPT vehicles in Thrissur have resorted to illegal operations to meet their expenses. The lack of proper attention and support from the authorities has hindered the growth and development of the IPT sector in the district.

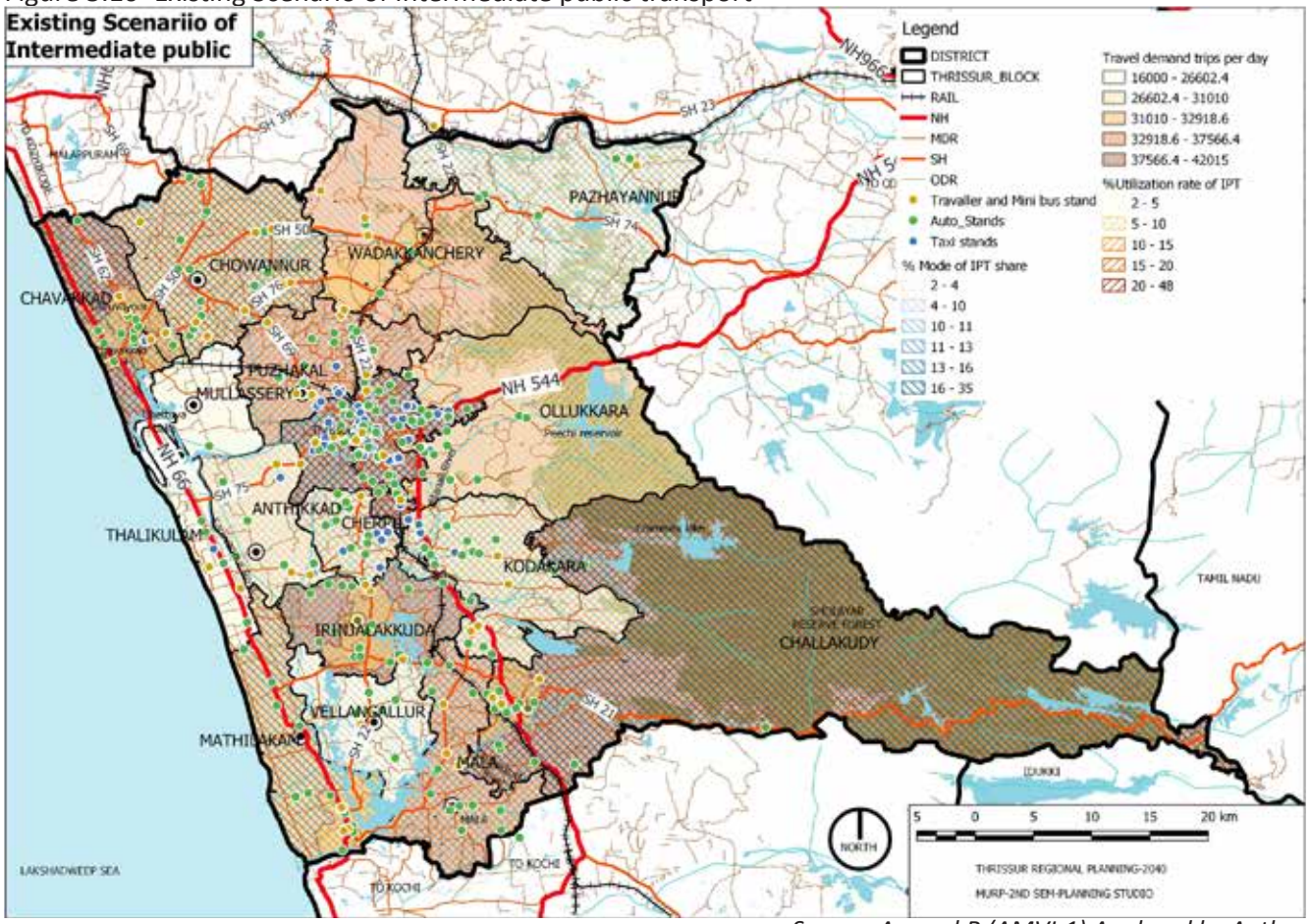
To bridge the gaps in the public transport system and contribute to the economic growth of the district, the IPT sector in Thrissur needs proper attention and support from the authorities. The authorities can consider increasing the number of permits granted to IPT operators, providing training and skill development programs for the operators, and implementing regulations and guidelines to ensure the safety and reliability of IPT services.

In addition, the authorities can explore the possibility of integrating IPTs with mass transit systems, such as buses and railways, to provide seamless and efficient transportation services to passengers. The integration can be achieved through the use of smart cards, common ticketing systems, and information technology-based solutions such as GPS tracking and real-time information dissemination.

Furthermore, the authorities can promote the use of eco-friendly IPT modes such as e-rickshaws and cycle rickshaws to reduce air pollution and promote sustainable transportation.

This indicates that the district is heavily dependent on IPTs for commuting, which proves the inadequacy of the city bus systems. This could be attributed to the fact that IPT vehicles are individually owned and operated and much more demand responsive than city bus systems.

Figure 5.10 Existing Scenario of Intermediate public transport



Source: Aromal.R (AMVI-1) Analysed by Author

Compared to the National Average for IPT/1000 population of 12.6, Kerala has a value of 3.6, while Thrissur district has 1.8. While the percentage of growth rate of passengers using the IPT system in 2016-17 was 31.83 percent, 2018-19 it was 27.88 percent and in 2021-22 is 4.5 percent.

Mode of transport share of IPT in different blocks

The mode of transport share of intermedia public transport is a key metric used to determine the usage of public transportation in a given region. It is calculated by dividing the number of passengers using a specific mode of transport by the total number of passengers and multiplying it by 100Percent. This metric is used to determine the popularity of various modes of transportation in a given region and can help local authorities make informed decisions about public transportation services.

The mode of transport share of Intermediate public transport data for the Thrissur district in Kerala, India, provides a

detailed insight into the usage of public transport in different blocks of the district. The data reveals that the highest percentage of passengers who use public transport is in Thrissur M.Corp., with 11.13 percent, followed by Cherpu, with 10.90 percent, and Mathikalam, with 8.83 percent. On the other hand, the lowest percentages of public transport usage are in Puzhakal, with 3.24 percent, and Chavakkad, with 4.93 percent.

Looking at the data, we can see that Kodakara has a mode of transport share of 7.79 percent, while Wadakkanchery has a mode of transport share of 6.09 percent, and Irinjalakuda has a mode of transport share of 4.47 percent. The percentage of public transport usage in Mala is 5.48 percent, and Vellangallur and Chowannur both have a mode of transport share of 5.82 percent. The mode of transport share for Thalikulam is 8.89 percent, Ollukara is 6.37 percent, Anthikkad is 6.30 percent, and Mullassery is 6.30 percent.

From the data above, we can see that the Thrissur M.Corp. has the highest mode of transport share of intermedia public transport at 11.13 percent, followed by Cherpu at 10.90 percent. Mathikalam and Thalikulam also have relatively high percentages at 8.83 percent and 8.89 percent, respectively. On the other hand, Puzhakal has the lowest mode of transport share at 3.24 percent, followed by Chavakkad at 4.93 percent.

The data above can be used to make informed decisions about public transportation services in the Thrissur district. For example, the local authorities could focus on improving public transportation services in areas with low mode of transport shares, such as Puzhakal and Chavakkad. They could also consider expanding services in areas with high mode of transport shares, such as Thrissur M.Corp., Cherpu, Mathikalam, and Thalikulam.

Overall, the mode of transport share of Intermediate public transport is a useful metric for understanding public transportation usage in a given region. The data above for different blocks in the district can help local authorities make informed decisions about public transportation services and improve transportation infrastructure for the benefit of the public.

Analysis of Travel Demand in Thrissur District

Travel demand in a particular area is a function of three key factors: population, trip rate, and modal share. In the case of block-wise district, the travel demand can be calculated using the population, trip rate, and modal share data for each block. Looking in each block's travel demand was found and compare them to gain insights into their travel patterns.

Kodakara has a travel demand of 3.6 lakhs, which is the lowest among all the blocks in Thrissur district. The block has a relatively small population, a low trip rate, and a low modal share. Wadakkanchery, on the other hand, has the highest travel demand among all the blocks, with a value of 26.3 lakhs. The block has a high population, a moderate trip rate, and a relatively high modal share, which contributes to its high travel demand.

Irinjalakuda has a travel demand of 15.3 lakhs, making it the third-highest block in terms of travel demand. Mala and Mathikalam have travel demands of 19.8lakhs and 51.3 lakhs, respectively, making them the fourth and fifth highest blocks in terms of travel demand. Thalikulam has a travel demand of 25.2 lakhs, while Vellangallur has a travel demand of 1,6.9lakhs. Both these blocks have a moderate to high travel demand, which can be attributed to their moderate population, trip rate, and modal share.

Chowannur has the highest travel demand among all the blocks, with a value of 79.2 lakhs. This can be attributed to its high population, a relatively high trip rate, and a high modal share. Thrissur M.Corp. has the second-highest travel demand among all the blocks, with a value of 73.6 lakhs. Cherpu has the lowest travel demand among all the blocks, with a value of 75.6lakhs. This can be attributed to its small population, low trip rate, and low modal share.

Puzhakal has a travel demand of 17.16 lakhs, while Chavakkad and Ollukara have travel demands of 52.6 lakhs and 22.04 lakhs, respectively. These blocks have a moderate to high travel demand, which can be attributed to their moderate population, trip rate, and modal share. Anthikkad and Mullassery have travel demands of 15.05 lakhs and 23.55 lakhs, respectively.

In summary, the travel demand in block-wise Thrissur district varies significantly, with Chowannur and Thrissur M.Corp. having the highest travel demand and Kodakara and Cherpu having the lowest travel demand. The travel demand in each block is affected by population, trip rate, and modal share. The blocks with high

population, moderate to high trip rate, and high modal share have a higher travel demand compared to blocks with a low population, low trip rate, and low modal share. By understanding the factors affecting travel demand in each block, as urban planners can develop appropriate strategies to improve mobility and access to transportation for residents in the district.

Challenges faced by Intermediate Public Transport (IPT) of Thrissur District, Kerala

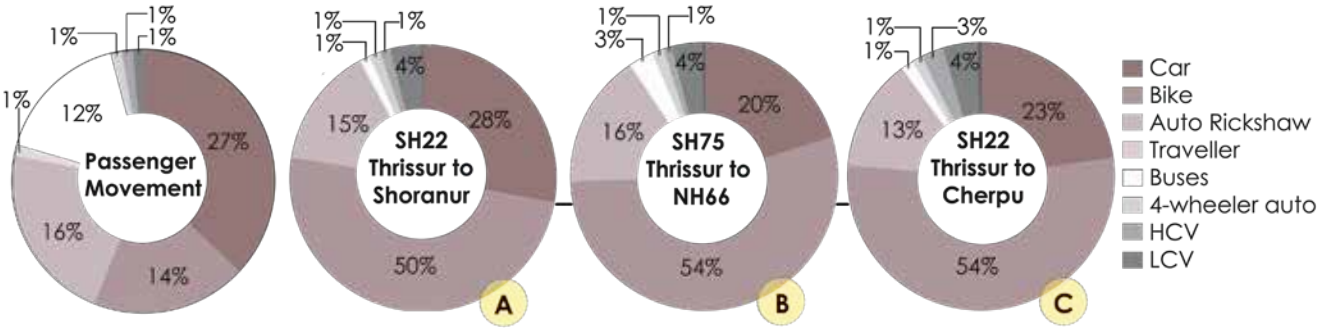
One of the significant challenges faced by the IPT services in Thrissur is the lack of proper regulation and monitoring. This is particularly true for informal public transport, which operates without proper oversight, leading to safety concerns for passengers. The authorities need to develop regulatory mechanisms and enforce them to ensure passenger safety.

The existing infrastructure for IPTs in Thrissur is inadequate, leading to issues like traffic congestion and inadequate parking space. The infrastructure needs to be improved to ensure the smooth functioning of IPT services. This includes the development of dedicated lanes and parking facilities for IPTs to reduce congestion on the roads.

While IPTs are an essential component of the public transport system in Thrissur, they lack integration with mass transit systems like buses, metros, railways, and ferries. This lack of integration leads to a disjointed transport system, causing inconvenience to passengers. Integrating IPTs with mass transit systems will provide seamless connectivity to passengers and make the transport system more efficient.

Another significant issue faced by IPT services in Thrissur is the inadequate training of drivers. Most IPT drivers lack adequate training in road safety and customer service, leading to issues like overcharging and reckless driving. Proper training and certification of drivers can improve the quality of IPT services and provide a better experience for passengers.

Figure 5.11 Traffic Volume Count



Source: Primary Survey

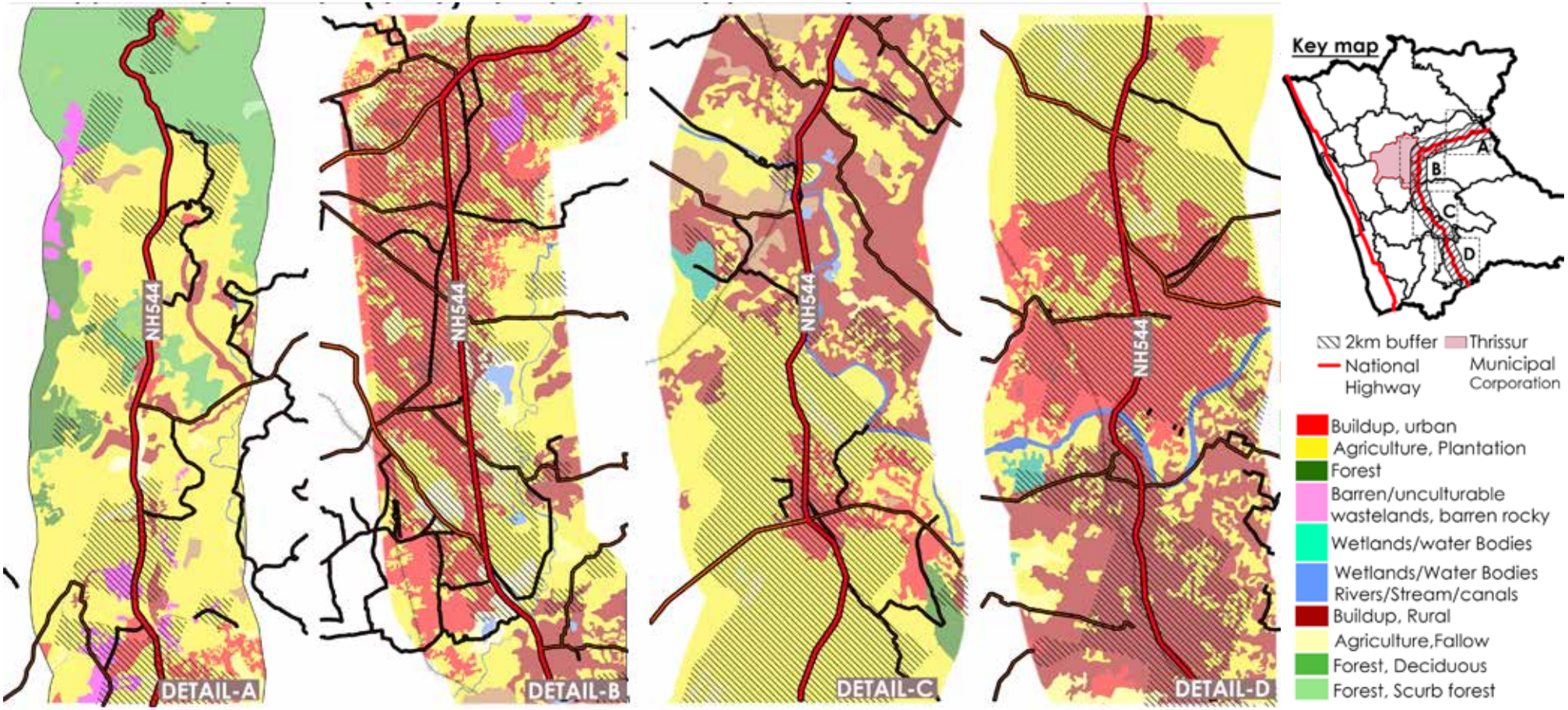
5.7 Traffic volume count

Thrissur district modal share in various modes of travel on SH22 Thrissur to Shoranur, SH22 Thrissur to Cherpu, and SH75 Thrissur to NH66. The traffic volume count survey including of all types of vehicles cars, bikes, buses, autorickshaw, HCV, LCV, and other modes of transport. The city experiences a higher number of trips on bikes and cars, which can be observed from the modal share provided during the morning peak hour 10:30 am to 11:30 am data was collected from SH22 and SH75 on the number of vehicles passing through. as shown in Figure 5.10 It is understood that the passenger movement in car is the most preferred mode of travel at 27Percent, whereas 14Percent of people prefer to bike. As much as 16Percent of the people travel taking autorickshaws, 1Percent move by the traveller, Buses are preferred by 12Percent of people, while the other modes of transportation such as traveller, 4-wheeler autos, LCV, and HCV are used by only a small percentage of people (1 Percent each). We found that SH22 is more congested than SH75 there is high traffic movement observed and more people move by car and bike. It tells that people more people travel by private vehicles they like private vehicles. We have also observed that due to the pooram festival, there are traffic problems faced in some parts of the city which leads to inconveniences for commuters.

5.8 National industrial Corridor

The industrial corridor project connect Kochi and Coimbatore through NH544 is expected to bring significant benefits to Thrissur district in Kerala. NH544 is a major highway that passes through Thrissur and connects Kochi and Coimbatore as shown in Figure 5.11. Thrissur is located between Kochi and Coimbatore and length of the corridor from Kochi to Coimbatore is 189 km. The industrial corridor project is expected to improve the connectivity between Thrissur and other major industrial hubs in South India.

Figure 5.12 Detail of NH544 Stretch



The project will involve widening and upgrading NH544 to facilitate smoother movement of goods and passengers. This could lead to improved transportation and logistics, making it easier for businesses in Thrissur to transport their goods to other parts of the country. The corridor will pass through several industrial clusters, including the Kochi-Kozhikode knowledge-based industries cluster. This is expected to attract investment in new industries and create job opportunities in Thrissur district. The project is expected to lead to the development of new infrastructure such as industrial parks, logistics hubs, and power transmission lines. It create opportunities for local businesses and entrepreneurs to set up new ventures and expand their existing businesses. Corridor can attract more investment to the district, particularly in industries that are well-suited to the region's strengths and resources. This can lead to the development of new industries and the expansion of existing ones, creating a more diverse economy.

5.9 Railways

5.9.1 Introduction

The district is well-connected to major cities and neighboring states through railways. It falls under the Southern railway zone in the Thiruvananthapuram division. The district has multiple lines connecting it to Vadodara in Western railway, South-Western, Konkan and Lokmanya Tilak terminus-Mumbai in Central railway, South Central railway, and Eastern railway. Additionally, it is well-connected to

Thiruvananthapuram and Kanyakumari. The district has 13 stations, with six blocks having railway stations while the rest are connected to it within 20 km via roadways.

The railway network in the district comprises two lines - a 107 km double broad gauge line from Shornur Jn to Cochin harbor, which is parallel to NH 544 and other is 23 km single broad gauge line spur to Guruvayur. The district has a total of 170 trains halting in it. To ease the journey for daily commuters traveling intra and inter-district, there are only 4 MEMU-suburban trains running between Palakkad and Ernakulum stations. The annual earnings is approximately 107 crore rupees.

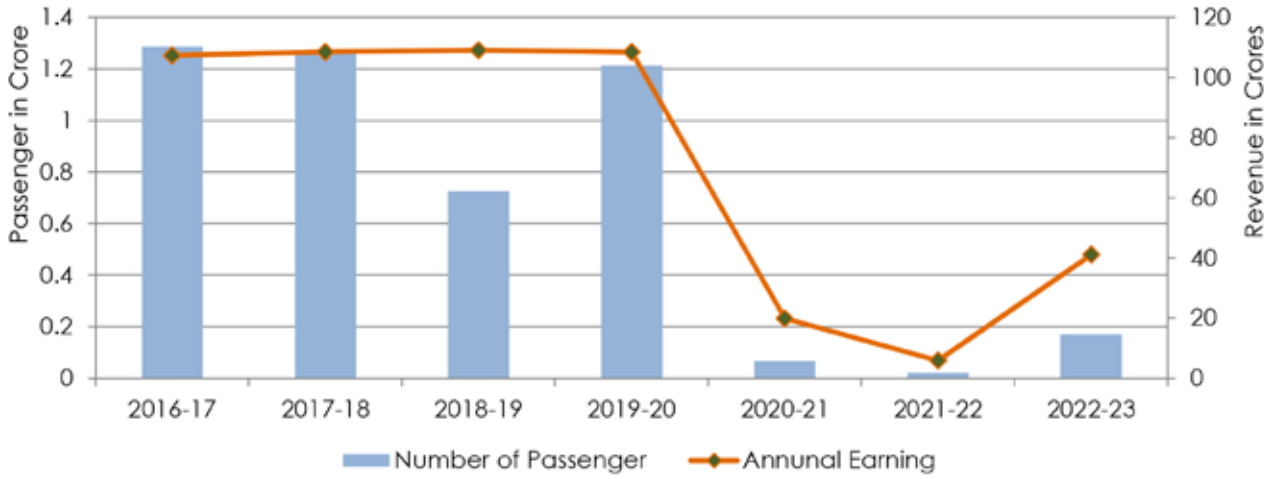
Passenger Footfall

The district has the 3rd most passenger footfall in the Thiruvananthapuram railway division after Thiruvananthapuram and Ernakulum, which are about 18759. Thrissur station has the highest passenger footfall of 49.7Percent, while Chalakudy, Guruvayur, and Iranjalakuda combined have 32Percent as shown in Figure 5.12- b. It is observed that the district has seen 6.6 times growth in passenger footfall than the previous year (2 times in division). However, it declined in 2018-19, which can be attributed to the flood that occurred in 2018 in the state. The revenue earned never decreased and was seeing growth till 2020, but the numbers decreased due to the pandemic as shown in Figure 5.12- a However, some numbers were still being recorded due to the special trains that were running during the pandemic.

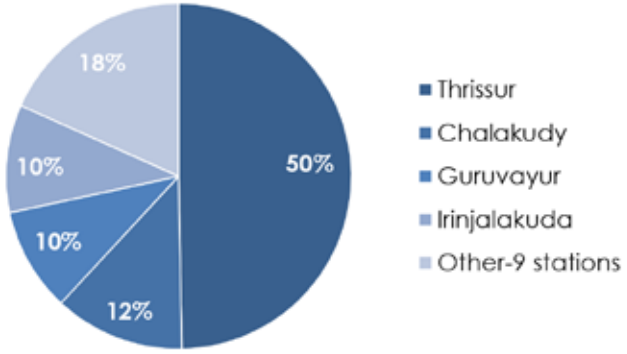
Freight Operation

In freight operation, the district has

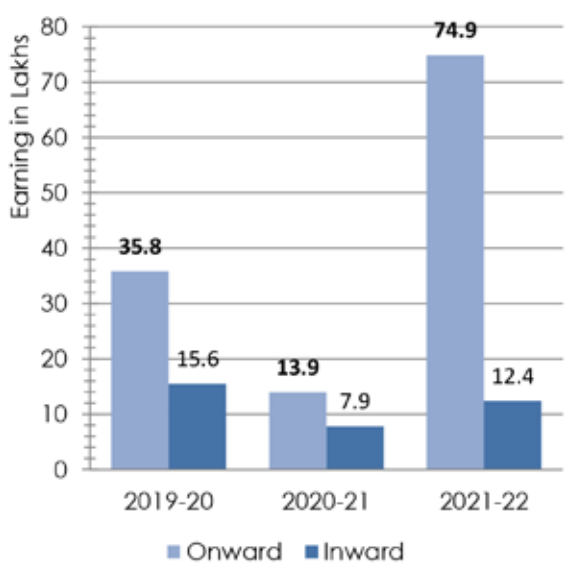
Figure 5.13 Annual Railway Statistics



(a) Annual footfall and earning



(b) Stationwise Footfall share



(c) Annual Freight revenue

Source: Station booking counter & Thiruvanthpuram annual report 2016-2022

57Percent and 437Percent growth in inward and onward, respectively, with 27Percent growth in the Thiruvananthapuram railway division as shown in Figure 5.11-c . The products being exported are Cement, fertilizer, kerosene oil, track Ballast stone, grain. Wheat imported is being imported from Punjab and Haryana and is mainly supplied to private companies like ITC-Aashirwaad and Elite foods. The food grains are also being supplied to Food Corporation of India and then supplied to the Public Distribution System (PDS).

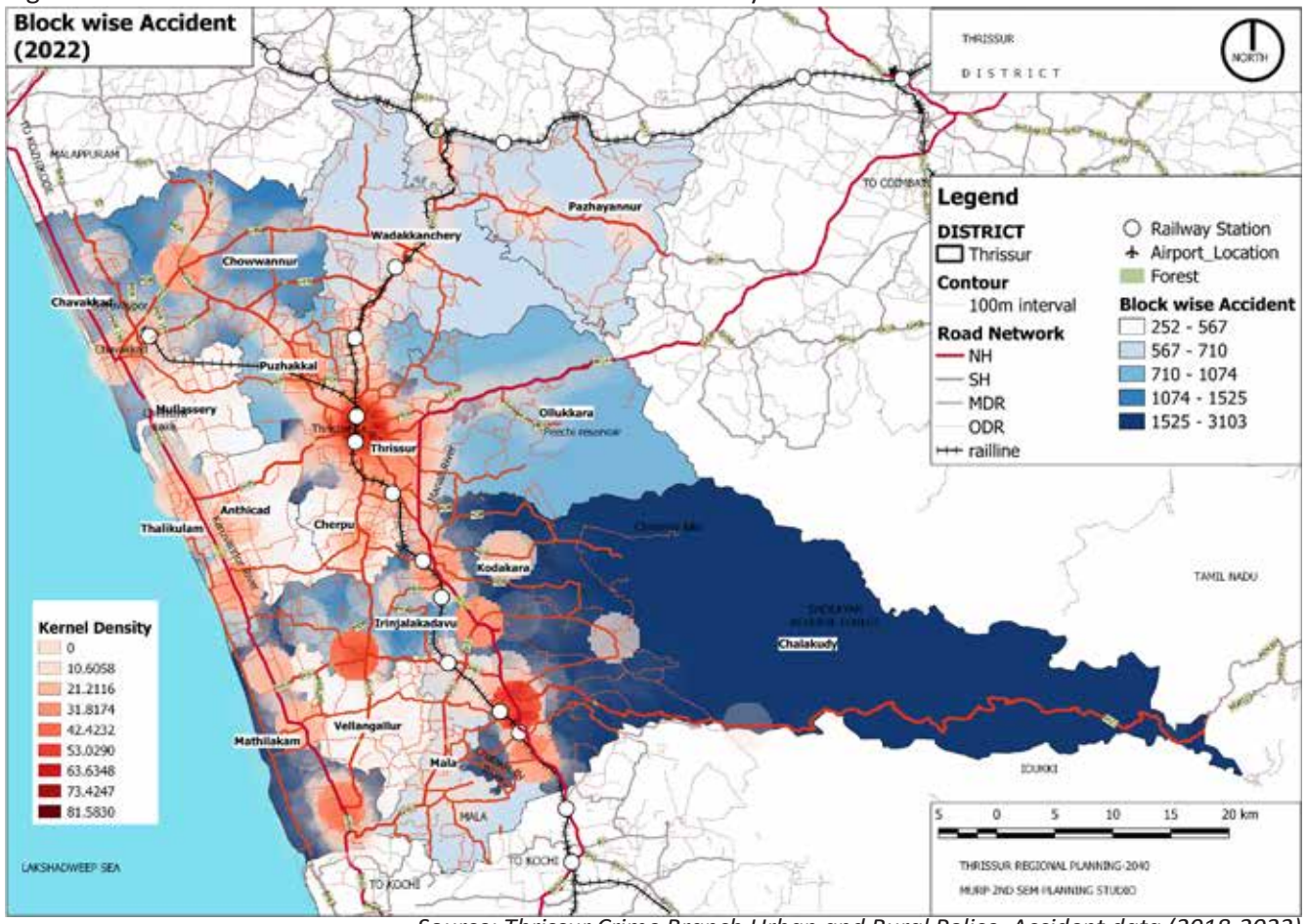
Inference

The increasing footfall in the district indicates that there is room for improvement and potential for attracting more visitors. Although the monsoon season poses challenges for train operations, resolving this issue could pave the way for exploring climate-resilient infrastructure. The Shoranur to Cochin harbor railway line has a maximum speed limit of only 80km/hr, which is lower than other sections of the Southern Railway where the speed limit is 110km/hr. This is due to the curved and undulating terrain of the district. However, the upcoming introduction of tilting train technology, which can run faster on curved tracks than conventional trains, has the potential to enhance and improve transportation within and to the district. Inconsistent train schedules make it difficult for commuters to travel during peak hours, forcing them to rely on buses, which are more time-consuming and expensive. Hence, it is necessary to ensure seamless connectivity for all modes of transportation in the district.

5.10 Road Safety

Road safety is always a major development issue, a public health concern and a leading cause of death and injury across the world. In Indian cities, the traffic is highly heterogeneous in nature, promotes large accident rates. Traffic accidents have severe financial and social implications. The Indian economy suffer significant loss as a result of property damage, missed productivity, medical costs, and elevated auto insurance prices. During 2021, a total number of 4,12,432 road accidents have been reported in the country, claiming 1,53,972 lives and causing injuries to 3,84,448 persons.

Figure 5.14 Blockwise accident distribution and Kernel Density Heatma



Source: Thrissur Crime Branch Urban and Rural Police, Accident data (2018-2022)

According to Kerala Police Department, total number of accidents occured in Kerala in 2022 till January 2023 is 4504 and total death that occurred is 385 and 5334 injuries. 85.45Percent of accident are due to the fault of driver. Contribution of car and two wheeler vehicle in accident are 30.06 Percent and 40.92 Percent respectively. Average growth of accident in last five years is increasing by 12.87 Percent and as well as fatality rate is increasing with 11.26 Percent.

Over the course of the last five years (2028-2022), the Thrissur Police Department has recorded a total of 19,048 road accidents, resulting in 1,590 fatalities and 13,042 severe injuries as shown in table 5.1. On average, there were 10 accidents per day, and 1 person died per day in Thrissur due to road accidents. The average fatality per 100 accidents is 8. However, when compared with state and national levels, the number is relatively low, with the national average being 1,130 accidents and 422 fatalities

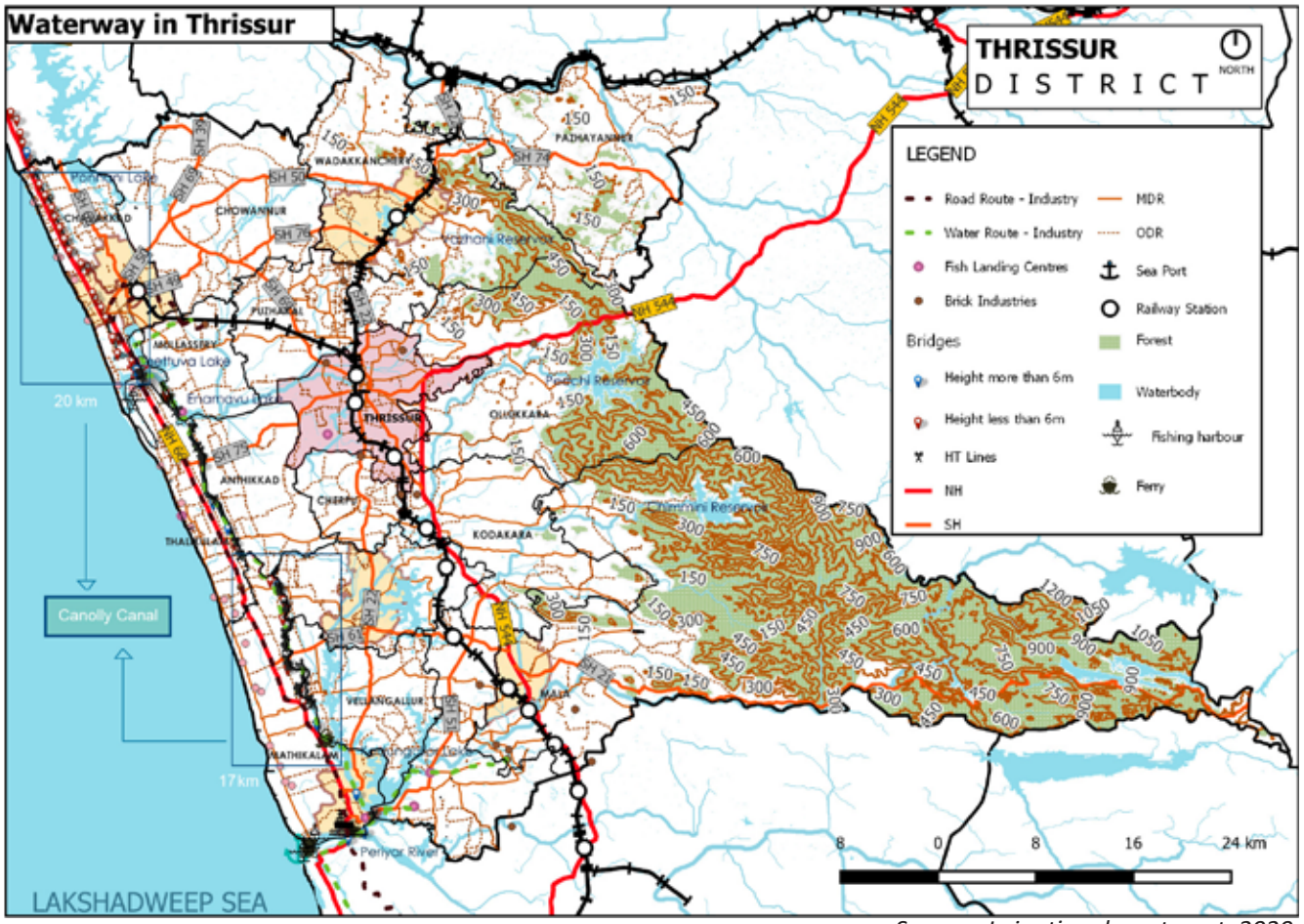
per day, and the Kerala state average being 105 accidents and 11 fatalities per day. When analyzed block-wise, the Thrissur M.Corp. had the highest number of reported accidents in the last five years, followed by the Chalakkudy and Mathilakam blocks as shown in Figure 5.13. However, the maximum fatality rates were recorded in the Ollukara block, followed by Kodakara. In both these blocks, the maximum number of accidents were reported on NH544.

Cause of accidents

The sudden decrease of road capacity from four lane to two lane road and the diversion tendency of drivers into the minor roads makes more accident vulnerable. The invading nature of two wheelers and three-wheelers in the congested road promotes a lot of accidents. As well as rushing speed and competition among the private buses and also KSRTC in these routes makes high accident rates. The presence of frequent summit and valley curve makes the scene more dangerous. Moreover, the rash and negligent driving are the main reasons behind the accidents.

Pedestrians and individuals on two-wheelers are particularly vulnerable to road accidents, with factors such as fast and reckless driving, mobile phone usage, and failure to wear helmets being the leading causes. Out of all accidents, 69 Percent involve two-wheelers, while 25 Percent involve pedestrians and 6Percent involve cyclists. Using data obtained from the Thrissur crime branch urban and rural, we conducted a Kernel Density analysis based on the WSI value ((41xK)+(4xGI)+1xMI)) where, K- number of death, GI- grievous injury and MI-minor injury. This analysis allowed us to identify spots and stretches with a high incidence of severe accidents over the past five years. These locations include Swaraj round Thrissur, NH544, NH66, SH69, SH50, SH76, SH22, the junction of SH51 and NH544, the junction of SH21 and SH61, and the junction of SH21 and NH544. Immediate attention is needed to address these black spots as shown in Figure 5.13. We also found that four roads - NH66, NH544, SH22, and SH69 - have the highest accident rates per km.

Figure 5.15 Current Scenario of Waterway in Thrissur District



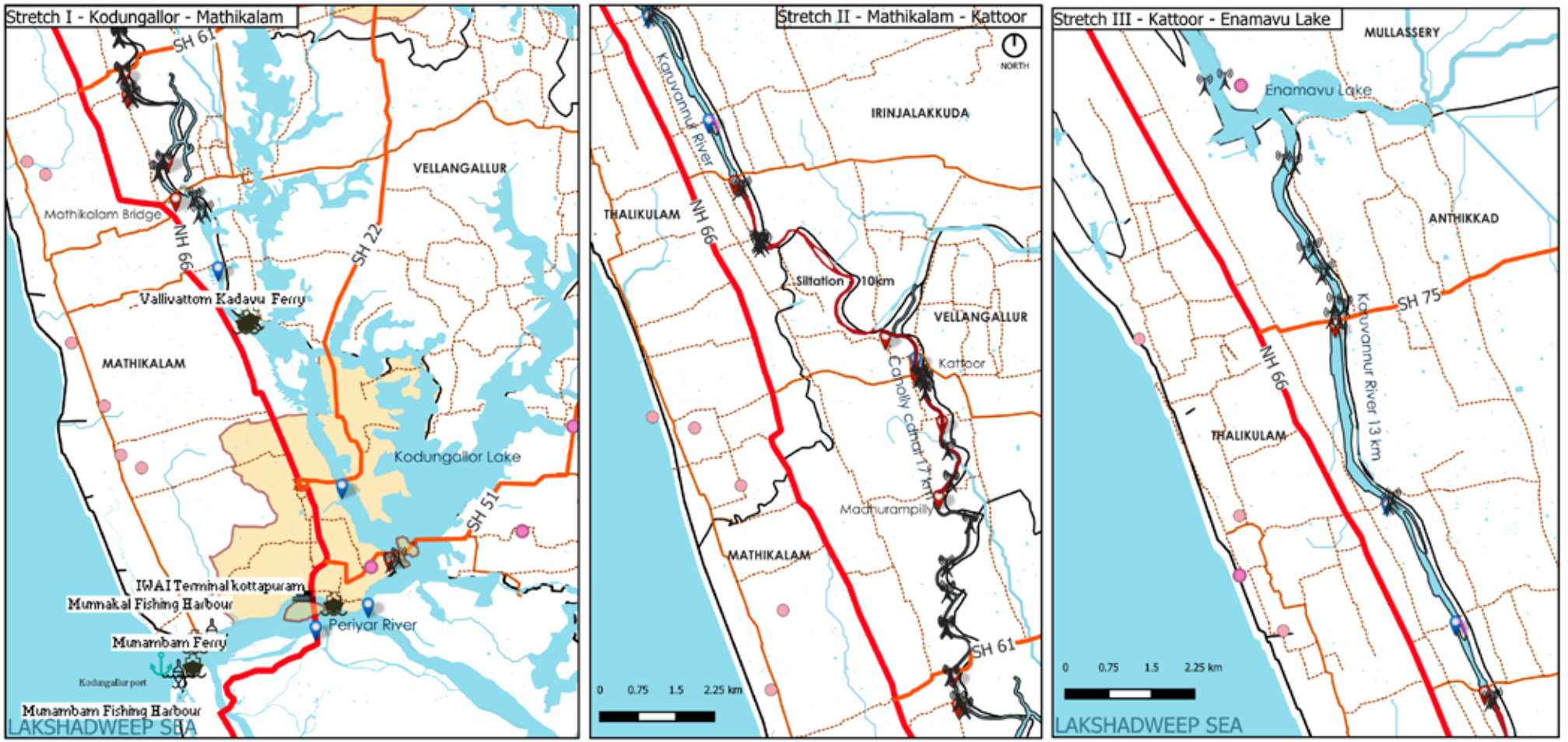
Source: Irrigation department, 2020

Hence, road safety in Thrissur can be greatly improved by addressing issues related to road width and traffic congestion.

5.11 Waterways

The Inland Waterways Authority of India (IWAI), a statutory authority, was established with the objective of developing and regulating the inland waterways for shipping and navigation purposes, to boost the water transportation in the country. IWT is not only fuel-efficient,

Figure 5.16 IWT (NW3 Extension) Stretches



Source: Irrigation department, 2020

environment-friendly, cost-effective but also less time consuming.

NH66 runs parallel to identified waterway and SH – 22, 50 ,61,75 bisects the waterway connecting with Thrissur. The identified waterway comprises of kodungallor backwaters, canolly canal, karuvannur river.

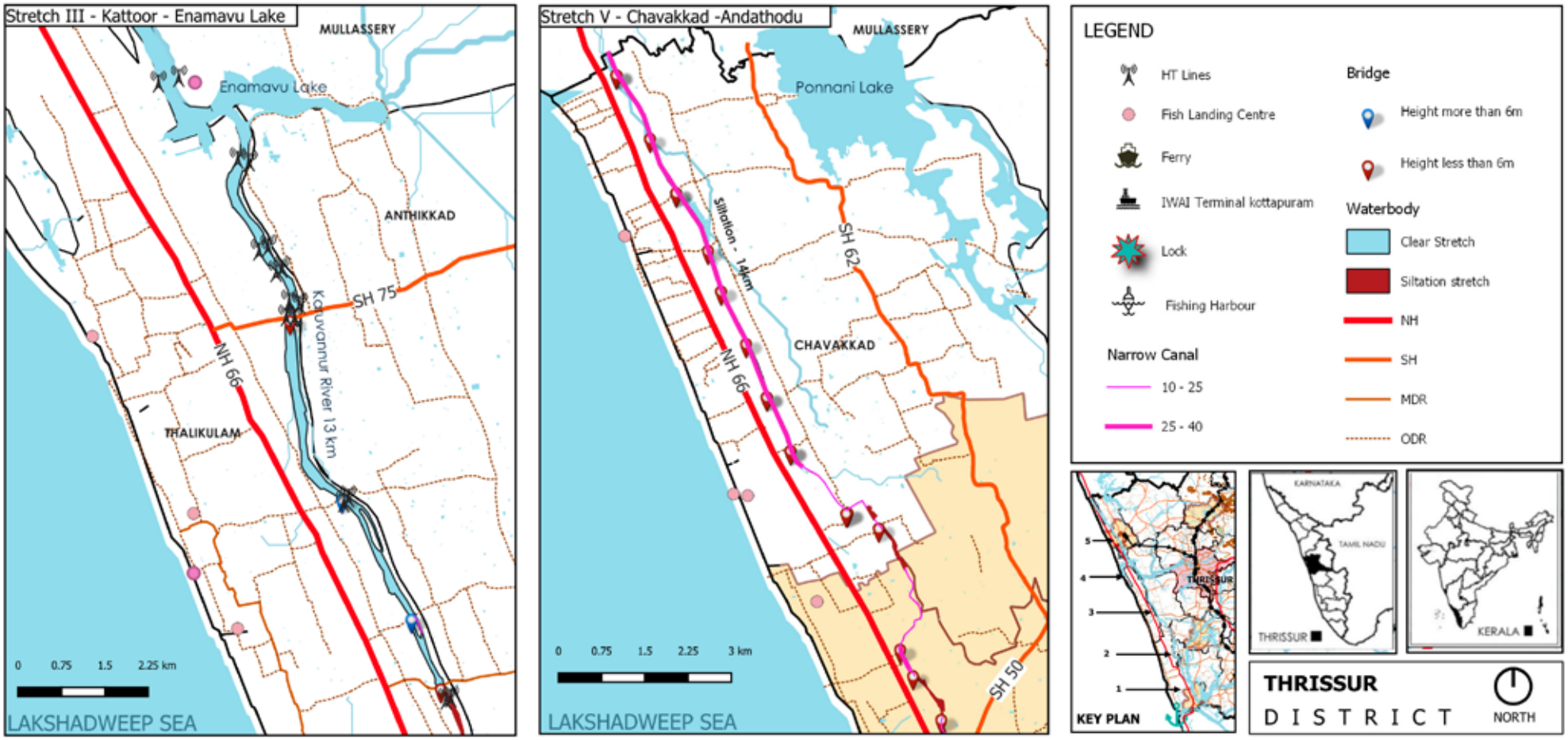
Issues

Kerala is highly congested with road freight (more than 60Percent). Major causes for the non-utilization of the waterway for freight transport is due to absence of Ports/ terminals, utility from navigation point of view, boat jetties, shallow water depth, vertical clearance due to bridges, electrical lines, narrow stretch of waterway being less than 40 m, siltation in rivers, lack of first & last mile connectivity, absence of locks, Non- availability of return cargo etc. The traffic density on the NH66 can be eased by this IWT mobility.

The Figure 3.5.1 shows water stretch in Chavakkad and Maithalikalam is highly blocked via. low height bridges, electrical lines are densely situated in Mathilikalam block and Thalikulam block (height 4.5 – 11.5m), as per standards it needs to be raised at 16.5m height for LT lines and 19.5m for HT Lines.

Site Potential

Figure 5.17 IWT (NW3 Extension) Stretches



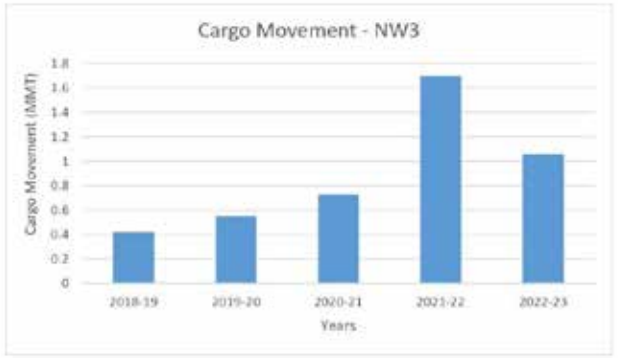
Source: Irrigation department, 2020

The Inland Water Transport (IWT) in India has the potential to supplement the over-burdened railways and congested roadways. Thrissur has the potential to utilize waterways for boosting trade, employment and economy via. the use of waterways for cargo and shipment transportation.

The Small and Medium Enterprises in Thrissur are traded locally. Further, the study stretch is traversing through Two Non Major Ports viz., Ponnani, Beypore port and one major port i.e. Kochi Port. Cargo is moved via. NH 66 to Kochi which surpasses Thrissur which is congesting NH66. Food grain production (cereal, pulses, oil seed, coconut- 1,50,000 tonne) in the catchment area and Horticulture production (mango, banana, papaya, tapioca, rubber, green chilly, etc – 1,65,166 tonne) are observed which are potential for trade via. Identified route. The waterway which runs parallel to NW3 thus has potential to decongest the road route and act as a freight corridor. The modal shift will reduce the congestion on the road, especially in the land scarce Kerala. Current fisheries production in catchment area of canal in 2019-2020 were 55,953 tonne in 2020-2021 were 3,454 tonne in 2021-2022 were 45,436 tonne of which 32 percent are exported which acts as potential.

Tourism spots can be developed around once the waterway is made fit for transportation.

Figure 5.18 Cargo Movement at NW3 (Existing)



The possibility of IWT mobility has been considered with Class III standard of Waterway with minimum 40 m Channel Width and 2.2 m depth of fairway with a vessel requirement for Class III vessel as 50 m (Length) x 9 m (Breadth) x 1.5 m (Loaded Draft) & height clearance for 6m minimum.

Existing Scenario & Analysis

A total stretch of 3, 205 km of NW3 exists from Kollam to Kottapuram, kodungallor. As per the National Waterway Bill, 2015, Extension of NW 3 is approved which will surpass Thrissur, stretching from Kottapuram to Kozhikode measuring up to 170 kms, having an overall stretch of 375 km.

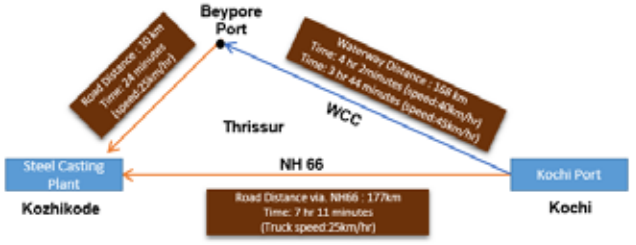
NH66 is parallel to NW3 Extension in the study area. The Identified waterway consists of backwaters, Periyar river, Karuvannur river, Canolly canal making an entire stretch of 68 kms. The stretch from Madhurampilly to Munayam (10km) & from Chavakkad to Andathodu (14km) are affected with heavy siltation. The 68 km long waterway has 47 bridges, out of which 30 bridges hinder its movement and 46 electrical lines.

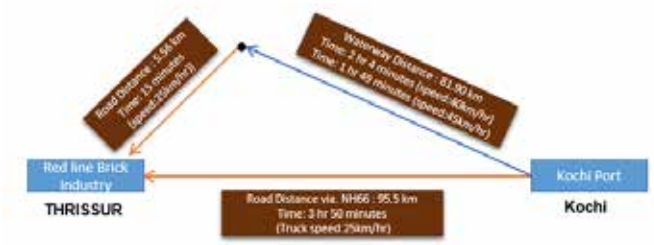
Table 5.4 Traffic Projection for Waterway Transportation in Thrissur

From	Destination	Traffic	Volume	Reasoning
Thrissur, Caught in WCC catchment area	Nearby blocks, districts	Fisheries	NA	Trade
Thrissur, produced in WCC catchment area	Nearby blocks, districts	Food grains	NA	Trade
Thrissur, population of catchment area	Nearby blocks, districts	Passenger	NA	Tourism
Ponnani & Beypore ferry terminal	Thrissur	Passenger	NA	Tourism
Kochi	Thrissur	Sand	21 million cum	brick manufacturing industries
Kochi	Beypore port/ Kozhikode	Steel scrap	0.4 Mn tonnes	Iron & steel industries requires raw
Kochi	Kozhikode	Paint industries	NA	Trade
Kozhikode	Kochi	Sea food companies (Uniroyal Marine)	18000 tonnes	Trade
Kozhikode (Beypore, Ponnai port)	Kochi	Fishes	NA	Trade

Source: Irrigation department, 2020

Figure 5.19 Time & distance comparison





Currently in the site there is no cargo movement via. water route, but it has been seen ferry movement at certain locations and some fishing harbours which trade fishes via. water route to nearby blocks of Ernakulum and Malappuram. There are more than 25 fish landing centers in the hinterland of catchment area, five fishing harbours and three ferry spots.

The majority of those inhabiting the region were engaged in traditional industries such as coir, cashew, brick-making and fishing. Any attempt to develop the inland waterways will favorably impact the well-being of this

region.

There are some identified brick manufacturing industries which trade sand from Kochi port via. NH66 which can be diverted to water route once it is implemented. Since some of the industries fall in hinterland of catchment area of canal the dredged sand from Kochi can be transported via. water route. Overall potential of waterway is projected below in table 5.4. Time & distance analysis calculation of change in route is projected below in figure 5.20.

Factors affecting the shift from existing mode to waterways is majorly due to proximity of the Jetty/terminal & multi modal connectivity. Extension of NW3 will be beneficial for trade purpose since it's an extension to existing channel providing it continous connectivity.

Cost Analysis

Development of the National Waterways is also expected to boost industrial growth of the hinterland along the waterways. As per Maritime India Vision (MIV) 2030 document, cargo movement on National Waterways is targeted as 200 MMT by 2030.

Development of waterways is 10Percent of the cost required to develop roadways, maintenance is 20Percent of that required for roadways.

Fuel efficient / economy and environment concerns – One litre of fuel can move 24 tonne-km of cargo by road, 85 tonne-km by rail and 105 tonne-km by waterways. Per metric ton kilometer cost of different modes of logistics in India in 2021 (in Indian rupees) for air 18 Rs, road 3.6 Rs, waterway 2 Rs, rail 1.6 Rs.

The adjacent Figure 5.20 shows time and distance comparison via. multimodal shift of road route and water route in study area, routes path are marked in Figure 5.15.

5.12 Conclusion

In conclusion, transport connectivity in Thrissur district plays a critical role in facilitating economic and social development. The district has a well-developed hierarchy of roads, which includes national highways, state highways, district roads, and other district roads enabling seamless movement of goods and people across different parts of the district. The increase in vehicular registration over the years has contributed in .

Public transportation, including bus transport and IPT, play a crucial role in connecting remote areas of the district. The railway network, which is linked to major cities in the country, provides an efficient and comfortable mode of travel. The waterway system includes National waterway-3 connects the southern district of kerala to Thrissur and the Chalakudy River, also offers immense potential for transportation, which needs to be explored further.

However, road safety remains a major concern in the district, with a high number of road accidents reported every year. The authorities must take urgent steps to enhance road safety by implementing stricter traffic rules and regulations, improving road infrastructure, and raising awareness among road users.

Overall, there is a need for a comprehensive approach to improve transport connectivity in Thrissur district, focusing on enhancing road safety, upgrading public transportation systems, and exploring the potential of the railway and waterway systems. Such measures will not only enhance connectivity within the district but also facilitate economic growth, social development, and improve the quality of life for the people of the district.



6. Social Infrastructure

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Bipasha Das 2022MURP031

Credits: Nivedita Aggarwal

6. Social Infrastructure

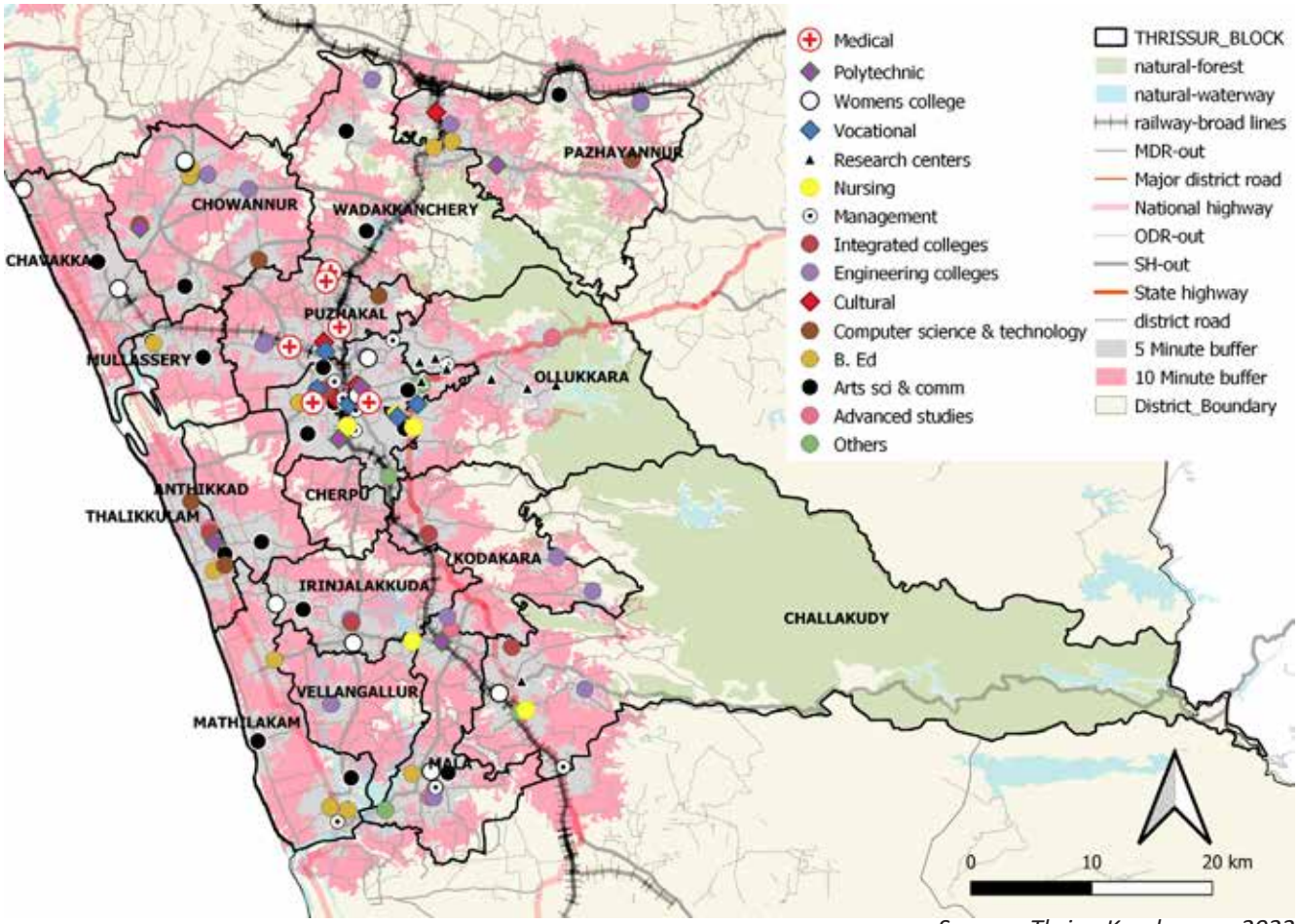
6.1 Overview

Transportation infrastructure is being followed by social infrastructure, consisting of the basic social amenities of education, healthcare and sports. It also includes infrastructure for elderly, which includes buildings, programs, resources and other linked initiatives for their welfare. These factors will provide us with a glimpse of the existing socio- economic scenario of Thrissur and help in identifying and bridging the gaps present in the sector.

6.2 Educational infrastructure

Thrissur is known as a knowledge hub and has remarkable infrastructure up to High school level. Good accessibility and government schemes have contributed to the upliftment of primary education in Thrissur district. There are approximately a total of 375 Schools divided across the district consisting of lower primary to higher secondary education levels. Thrissur receives a good amount of exposure as well in terms of it being tagged as a UNESCO learning city. The accesibility levels of the colleges are quite efficient as can be seen in fig. 6.1.

Figure 6.1 Locations of colleges in Thrissur district



Source: ThrisurKerala.com, 2022

Thrissur has a total of 145 colleges across the district of various fields, but one faces a dilemma after passing higher secondary level. Though Kerala has achieved high educational development, the educational policy adopted here was not suited to the manpower requirement of Kerala. The educational policy of Kerala gave much importance to general education and not given due importance to professional and technical education and also ignored the need to introduce job oriented vocational course suited to Kerala. All of these led to the issue of educated unemployment. The problem is more serious among the educated that are unable to utilize their skill and knowledge which they have acquired for affecting qualitative changes in the economy and society. Similarly, the unemployment rate among the young females is much higher than that of the young females. It has pointed out that women in the state are found to be well educated. More than 60% of the total job seekers in Kerala are women, with most of them are well educated. It is also seen that the unemployment rate among the women job seekers is much higher than that among the male job seekers. Out of the total literate

Table 6.1 Gap/ deficit in terms of number of colleges present block wise for the current as well as year 2047.

Block/ Municipal Corp. name	Medical	Engineering	Polytechnic	Women's	Nursing	Management	Integrated	Computer Science & Technology	Art, Science & Commerce	B. Ed	Advanced Studies	Research Institues	Vocational	Cultural	Dental	Ayurveda	Digital media	Pharmaceutical	Dairy	Law	Veterinary	Total
Thrissur Municipal Corp.	2	1	2	2	3	5	1	1	8	2	1	1	3	3	1	1				2		39
Anthikkad									1													1
Cherpu																						0
Kodakara		2					1															3
Wadakkanchery	1	1							2	1												5
Irinjalakuda		1		2			1		1													5
Mala		3	1	1	1	1			1	1	2											11
Mathikalam						1			2	3												6
Thalikulam			1				1	2	1	1	1											7
Vellangallur		1																				1
Chowannur		2	1	2			1	1	2	2												11
Puzhakal	4	2			2	1		1				1	1	1								13
Chavakkad				2					1													3
Pazhayannur		2	1					1	1	1				1				1				8
Challakudy		1		1	1	1	1		1			1					1	1				9
Ollukara					1	2					1	6	1						1		1	13
Mullassery									2	1												3
Total	7	16	6	10	8	11	6	6	23	12	5	9	5	5	1	1	1	2	1	2	1	138

Phase 1 Phase 2 1 2 3 4 < 4 Deficit

Source: ThrisurKerala.com, 2022

population, only 35.4% are having either a graduation and post-graduation degree.

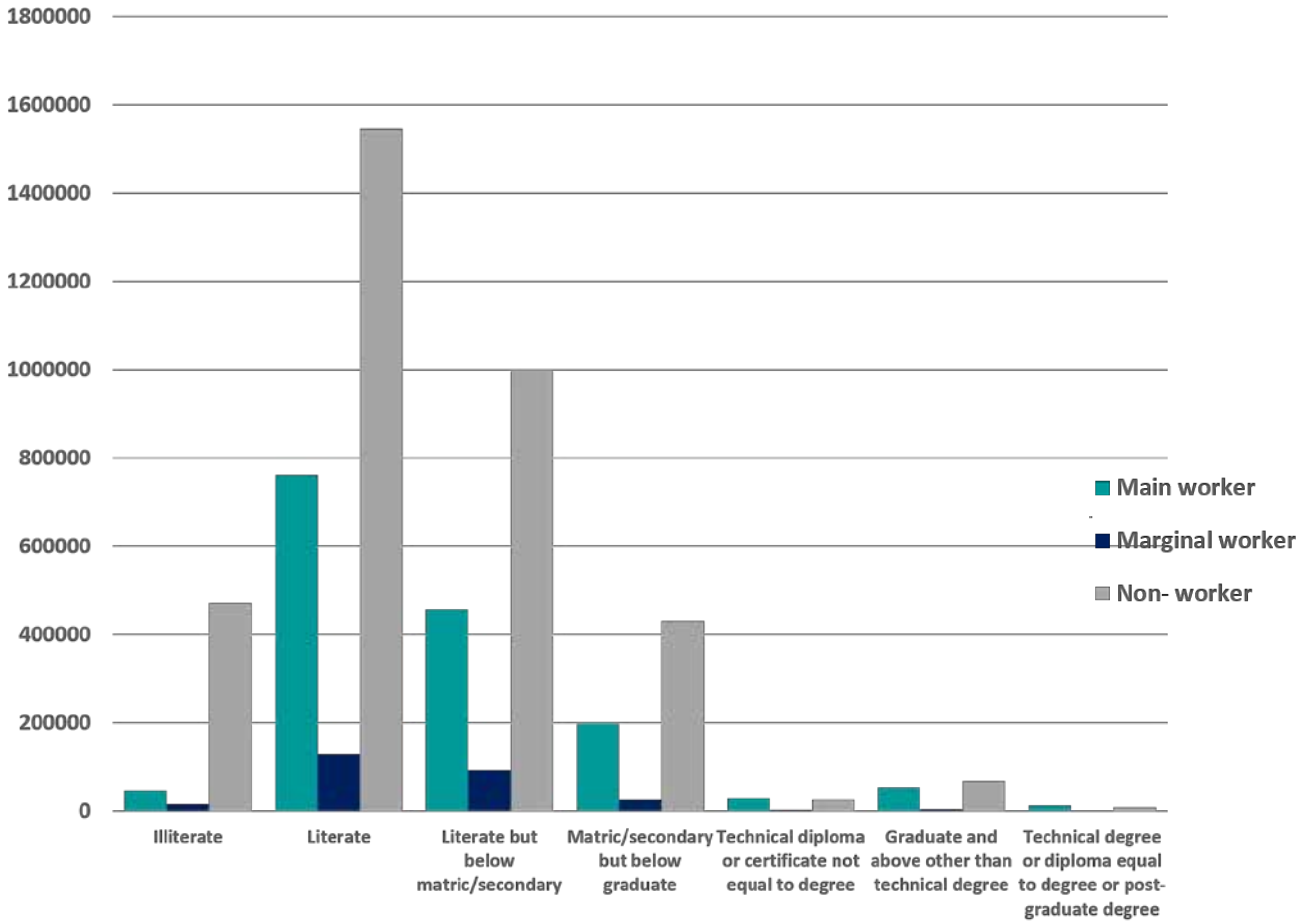
6.2.1 Issue of educated unemployment

The growth rate of the youth population in Thrissur is 9.81%, for 2001- 11. But the colleges were not able to accommodate the growing number of students, which is why the universities of Kerala and Calicut introduced private registration and this resulted in a mushroom growth of private parallel colleges in Kerala. It resulted in a large number of unemployed pre-degree holders, graduates and post-graduates. High demand occurred because of the lack of seats available in Kerala, a large number of students are forced to go to other states and seek admissions in engineering courses by paying huge amount as capitation fees. Kerala has not been able to give high priority for the development of various disciplines of Technical education like Ayurveda, Robotics (AI), Virology studies etc. Though there is high demand for these courses , due to lack of seats in Kerala, a large number of students seek admission in the private medical educational institutions in other states paying huge amount as capitation fees. The basic defect of the educational system is its failure to introduce targeted specified vocational courses to train people to start self employment ventures. Also, the government has quite negligible contribution in encouraging people for self-entrepreneurship, in terms of providing with financial assistance. Some of the drawbacks of educational policy pursued in Kerala include graduation becoming a minimum requirement for those who aspire for a clerical job.

Even though the educational scenario of Thrissur is quite optimal, it has major gaps between courses offered and the amount of aligned industries present in the district to consume the highly skilled work force. Due to the lack of such job opportunities the number of educated unemployment has increased drastically. To escape unemployment, the youth are migrating outside the district either in search of quality education for a specific field, or for well- paid high skilled jobs.

To eradicate this condition, various

Figure 6.2 Classification of workers of Thrissur, based on their education levels, 2001



Source: Census, 2001

proposals are being worked upon some of them including Thrissur as an educational hub, as a UNESCO recognised learning city etc. Apart from these proposals, the focus should be on the upgradation of technical education, providing more research oriented facilities, targeted skill development for self entrepreneurship etc. These proposals will initiate a good amount of rise in employment generation, as well as bringing in world- class facilities that will ultimately require high skilled labours, mitigating educated unemployment and contributing to the economy.

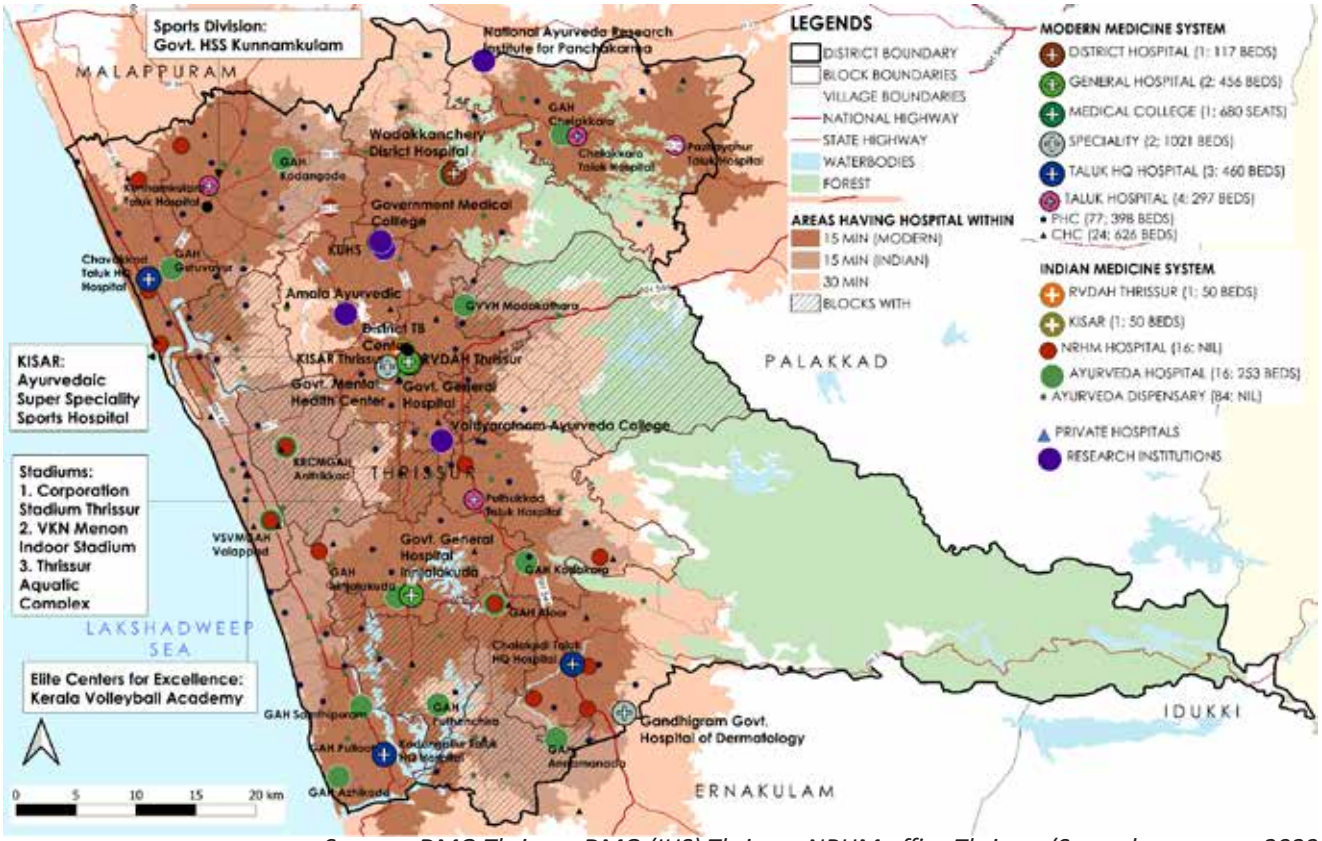
6.3 Healthcare and sports infrastructure

The state of Kerala has received recognition from around the world for its achievements in health. Other Indian States have looked to Kerala's health sector as a model for improving the sector and address pressing public health issues. The situation in Thrissur is not too different from Kerala in terms of primary healthcare. The best treatment facilities and most knowledgeable medical staff can be found in Thrissur, which has a strong and well-regarded healthcare foundation as well as numerous providers in both the public and private sector. A high life expectancy, low infant mortality rate, high birth rate, and low death rate are a few of the health indicators in which the district has improved significantly.

In accordance to the state's healthcare structure Thrissur also follows a decentralized system of healthcare with facilities available at every level of the three-tier hierarchy i.e., village level, taluk level and district level. District level facilities include general hospitals, medical college and district hospital. At taluk level there are two tier facilities that is taluk headquarter hospital and taluk hospital. Community Health Centers and Primary Health Centers serve the villages and the lowest level of hierarchy. Figure 6.3 shows the location of public healthcare facilities in Thrissur District.

Thrissur also recognizes the Indian System of Medicine (ISM) as a healthcare service. Therefore, a specific outlay is allocated aimed at development of ayurvedic hospitals and education in ISM. Kerala is known as the home of ayurveda with Thrissur having 18 Ayurvedic hospitals in the whole district with a total of 353 beds. A national level Panchakarma

Figure 6.3 No. of public healthcare facilities in Thrissur District.



Source: DMO Thrissur, DMO (IHS) Thrissur, NRHM office Thrissur (Secondary survey, 2023)

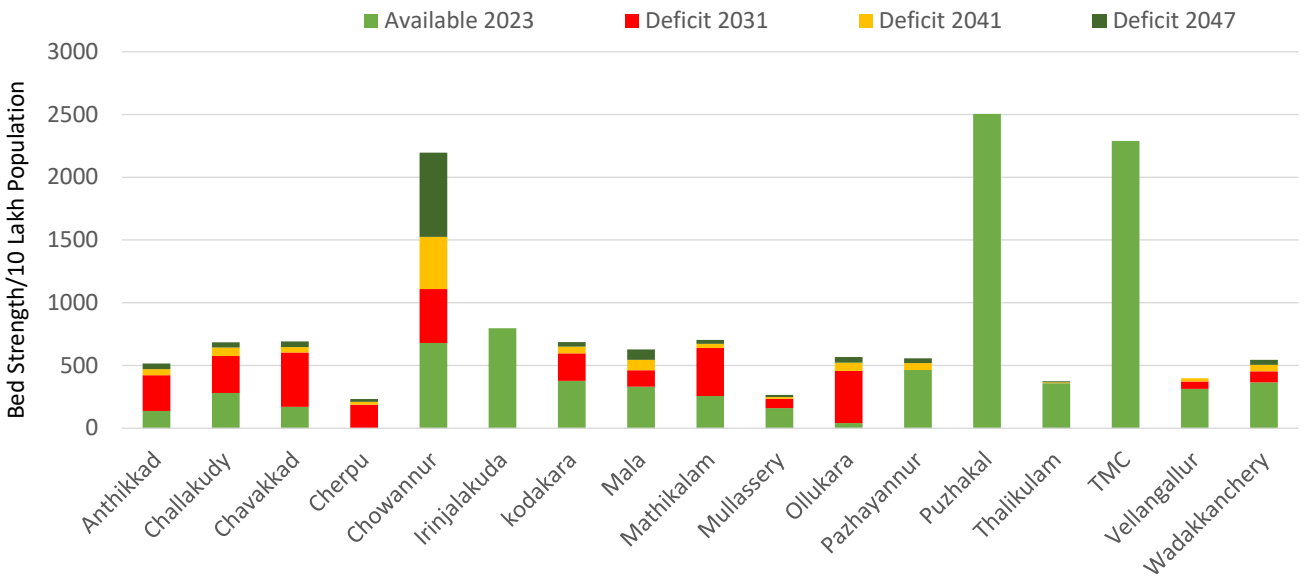
Research Institute is situated at Cheruthuruthy in the Pazhayannur Block. Thrissur also houses Vaidyaratnam Oushadhasala Pvt. Ltd., a leading ayurvedic drug manufacturing company. Therefore the district has an opportunity to boost its economy by developing its medical tourism facilities.

The bed strength in the whole district is far beyond the recommended IPHS standards which state that for 10 lakh population 220 beds should be provided. The total bed strength was about 2718 beds per 10 lakh population in 2021 which is projected to decrease to 1802 beds per 10 lakh population in 2047, still being more than the recommended standards. However, bed strength in these facilities at the block level are compared using the URDPFI guidelines as can be seen in the Figure 6.4, it can be considered that the bed strength in the blocks is insufficient. But considering the urbanization level of the district, the urban rural continuum and the good connectivity these comparisons can be highly misleading. The district will be 91% urbanized by 2047 which is higher than the national average of 31.2 % as per census 2011 and thus these comparisons generate false results. Also, the connectivity within the district is so efficient that everyone has an access to primary, secondary and tertiary facilities well within 30 minutes (Figure 6.3) as recommended by WHO. Therefore, the only interventions in the infrastructure facility required are in terms of developing Emergency & Trauma Care Network along the major highways.

Although Kerala has emerged as the best performing state in health sector. However, its system is now facing new difficulties due the economic underdevelopment during the past years, which has contributed to fiscal issues. In addition, an ageing population and increased cost of technological innovation have further deteriorated the scenario. Thrissur district has high number of qualified professional seeking jobs in the field of medicine. Out of the total literate population 35.4% are have either a graduation and post-graduation degree. 3% of this population is directly concerned with medicine field. The district has failed to exploit this large pool of qualified manpower andx is yet to explore the potentials of roping in private players in clinical research, biotechnology industry and other research programs in the medical arena - Diagnostics, Drugs and Medical Devices. Futhermore, there is a need to build on the existing popularity of Ayurveda sector

In terms of prevention and control, the new threats to the health scenario are mental health problems, suicide, substance abuse and

Figure 6.4 Bed Strength Deficit (per 10 lakh population) in all blocks and TMC as per URDPFI Guidelines



Source: URDPFI Guidelines, 2015

alcoholism, adolescent health issues and rising number of diabetes, hypertension, cardio vascular diseases, obesity and lung diseases patients, which have emerged as major issue throughout the nation. This is the direct result of increased stress levels and low physical activity. Unless immediate interventions are made to control these lifestyle diseases, their burden is likely to increase over the years. Therefore. the state has taken various initiatives like sports festivals, clubs, training programs and panchayat level schemes to promote healthy lifestyle. Still the district lacks in terms of adequate infrastructure for said activities. The available infrastructure ins mostly concentrated in the municipal corporation as can be seen in Figure 8.3. Since sports and fitness is the backbone of happy and healthy district more intensive interventions in infrastructure development are required in this sector. Sports facilities not only impart fitness among the citizens but also create a sports ecosystem and explore the opportunities for sports as a career avenue. Thus, the district shall explore such opportunities.

Thrissur's future strategy now should not only focus on developing as a medical research hub catering to national and international markets, but also on leveraging sports as a vehicle to achieve multi-pronged benefits to society. The district should build on its core existing strengths, in the form of infrastructure and skilled resources, while also focusing on some value adding new research areas. In order to position itself as a healthy and happy place to live, there is a need to make a mark on the themes identified above, and take targeted actions on priority.

6.4 Infrastructure for elderly

Infrastructure for the elderly includes buildings, programs, and resources that are tailored to their unique needs. Age-friendly housing, accessible transportation, healthcare services, and community support initiatives can all fall under this category. The goal of the elderly infrastructure is to encourage independent living, social inclusion, and healthy aging in older adults.

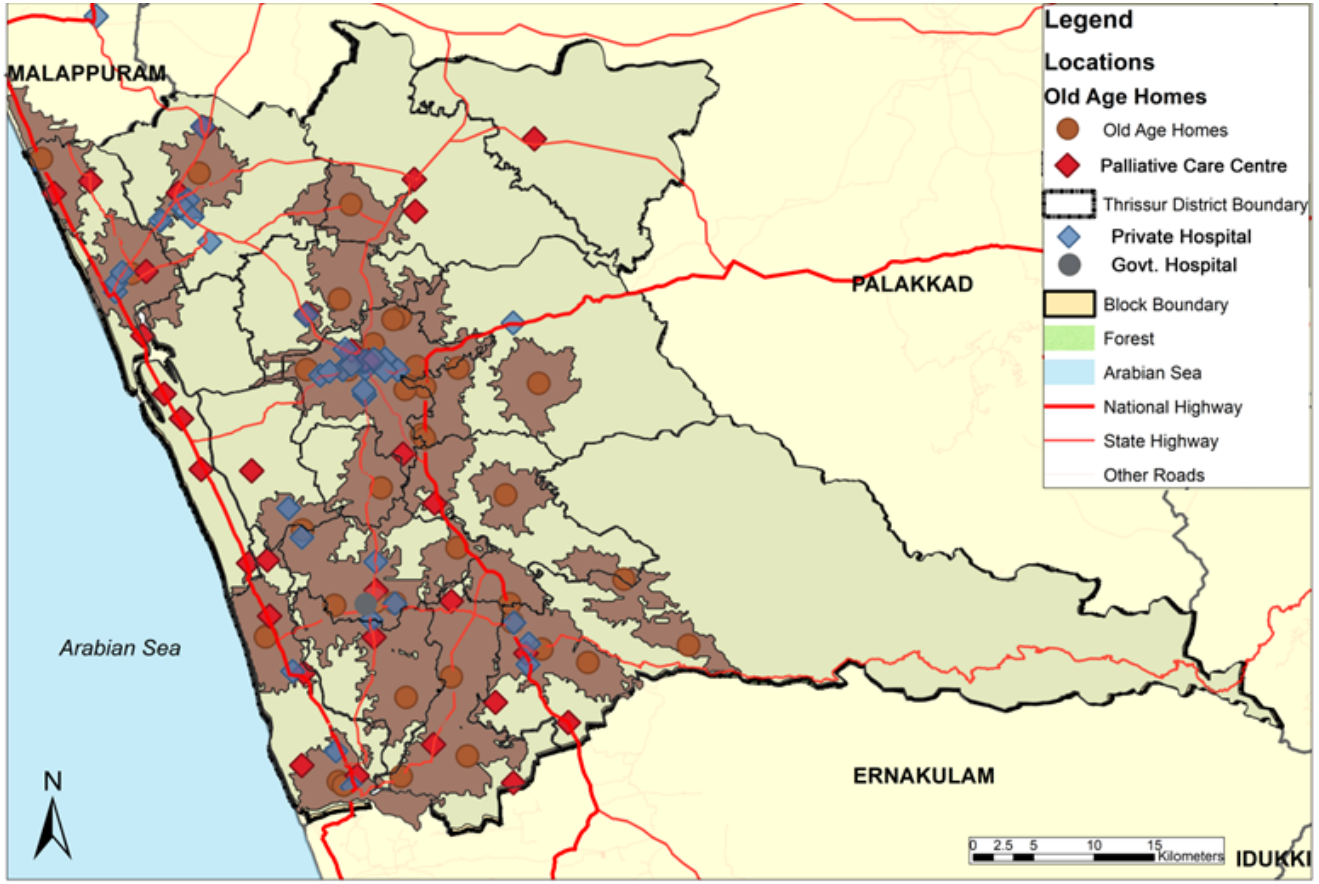
The Figure 6.5 shows old age homes, palliative care centers, and other health facility locations and also shows the health infrastructure available near old age homes (within 10 minutes distance radius). A total number of 64 old age homes and 31 palliative care were identified in the Thrissur district.

This demographic change greatly impacts the community's social and economic landscape. The demand for healthcare services, long-term care facilities, and services for older adults is rising due to the growing elderly population. In addition, it offers chances for intergenerational activities and social engagement that can support social inclusion and healthy aging.

6.4.1 Policy and Schemes Initiatives

Policies and schemes initiatives aim to enhance the quality of life for senior citizens by addressing their unique needs and promoting their well-being.

Figure 6.5 Old age homes in Thrissur district



Source: Social Justice Department, Government of Kerala (Secondary survey, 2023)

Several state-level initiatives shall be proposed to address various social and welfare issues. The Sayan Prabha House initiative with an aim to provide yoga meditation programs and a 24 X 7 education program, promoting mental and physical well-being among individuals. Another initiative, Show Smile, with a focuse on supporting marginalized individuals by providing livelihood and enterprise opportunities, empowering them to improve their quality of life. Additionally, there shall be an initiative to provide old age pensions, ensuring financial security for the elderly population. Furthermore, services for people with dementia should be implemented to cater to the specific needs of individuals dealing with this condition. Lastly, the Age-friendly Panchayat initiatives with a goal to create an inclusive and supportive environment for senior citizens within the local community. These state-level initiatives will showcase the commitment towards addressing diverse social challenges and enhancing the overall well-being of the population.

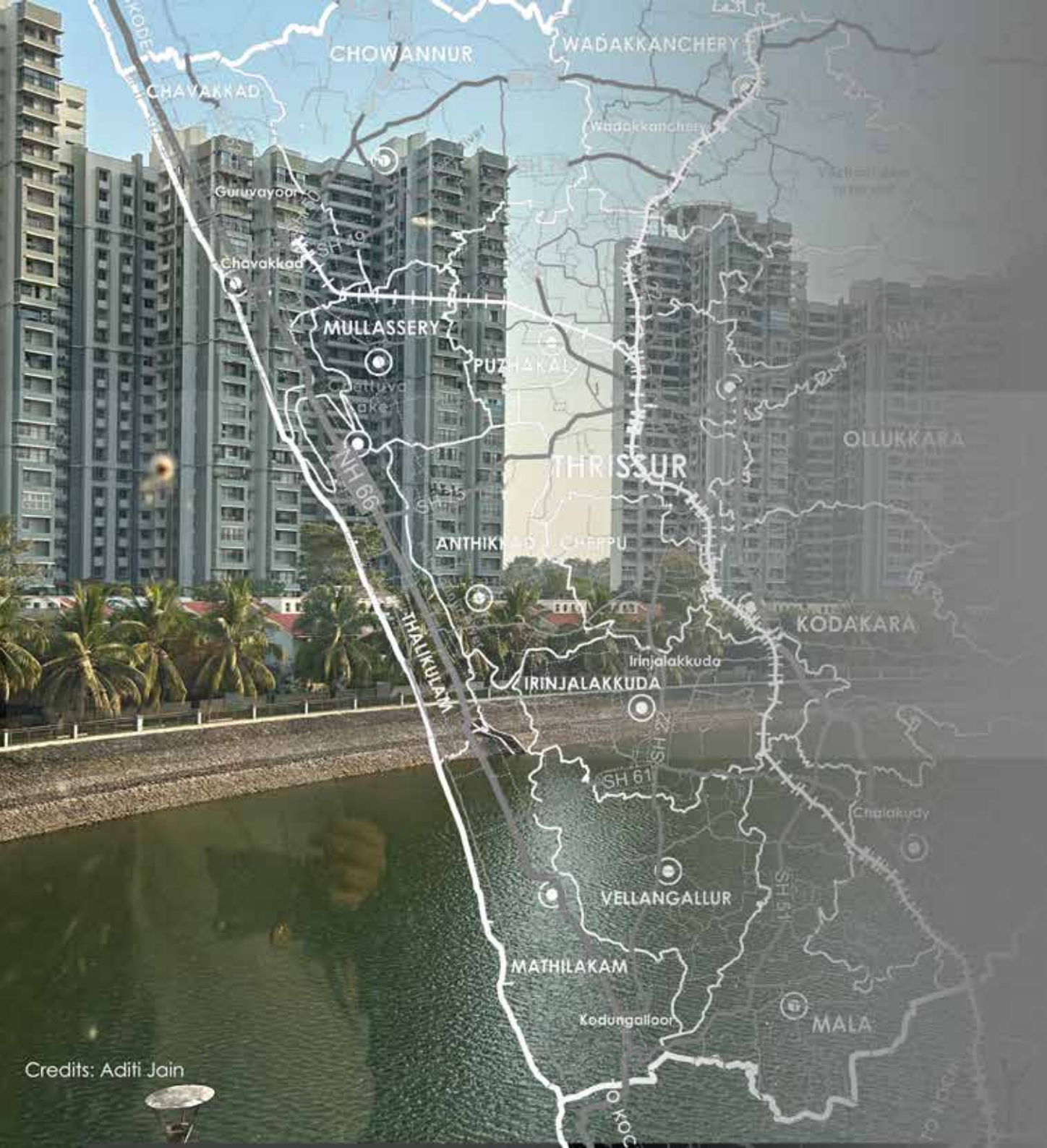
Block-level initiatives such as Palliative facility, social justice department, age-friendly planning, and another initiative by local self-government at the block level and by providing an annual budget for the elderly.

Because of this, it's critical for Thrissur's policymakers and local government to prepare for the needs of the aging population, which includes ensuring that older people have access to affordable healthcare, encouraging healthy lifestyles, and building age-friendly neighborhoods that encourage independent living and social engagement. Furthermore, there is a need for novel solutions that can address the particular requirements and difficulties that older adults face, such as social isolation, financial security, and healthcare accessibility.

6.5 Conclusion

There is a need for socio- economic developent in Thrissur. Considering the tag of Thrissur as a knowledge hub, focus should be on to reduce the unemployment rates particularly among educated women, who are 60% of the job seekers. The limited availability of college seats and lack of emphasis on developing technical education disciplines and targeted vocational courses for self-employment opportunities are some of the major concerns that should be worked upon. In terms of healthcare, Thrissur stands

out with its excellent treatment facilities,like the bed strength in the whole district is far beyond the recommended IPHS standards which state that for 10 lakh population 220 beds should be provided. The total bed strength was about 2718 beds per 10 lakh population in 2021 which is projected to decrease to 1802 beds per 10 lakh population in 2047, still being more than the recommended standards. But the system faces challenges due to economic underdevelopment, an aging population, and rising costs of technological innovation. Despite a high number of qualified professionals in the medical field, the district has not fully utilized this resource and needs to explore opportunities for private participation in clinical research, biotechnology, and other medical research programs. The state has initiated various programs to promote healthy lifestyles and prevent these lifestyle diseases. However, there is a lack of adequate infrastructure for sports and fitness activities, especially outside the municipal corporation. Thrissur should focus on leveraging sports as a means to achieve multiple benefits for society. In terms of infrastructure for the elderly, Thrissur has identified old age homes, palliative care centers, and health facilities within close proximity. The growing elderly population necessitates the provision of healthcare services and long-term care facilities. To prepare for the needs of the aging population, access must be ensured to affordable healthcare, encourage healthy lifestyles, and create age-friendly neighborhoods. Novel solutions are needed to address social isolation, financial security, and healthcare accessibility challenges faced by older adults.



7. Physical Infrastructure

Nitin Rathee 2022MURP017
Anilkumar Moirangthem 2022MURP021
Dipika Raut 2022MURP028

7. Physical Infrastructure

7.1 Energy

The district has several power generation and distribution institutions, including KSEB Limited, Thrissur Corporation Electricity Department, Anert, Energy Management Cell, and Electrical Inspectorate. KSEB mainly generates electricity from hydroelectric plants, but solar power generation is also being explored by KSEB, Thrissur Corporation Electricity Department, and private institutions. Electricity, LPG, and Vic are the primary energy sources consuming in the domestic sector, while electricity is mainly using the industrial, agricultural, and commercial sectors. Rooftop solar power plants have a lot of potential in the district, and wind power generation should also be explored in coalfields. Completion of under-construction hydropower plants is necessary for energy availability. The district's energy consumption pattern is 52.41% domestic, 14% commercial, 11.26% industrial, and 14% agricultural. Self-sufficiency in power generation is being pursued by the Thrissur Corporation, with a 200 KW solar power plant and approval for small hydropower projects.

Thrissur district has 123 sunny days on average per year and an annual average solar insolation of 5.59 KWh/m2/day, indicating a significant potential for solar energy generation. Kerala has a high solar potential, with a Direct Normal Irradiance (DNI) of 4.60 kWh/m2/day and a Global Horizontal Irradiance (GHI) of 5.53 kWh/m2/day. Kerala has a total renewable energy potential of 9.594 MW, according to the Ministry of New and Renewable Energy (MNRE) 2021 report, with a wind power potential of 1.7 MW, small hydropower potential of 0.704 MW, biomass power potential of 1.044 MW, waste to the energy potential of 0.036 MW, and solar potential of 6.11 MW. According to the research, Kerala has a high potential for generating renewable energy from a variety of sources.

In 2021, the population of the Thrissur district is projected to be at 3.5 Crore. The district's electricity usage is 1.2 KWh, with a per capita consumption of 0.36 MWh/capita/day. The district's anticipated population in 2047 is 4.6 Crore, with an electrical usage of 1.7MkWh. These numbers show that the demand for power in Thrissur is increasing, emphasizing the need for renewable energy solutions to supply this need responsibly. The consumption of Thrissur Corporation is 77820 kWH. The total number of consumers of Thrissur Corporation is 41225

In Thrissur district, there is a significant amount of electricity being generated through various renewable energy sources. The following breakdown of the energy generation from different sources:

Figure 7.1 Total Installed Capacity MW in Kerala in2020-21

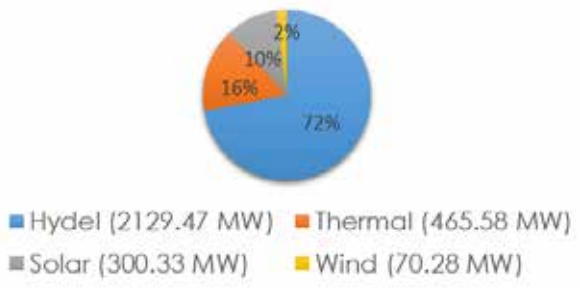


Figure 7.2 Pattern of Energy Consumption in Thrissur District

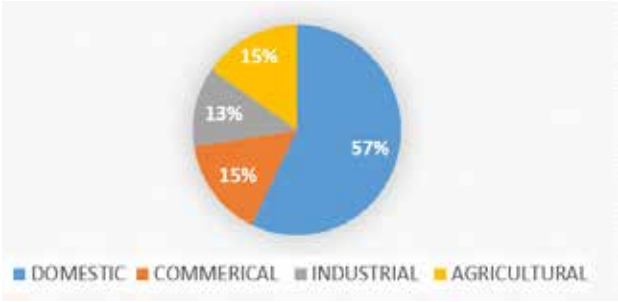


Figure 7.3 Trend Consumption Pattern

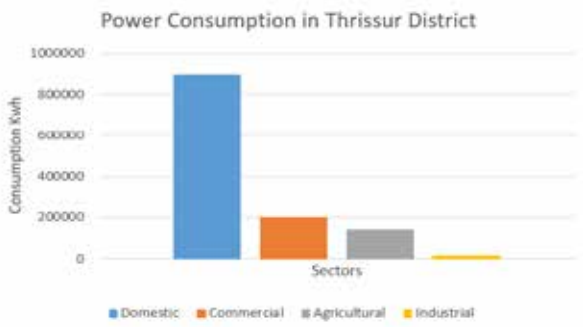
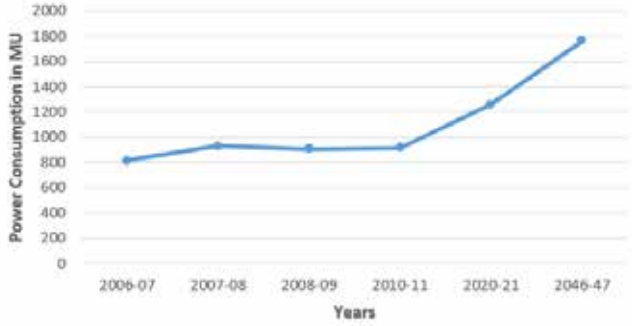


Figure 7.4 Trend Consumption Pattern



Source-KSEB,Municipal corp.,MNRE, 2022

Hydel: The district generates 106 MW of electricity through hydropower. Hydropower utilizes the energy from flowing or falling water to generate electricity, and it is a clean and sustainable energy source.

SHEP (Small Hydroelectric Power): There is an additional 9.750 MW of electricity generated through small hydroelectric power projects. These projects harness the energy from small rivers or streams to produce electricity.

Wind: The district generates 2.025 MW of electricity through wind power. Wind turbines convert the kinetic energy of the wind into electrical energy, providing a clean and renewable source of power.

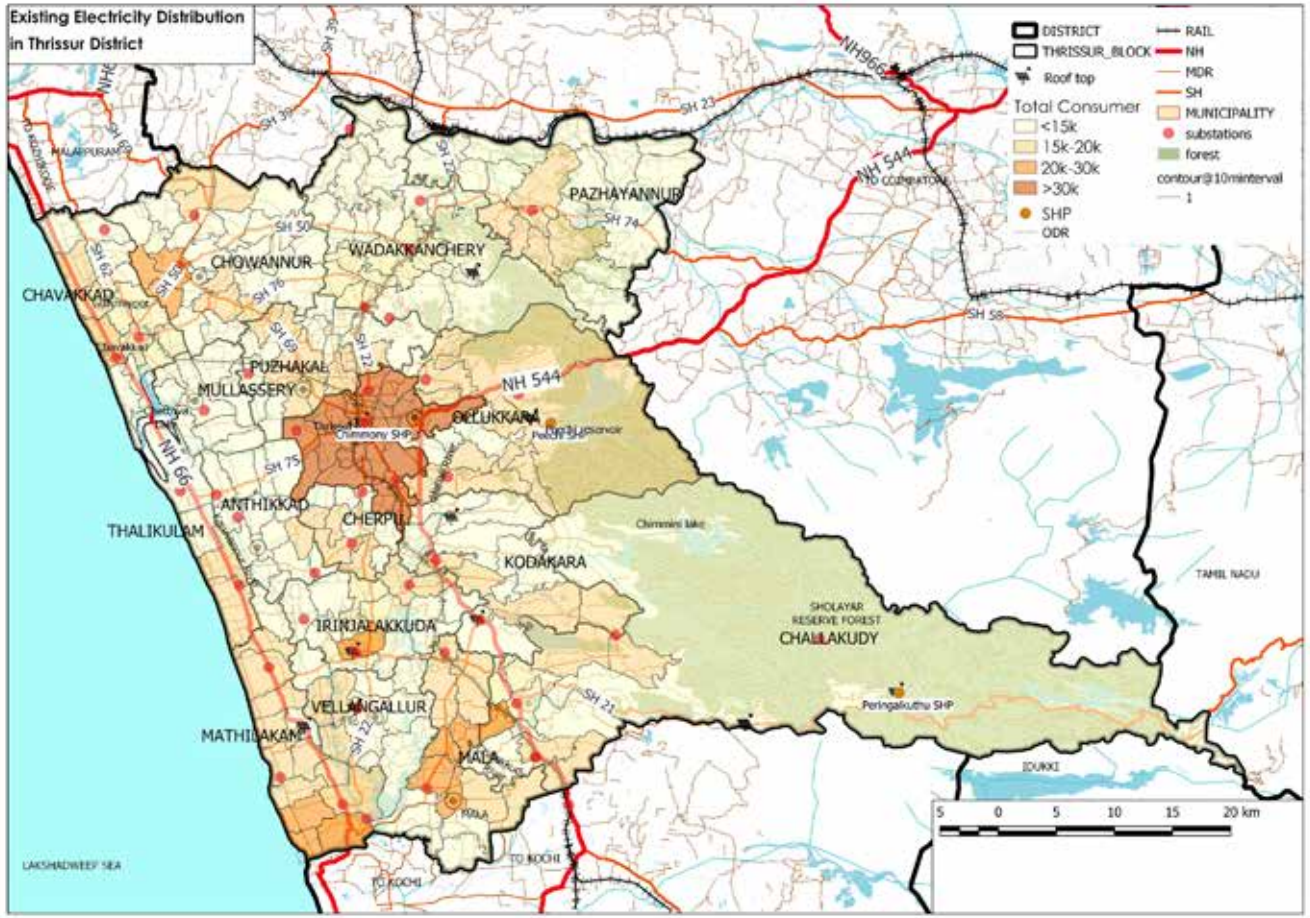
Solar (Rooftop): The district also generates 0.12 MW of electricity through rooftop solar installations. Solar power converts sunlight into electricity using photovoltaic panels, making it an environmentally friendly energy source.

The above mentioned demonstrate the district's commitment to harnessing renewable energy and reducing reliance on fossil fuels. By utilizing a diverse range of renewable energy sources, Thrissur district is contributing to a more sustainable and environmentally friendly future.

Resource-based development is aimed at reducing extravagance and ensuring frugality in the energy sector, and the non-conventional, waste-to-energy, and micro-hydropower projects being considered for long-term friendly programs. Energy conservation and auditing are important complementary activities. At least in 5 Local Government Areas in the district, an extensive solar power project can be implemented with planning to determine the percentage of total electricity consumption in the Local Government from solar energy. Domestic biogas plants (using kitchen waste, kitchen waste, and toasted waste) can be set up to treat organic waste, Street lights of local government bodies I. E. will be changed to D, Extensive awareness program related to energy conservation should be instituted in schools, Projects can be prepared for heating, stoves, smokeless stoves, and solar water heaters to realize fuel savings. The three major challenges with energy use and supply, to begin with, energy consumption is growing but supply is insufficient. Second, there is a lack of understanding about how to optimize resources for long-term demand sustainability and non-conventional power production sources exploity, but their usefulness is relatively limited.

The state-owned electrical utility, KSEB, generates around 30% of Kerala's total energy consumption, with the remainder fulfilled by

Figure 7.5 Existing Electricity Distribution in Thrissur District



Source: ThrisurKerala.com

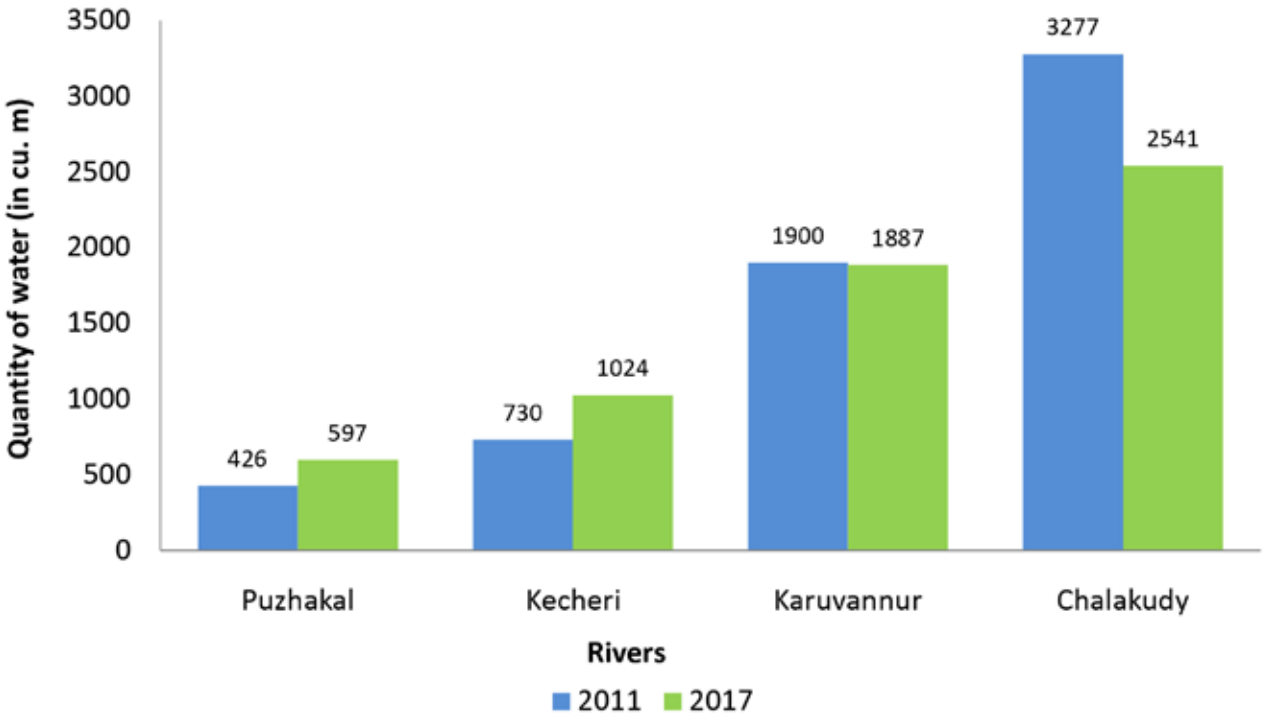
the central producing units and other producers. The Thrissur Corporation's goal is to create 250 million units of electricity by 2025, and they have already erected a 200KW solar plant as part of this project. In addition, the government has approved 25.5MW hydropower projects in the region, which would help to supply energy. The total installed capacity of grid-connected solar power installations in the Thrissur district is now 15.56 MW, reflecting progress towards sustainable and renewable energy sources. These efforts towards energy self-sufficiency and renewable energy sources are critical for the region's economic and environmental sustainability, and such measures must be maintained to assure the region's energy security.

As far as the power sector in the district is considered, the power consumption seems to be proportional to the growth of consumers. Hence steps providing infrastructure should be initiated from various fields to reduction to other the energy consumption or else it would be very difficult to meet the required demand from the ex-existing resources. Similarly, steps should be taken to utilize non-conventional energy sources to generate electricity such as biowaste, using wind energy wherever it is feasible, and using tidal energy in the coastal areas. Effective Utilisation of the available resources could build up a better environment to cater to the future demands of the District.

The Thrissur district provides significant opportunities for renewable energy development, particularly in solar, waste-to-energy, and wind energy. Solar parks might result in job development, increased energy security, and lower greenhouse gas emissions. The potential for waste-to-energy conversion is intriguing, and it has the ability to assist satisfy the region's energy demands in a sustainable manner while simultaneously decreasing trash. There are currently plans in the works to build wind farms in the area, which is an ideal location for wind energy generation due to its mountainous topography, vast fields, coastal position, and strong wind speeds. Overall, these renewable energy sources might help the Thrissur district in meeting its energy requirements while also contributing to a more sustainable future.

The Issues facing by Thrissur District is Energy consumption is increasing while supply remains insufficient. This causes energy shortages and stifles regional growth. Second, there is a dearth of understanding about the most effective manner to use resources to guarantee long-term sustainability. This indicates that resources are being depleted without regard for their long-term environmental impact or the availability of resources for future generations.The region is

Figure 7.6 Graph showing quantity of water provided by various rivers in the district



Source: IDDP Thrissur (2013), DPC, Thrissur (2017)

not fully using non-conventional energy sources for power generation. This reduces the availability of renewable energy sources and contributes to the region's reliance on conventional energy sources, which may have adverse effects on the environment. These concerns must be addressed if the area is to have a sustainable and energy secure future.

7.2 Water Supply

7.2.1 Water Sources:

a) Surface Water Source

Several rivers, streams, and ponds make up the Thrissur District's surface water resources. The district is divided among three river basins: portions of the Ponnani, Keecheri, and Karuvannur (Kole lands), and Chalakudy basins. Each of these three basins has an area of 510, 1691, and 830 sq km, respectively.

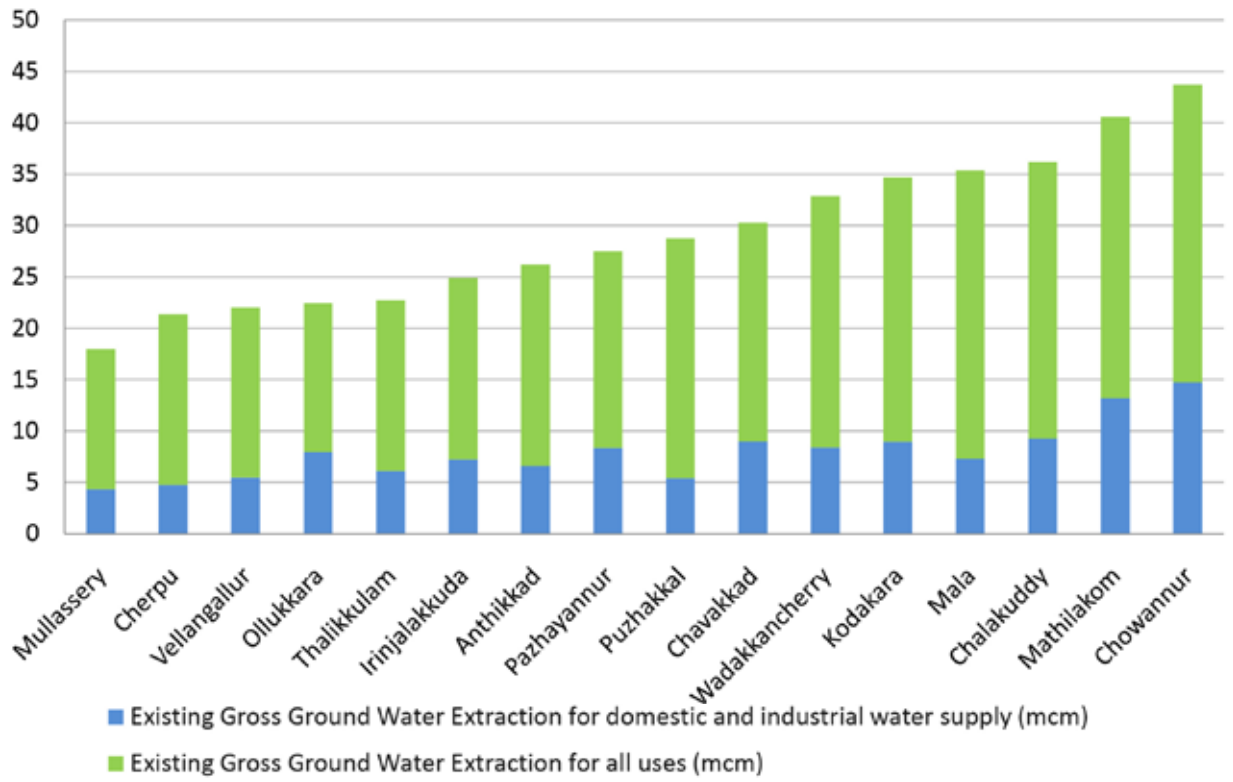
The Kecheri (Vazhani), Manali, Bharatapuzha, Karuvannur, and Chalakudi rivers all pass through the Thrissur district. The average annual flow of the Keecheri and Puzhakal rivers has increased through time, whereas the flow of other rivers, such as the Bharatapuzha, Chalakudy, and Karuvannur rivers, has decreased.

There are 8 River gauge stations maintained in the District. They are located at Manali, Kurumali, Karikkadavu, Pazoor, Cheruthuruthy, Pillathode, Pambadi and Kundukad.

b) Ground Water Source:

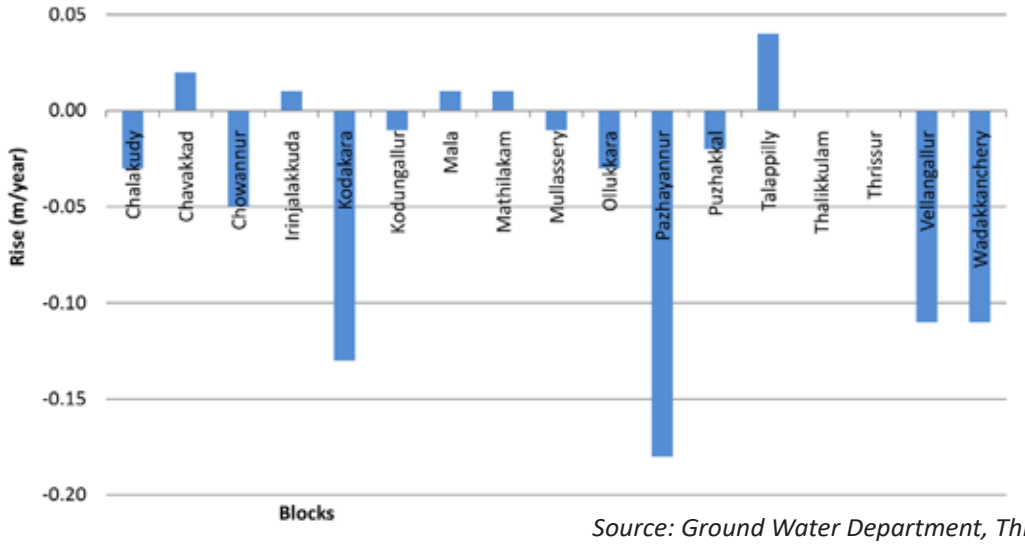
Ground Water is extracted by means of open wells, bore wells/ tube wells for the drinking purpose and water supply facility. Most groundwater use occurs through wells that have

Figure 7.7 Ground Water Extraction table for year 2019 for domestic, industrial and irrigation purpose



Source: Central Ground Water Board, Thrissur (2019)

Figure 7.8 Ground Water Table Rise/Fall (2002-2022)



Source: Ground Water Department, Thrissur (2017)

been drilled. Although the dug wells in this region typically dry up during the summer, bore wells are also widespread on high land topography. Spring water is a valuable source of drinking water in highland areas. The water quality in the area is generally good, with the exception of iron and nitrate levels that are higher than those allowed for drinking in some places.

According to estimates of the district's 16 development blocks' groundwater resources, 3 of the blocks are classified as semi-critical, while the other 13 are safe. Sedimentary terrains cover the Thalikulam and Mathilakom semi-critical blocks, whereas hard rock terrains cover the Chowannur block. Even if the blocks fall into the safe or semi-critical category, wells might dry up during the summer and in years with little rainfall.

c) Other Water Sources – Storage Reservoirs

Water supplies for irrigation, hydroelectric development, household and industrial needs, and other uses are generally provided by storage reservoirs.

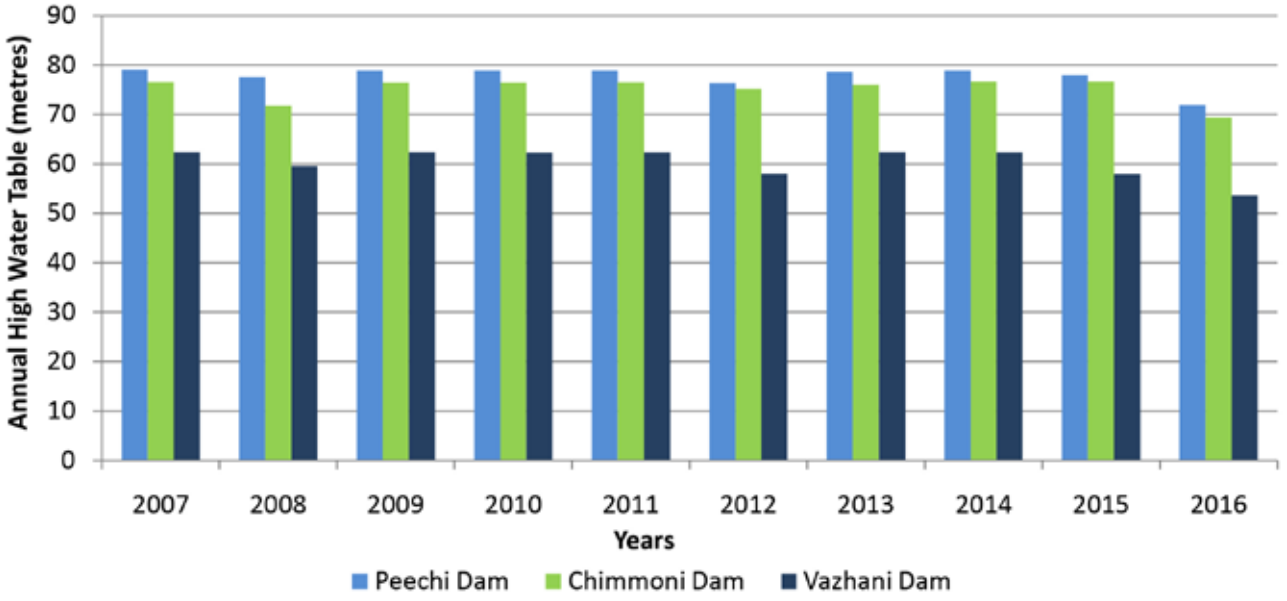
1.Water Scarcity: Due to the drying up of

Table 7.1 Other water sources and capacity

Name of the Reservoir/ Dam	Catchment Area (sq. Km)	Present Storage (cu. Mm)	Drinking water provision in MLD
Peechi	107.00	79.611	55
Vazhani	20.72	18.121	
Chimmoni	72.13	179.39	

Source: IDDP, Thrissur (2013)

Figure 7.9 Annual High Water Table for various Dams/ Reservoir in Thrissur District



Source: DPC, Thrissur (2017)

Table 7.2 Areas served by various Dams/ Reservoir in Thrissur District

Source of water supply	Areas served
Peechi Reservoir	Thrissur Municipal Corporation and neighbouring gram panchayats
Bharatapuzha River	Wadakkanchery, Kunnamkulam, Guruvayur and Chavakkad MC and neighbouring gram panchayat
Karuvannur River	Irinjalakkuda, Guruvayur, Chavakkad, Thrissur MC and neighbouring gram panchayats
Chalakudy River	Chalakkudy, Kodungallur MC and neighbouring gram panchayat
Kurumali River	Pudukkad, Alagappanagar, Kodakara, Mattathur, Parappurkara and Varandharappilly Gram Panchayats
Manali River	Thrikkur, Puthur Gram Panchayat

Source: IDDP, Thrissur (2013)

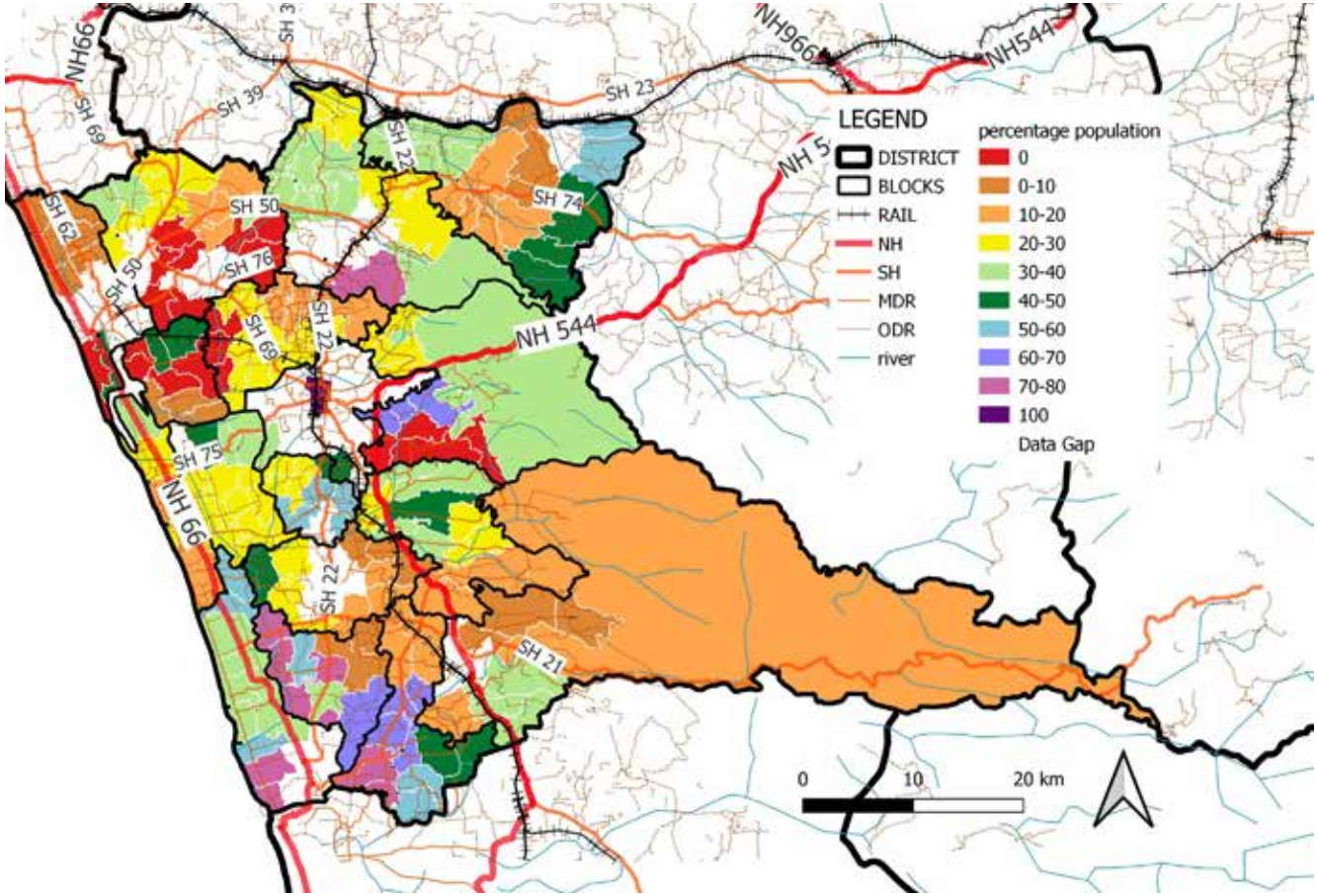
hand pumps and drilled wells, midland and hilly areas are experiencing acute and widespread water shortages throughout the summer. The four significant rivers that travel through the district are having problems being sustainable because of the decreasing summer flow. Aquifer depletion has been extensively recorded throughout the area in several panchayats. The panchayats experiencing water scarcity problem are in parts of Velur, Kadangode, Kunnamkulam Municipality (Chowannur Block); Thiruvilwamala, Kondazhy & Chelakara (Pazhayannur Block); Varavoor, Mulloorkara, Thekkumkara & Mundathikode (Wadakkanchery Block); Avannur, Mulangunnathukavu & Kolazhy (Puzhakkal Block); Puthur, Nadathara (Ollukara Block); Kodassery, Koratty (Chalakudy Muncipality & Block); Veloorkara (Vellangallur Block), Guruyavur Municiplality, Kadapuram (Chavakkad Block) ;

Kodungallur Municipality,Edavalangu, Allur, SN puram, Anthikad (Mathilakom Block) and Engandiyur, Edathuruthy, Nattika, Thalikulam (Thalikulam Block).

If the monsoon is delayed or if there are no summer rains, dug wells in the midland area dry up because the laterite formations, which are very porous and have a poor capacity for water retention, lose water as base-flow throughout the summer. The drying up of dug wells on lateritic mounds and slopes results from the growing reliance on bore wells in midland areas, which impacts the drinking water requirements of those areas.

In the Wadakkanchery Municipality, Chelakkara, Desamangalam, Erumapetty, Panjal, Thekkumkara, Thiruvilamala, Vallathol Nagar,

Figure 7.10 Population served with Water Supply facility by KWA



Source: Kerala Water Authority

Kadangode, and Velur Gram Panchayaths, there has been a shortage of drinking water. due to geographical features and the destruction of conventional water storage systems like ponds, tanks, and wetlands, it is impossible to store the excess runoff that is accessible during the monsoons.

Particularly on hilltops, steep slopes, andsolitary hillocks, there is a dearth of water. Increasing urbanisation leads to less groundwater recharge, less water conservation, and greater water use. The migration of land from agricultural to non-agricultural uses as a result of recent changes in land use and cropping patterns has reduced groundwater recharge and water conservation.

2.Coastal Erosion and Water logging: Thesettlements of Eriyad, Nattika, and Chamakala, as well as the coastline region from Engandiyoor to Chettuva, regularly undergo significant coast-

al erosion, which worsens the quality of the ground water in the area of the coastal aquifer. The Kole land and surrounding regions experience flooding for around six months out of the year. In some regions, combined ground- and surface-water utilisation for irrigation and industrial purposes should be practised. The salinity has been seen to increase from February to May in Kole Land, occurring more frequently during high tides and less frequently during low tides. Bunds and regulators built across rivers that empty into the sea have partially remedied the salinity issue. The majority of the time, particularly in the summer, the coastal areas where streams meet the sea are where the quality issues may be discovered.

3.Groundwater depletion: Due to extensive groundwater depletion, groundwater is becoming scarce in semi-urban regions like Chowannur, Mathilakom, and Thalikulam Blocks. Sands from the Bharathapuzha and Chalakudy rivers are mined illegally, which has an effect on the groundwater regime, particularly by reducing groundwater levels and degrading water quality in riparian areas and nearby flood plains. As a result, the hydraulic gradient towards the river will ultimately grow, causing the aquifer's groundwater to flow into the river at a larger rate. Shallow wells start to dry up as a result of these changes, and the number of sustainable groundwater abstraction infrastructure decreases.

Many sand mining operations may potentially contaminate the river water and the groundwater that is hydraulically connected to it. If this trend of the lowering water table is not reversed, it will soon pose a serious threat to the economy. To combat the depletion, ground water recharge and conservation techniques may be used in these locations.

4.Quarrying: Localized groundwater depletion occurs due to rock quarrying. Granite dimension stone and construction materials are easily obtained from Charnockites, who make up the majority of the population in the region. Localised quarrying for Granite building stones is highly rampant in the Perumpilavu, Analur, Chengaloor, Kadukutty, Kallur, Kodakara, Kodasserry, Korathy, Kuttachira, Mattathur, Melmuri, Melur, Mupliyam, Muringur -Thekkumuri, Pariyaram, Puthenchira, Puthur, Thoravu, Trikkur, Vadakkumkara, Vellikulangara, Velookkara, Kainur, Killannur, Kurichikara, Kolazhy, Pananchery, Peechi and Puthur villages. In addition to mining and quarrying granite construction stone, laterite is also frequently found near soft rock and hard rock. In Killannur, Kurichikkara, and other locations, migmatite gneiss and biotite gneiss are mined for construction purposes.

The shallow aquifer system has been impacted by the frequent rock blasting in the aforementioned Panchayaths and its surroundings, which has changed the groundwater flow pattern and led to the drying up of dugwells and borewells. For quarrying purposes, cutting down trees and removing vegetation increases runoff and decreases precipitation infiltration. The local phreatic aquifer is effectively removed when excess laterite, lithomarge, and weathered rock are removed for quarrying operations.

5.Groundwater quality problems: Iron above permissible limit (>1 mg/l) are observed at Mallakam (1.06 mg/l), Chayipinkuzhy (1.11 mg/l), Karuvannur (1.31 mg/l), Thozhupadom (1.616 mg/l), Thrichoor (1.99 mg/l), Aarurmozhy (2.32 mg/l), Mattom (3.07 mg/l), Kadukassery (3.14mg/l), Kalur (5.21 mg/l), Moorkanikkara (10.23 mg/l), Kadangode (11.5 mg/l), Akamala (15 mg/l) and Thippulissery (15.5 mg/l) of Chowannur, Chalakudi, Pazhayannur, Kodakara, Ollukara and Wadakkancherry blocks. At Mupliam (48.5 mg/l), Kecheri (53.1 mg/l), Kodungallur (84 mg/l), and Perinjanam (171 mg/l), nitrate concentrations were found to be over the acceptable limit (>45 mg/l). In groundwater samples gathered in the region, coliform bacteria have been found. According to them, post-monsoon samples had considerably more coliforms than pre-monsoon ones. Monsoon season is when thermotolerant coliforms are most prevalent. Rainfall, overland flow, nutrient load, and temperature changes may all be contributing factors to this cyclical variation. In wells near rivers, canals, paddy fields, and water bodies near pilgrimage sites, fertiliser industries, and public locations, significant changes in the coliform levels are seen.

Water Supply System

According to Panchayat basis report of 2017, there are 2818 number of public wells availability and 833 tubewells.

Agencies involved

1. Kerala Water Authority
2. Ground Water Department
3. Jalanidhi (KRWSA)
4. Local Self Government Departments

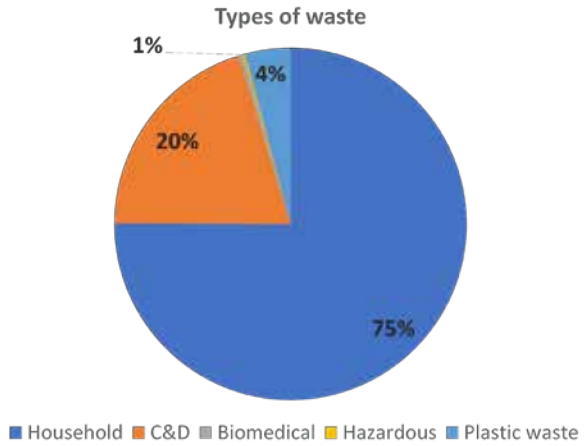
5. NGOs – NGOs take part in many programmes such as Mazhapolima, open well recharging, and rain water harvesting and other ground water recharging programmes

Sources of water for water supply schemes:

The principal sources of the drinking water supply schemes run by the Kerala Water Authority in the District are the rivers Kurumali, Manali, Karuvannur, Chalakkudy, and Bharathapuzha. Other reservoirs include the Peechi, Vazhani, and Chimmini. In addition to this, the district has a number of operating borewell and open well water delivery facilities.

Water Supply by Government agencies: The availability of water has increased over time. In 2011, 20.75% of urban areas and 18.87% of rural areas were supplied by Kerala Water Authority along with Jalnidhi. While include 20.63% of rural areas and 43.42% of urban regions in 2017. By 2020, 29.36% of the population had access to water in rural regions.

Figure 7.11 Types of waste generated



Source-Environmental report, 2018

Table 7.3 Waste generated 2021

		2021					2047	
S. No.	Block	Population (Lakh)	Sewage (MLD)	Existing SWM (MLD)	GAP	Benchmark (%)	Population (Lakh)	Sewage (MLD)
1	Kodakara	2.47	33.38	-	33.38	100	3.12	42.14
2	Wadakkanchery	1.98	26.79	-	26.79	100	2.66	35.92
3	Irinjalakuda	1.68	22.74	-	22.74	100	2.01	27.18
4	Mala	1.78	24.08	-	24.08	100	2.85	38.48
5	Mathilakam	3.06	41.31	-	41.31	100	3.55	48.05
6	Thalikulam	1.41	19.16	-	19.16	100	1.65	22.28
7	Vellangallur	1.58	21.35	-	21.35	100	1.90	25.76
8	Chowannur	3.74	50.50	-	50.50	100	5.70	76.97
9	Thrissur Muni. Corp	3.45	46.62	0.36	46.26	100	3.73	50.44
10	Cherpu	0.90	12.24	-	12.24	100	1.20	16.29
11	Puzhakal	1.80	24.40	-	24.40	100	2.78	37.56
12	Chavakkad	2.57	34.73	3.10	31.63	100	3.14	42.45
13	Pazhayannur	2.07	28.02	-	28.02	100	2.75	37.13
14	Challakudy	2.31	31.23	-	31.23	100	3.11	42.02
15	Ollukara	1.80	24.32	-	24.32	100	2.58	34.83
16	Anthikkad	1.71	23.13	-	23.13	100	2.34	31.60
17	Mullassery	1.00	13.51	-	13.51	100	1.20	16.27
		35.36	477.49	3.46	474.03		46.32	625.37

Note: Note: Population is projected with geometric progression and incremental increase method

Source- Sewage PER, 2021

7.3 Solid Waste Management and Sewerage Treatment Plant

This Chapter aims to provide an analysis of the existing condition of Solid Waste Management and Sewerage Treatment Plant. The purpose of this analysis is to identify the strengths and weaknesses of the current systems in the district.

7.3.1 Solid Waste Management

Table 7.4: Non biodegradable waste collection schedule

Sl.	Item	Month
1	Paper, Plastic, Plastic covers	Every month
2	Shoe, Bags, Thermocol	Jan, Apr, Jul & Oct
3	Mirror, Glass bottle, Glass waste	Feb, May, Aug & Nov
4	E-waste, Light bulbs, battery	Mar, Jun & Dec
5	Medical strip	Jan, Mar, Jun, Sep & Dec
6	Textile waste	Apr & Sep

Source- Chalakudy five year plan 2023-24

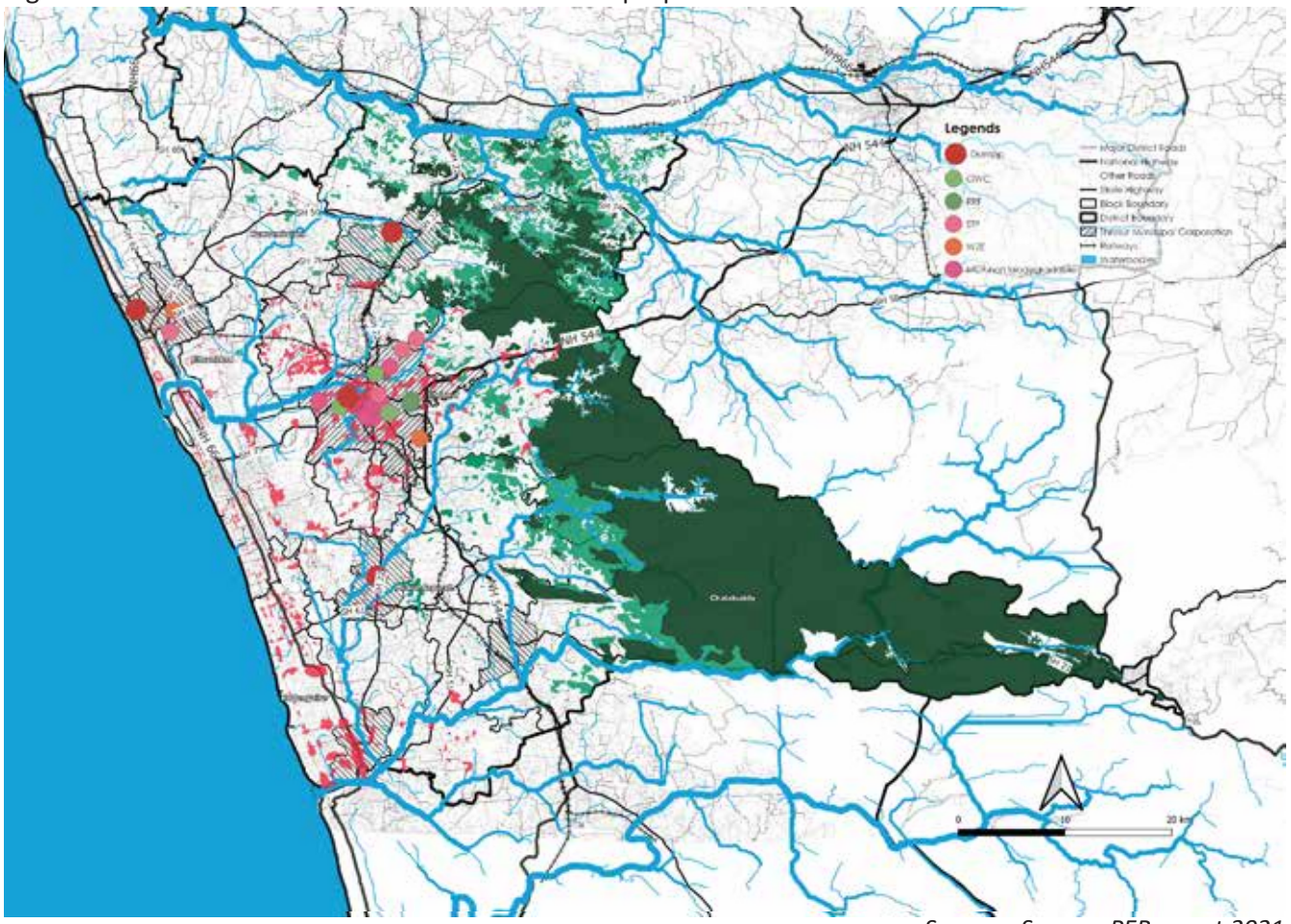
Solid waste are produced by households or commercial institutes, which is a mixture of biodegradable and non-biodegradable waste. As per the Thrissur Solid Waste Report, 2018 1237.94 tonnes of household waste is being generated every day in the district, out of which 928.46 tonnes are biodegradable waste and 309.49 tonnes are non-biodegradable waste. Of the total biodegradable waste generated every year only 70.46 tonnes is processed, block wise waste generation and management is provided in table 1.3. Bio-medical waste is processed either in-house or transported to the treatment plant in Palakkad, every year 1699 tonnes of bio-medical waste is generated and processed. Types of waste generated in the district is shown in Figure 1.1.

As per the report published by Thrissur Municipal Corporation, 127 TPD of solid waste is generated in the corporation out of which 97.79 tonnes is biodegradable waste, 26.67 tonnes is non-biodegradable waste and 2.54 tonnes is inert waste. The biodegradable waste is treated at 3 Organic Waste Compost:

i. Shankthan, capacity of 8 TPD

ii. Kurichira, capacity of 4 TPD

Figure 7.12 Location of SWM collection centres and proposed STP sites



Source- Sewage PER report,2021

iii. Kovilakathumpadam, capacity of 4 TPD

There are 6 biogas plants with a total capacity of 2 TPD located at Agathi Mandhiram, Sakthan, Padinjarekotta and Ollur market. A total of 6.75 TPD is fed to pigs in pig farms. 62.39 TPD is treated at community level or household level, 9 TPD at Institutional level, 0.5 TPD through Mobi trash and 1.15 TPD is treated through Thumboormuzhi.

Non-biodegradable waste is exported to other states through Clean Kerala Company at a fixed rate. The collection happens at 12 Material Collection Centres, equipped with shredding machines and compactors and 3 Rejected Residual Waste centre. There is still a gap of 7.04 TPD for SWM in Thrissur Municipal Corporation.

Door to Door collection service for waste is successful in the district but 100% coverage is not achieved. The number of bulk wet waste generators was also identified, a total of 153

Table 7.5 Waste generated

		2021							2047			
S. no.	Block	Population (Lakh)	Waste (TPD)	Biodegradable (TPD)	Non-biodegradable (TPD)	Existing Bio degradable SWM (TPD)	Gap	Benchmark (%)	Population (Lakh)	Waste (TPD)	Biodegradable (TPD)	Non-biodegradable (TPD)
1	Kodakara	2.47	86.53	64.90	21.63	-	64.90	100	3.12	109.24	81.93	27.31
2	Wadakkanchery	1.98	69.46	52.09	17.36	2.00	50.09	100	2.66	93.13	69.85	23.28
3	Irinjalakuda	1.68	58.94	44.21	14.74	6.45	37.76	100	2.01	70.47	52.85	17.62
4	Mala	1.78	62.42	46.82	15.61	-	46.82	100	2.85	99.75	74.81	24.94
5	Mathilakam	3.06	107.10	80.33	26.78	6.30	74.03	100	3.55	124.58	93.43	31.14
6	Thalikulam	1.41	49.68	37.26	12.42	-	37.26	100	1.65	57.76	43.32	14.44
7	Vellangallur	1.58	55.36	41.52	13.84	-	41.52	100	1.90	66.77	50.08	16.69
8	Chowannur	3.74	130.94	98.20	32.73	9.00	89.20	100	5.70	199.55	149.66	49.89
9	Thrissur Muni. Corp	3.45	120.86	90.64	30.21	20.65	69.99	100	3.73	130.77	98.08	32.69
10	Cherpu	0.90	31.73	23.80	7.93	-	23.80	100	1.20	42.24	31.68	10.56
11	Puzhakal	1.80	63.26	47.44	15.81	-	47.44	100	2.78	97.38	73.04	24.35
12	Chavakkad	2.57	90.04	67.53	22.51	12.00	55.53	100	3.14	110.06	82.55	27.52
13	Pazhayannur	2.07	72.64	54.48	18.16	-	54.48	100	2.75	96.26	72.20	24.07
14	Challakudy	2.31	80.97	60.72	20.24	5.50	55.22	100	3.11	108.95	81.71	27.24
15	Ollukara	1.80	63.05	47.28	15.76	-	47.28	100	2.58	90.31	67.73	22.58
16	Anthikkad	1.71	59.96	44.97	14.99	-	44.97	100	2.34	81.92	61.44	20.48
17	Mullassery	1.00	35.02	26.26	8.75	-	26.26	100	1.20	42.18	31.63	10.54
18	Gram Panchayats					8.56						
		35.36	1237.94	928.46	309.49	70.46	858.00		46.32	1621.33	1216.00	405.33

Source- Thrissur Solid Waste Report, 2018

bulk waste generators with 106 with the provision for on site disposal system. There is no gap for on site disposal systems found in Guruvayoor, Chavakkad, Chalakkudy and Kodungalloor. There is a gap of 30 bulk waste generator in Thrissur corporation with 50 bulk waste generator identified with 20 of the identified generators having on site disposal system, a gap of 5 in Irinjalkkuda, 30 bulk waste generators and 25 with on site disposal system and in Kunnamkulam there is 12 bulk waste generator none of the sites having on site generators leading to a gap of 12.

Waste generated from construction and demolition per year in the district is 82130.42 tonnes and no processing plant or storage site.

The plastic waste, glass waste and textile waste generated are exported to other processing plants outside of the district. The plastic wastes are shredded and stored before its export.

The biodegradable waste generated in the district are processed in a centralized plant in Kondungallur, having a capacity of 4 TPD and a community level vermi-composting plant in Chavakkad with a capacity of 1.5 TPD.

Non-biodegradable waste collection by Clean Kerala Company is scheduled yearly by the types of waste to be collected.

7.3.2 Sewerage Treatment Plant

Thrissur has a high percentage of households with latrines, with a rate of 97.8%. However, the issue lies in the unscientific toilet systems prevalent in the area. Of all the toilets in the district, 29% utilize pit toilet systems, with 28% in urban areas and 37% in rural areas.

The sewage in pit toilet seeps into the natural water bodies and contaminates the water bodies and the underground water. Water contamination level rises during the monsoon with the rise in the water table. 12% toilets are serviced by piped sewer system.

There is a total of 2 STP in Thrissur Municipal corporation, 100 KLD STP at Ramavarmapuram and a 360 KLD STP at General Hospital for which the technical bid evaluation is in progress, both the STPs in Thrissur Municipal Corporation is operating under AMRUT phase I. A FSTP of 10 KLD capacity is also operational in Mattampura. A 3 MLD STP is located in Guruvayur, operation since april 2022. The collection happens through 7kms of sewerage line and 20 KLD through core treatment. Capacity augmentation is proposed to increase the capacity to 5 MLD.

As part of AMRUT phase II, to be implemented after 2026, a 2.5 MLD STP is proposed for Thrissur Municiapl Corporation and will cover 27kms. The administrative sanction has been approved and a request to change the land-use of the proposed site, since the site is presently occupied under paddy field.

The Sewage load, per Census 2011 is 332.26 MLD and the capacity of STP is 0.35 MLD causing a shortage of 331.91 MLD. 66 STPs has been proposed by Kerala Water Authority under the guidelines from National Green Tribunal to cover the estimated sewage load of 451.41MLD by 2052. Total capacity of the 66 STPs will be 231 MLD for sewage and 528 KLD for septage treatment. The proposed STPs are designed for a decentralized system to meet the demand for the scattered population growth and the challenging, diverse topography. The STPs are proposed with the aim to reduce the water contamination and to stop the discharge of untreated sewerage to rivers and other natural water bodies.

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Thrissur district has been declared as ODF district.[1]

7.4 Conclusion

Thrissur district in Kerala exhibits a diverse energy landscape, with a focus on renewable energy sources. While hydropower remains the primary source of electricity, solar power generation is gaining momentum, supported by both public and private entities. The district's energy consumption is driven mainly by the domestic sector, followed by commercial, industrial, and agricultural sectors. Rooftop solar and wind power present untapped potential for further development. Completing ongoing hydropower projects is crucial to ensure sufficient energy availability. With abundant sunshine and high solar potential, Thrissur district is well-suited for solar energy generation. The increasing population and electricity usage underscore the need for responsible and renewable energy solutions. Thrissur Corporation is actively striving for energy self-sufficiency through solar and small hydropower projects. Kerala as a whole holds significant prospects for renewable energy generation across various sources. To ensure economic and environmental sustainability, the district must address challenges such as rising energy demand, inadequate supply, and underutilization of non-conventional energy sources. Embracing renewable energy development in solar, waste-to-energy, and wind power will contribute to a sustainable future for Thrissur district.

Although the district has a number of different water sources, including a river, water reservoirs, pools, streams and backwaters, chira

wells, and tubewells, it mostly relies on groundwater to supply its daily water needs. The district has 5 rivers, the Bharathapuzha, Chalakudy, Karuvannur, Kecheri, and Puzhakkal, along with 6 reservoirs: Peechi, Chimmini, Vazhani, Poomala, Ashurankund, and Pathazhakund Dam. These rivers have 8 gauge stations to measure the water flow in the upper rivers. With 833 tube wells and 2818 public wells in the district, there are 621 large and small public pools. Roughly 10 lakh people rely on wells for their drinking water.

Over the years, the government has attempted to address water demands by increasing the number of water supply facilities from 18.87% of the rural population being serviced with water supply facilities in 2011 to 20.63% in 2017 to 29.36% in 2020. Water supply connections are viewed as being quite important in urban settings. Kerala Water Authority, along with Jalnidhi under KRWSA, ground water department, and local government authorities, is in charge of water supply connections. According to the DPC,2017 report, KWA is responsible for supplying 196.65MLD of water for drinking purposes, while the Department of Agriculture is responsible for 100 bore well projects.

Furthermore, it meets the future demand of 700MLD from the current domestic demand of 536MLD and reduces reliance on the declining groundwater source for irrigation and agricultural purposes; there is a need to provide some alternate water source to maintain the good water flow.

The analysis of the existing Solid Waste Management and Sewerage Treatment Plant in the district higlights the issues and the oppurtunity for future development.

Around 1237 TPD is generated, as of 2021, out of which 928 TPD is biodegradable waste and 309 TPD is non-biodegradable waste. With the available waste management system arounnd 70 tonnes is treated on a daily that leads to a gap of 858 TPD. The door-to-door collection service is also inadequate. There is a lack of recyling and management plant for non-biodegradable waste, such as plastic waste, glass waste and textile waste, leading to their export outisde of the district.

It is noted that Thrissur has high percentage of household with latrines and has been declared an Open Defecation Free district, however, there is an prevailing issue of unscientific latrines which contributes to water contamination. As of 2021, the district generated 477 MLD sewage and a treatment capacity of only 3.46 MLD, creating a gap of 474 MLD. It is crucial to meet the demand of waste and sewage generated in terms of its treatment to ensure a cleaner and healthier future for the residents.



8. Economy

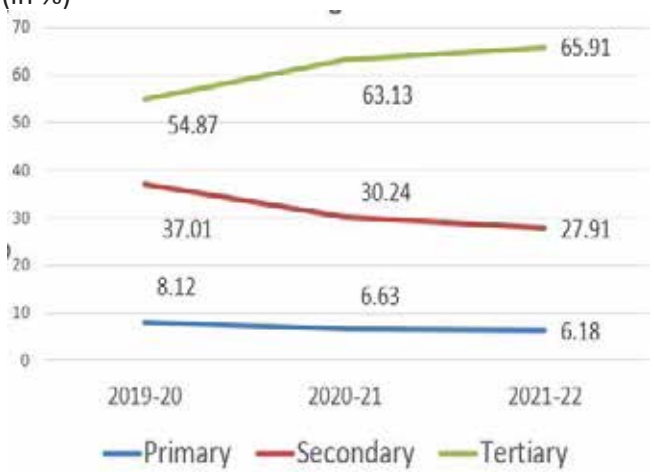
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Geeta Kumari 2022MURP008
Shubhi Agarwal 2022MURP009
Rupono Khuvung 2022MURP016
Nitin Rathee 2022MURP017
Akanksha Bhavsar 2022MURP018
Elisha 2022MURP020
Dhruvil Godhani 2022MURP027
Garvit Sharma 2022MURP029
Tarini Prasad 2022MURP034
Kshitij Bharti 2022MURP036

8. Overall Economy

Thrissur, the cultural capital of Kerala is a major South Indian business and commercial centre. It is home to many successful Malayali businessmen and is the center of Kerala's business acumen. It is Kerala's preferred investment destination and is known for its banking, business acumen, and gold production. The Golden City of India is another name for the city of Thrissur, producing 70% of Kerala's plain gold jewelry per day. The district is home to several industries, including textiles, wood, coir, fish, agricultural products, and tiles. However, the aforementioned sectors are not the sole sources of income. The districts economy of Thrissur is significantly influenced by the tourism sector.

In India we see the majority GDP contribution in 2021 is by the tertiary sector that is 53.89%. It is followed by the secondary sector at 25.92% and primary sector at 20.19%. Comparatively in Kerala from 2021-2022 we see GDP contribution of tertiary sector at 66%, secondary sector at 23% and primary sector at 12% and in Thrissur from 2021-2022 we see GDVA contribution ofteriary sector at 65.91%, secondary sector at 27.91% and primary sector at 6.18%. In national, state and district level we see the largest contribution in economy is by the tertiary sector, the primary sector is at a decline. At 2021-2022 GDVA, we see Thrissur contributing to 7.26% of Kerala's economy compared to Ernakulam contributing 8.81%. In 2007 the services sector contributed to 71% of Thrissur's GDP, followed by industries sector at 17% and agriculture sector at 12%. By 2012 the GDP contribution of tertiary sector was at 69%, secondary sector at 21% and primary sector at 10%. The tertiary sector has maintained an ever high while the primary sector contribution has reduced even further as seen in the 2022 GDVA contribution.

Figure 8.1 GDVA contribution of Sectors in Thrissur (in %)



Source: Department of Economy and Statistics, Kerala. 2019-2022

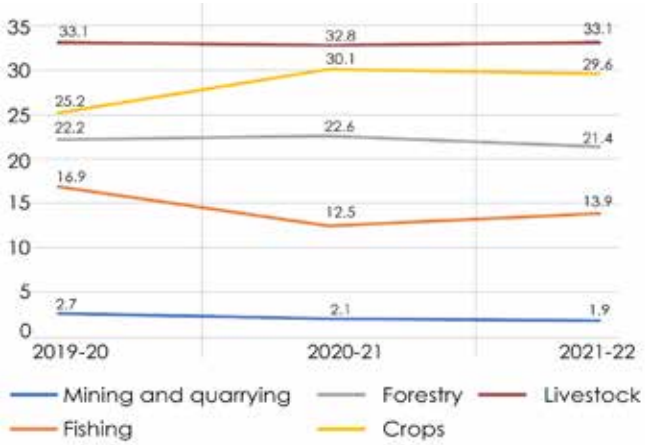
- **Primary economy**

As per Census 2011, from the total main workers, 17.62% are involved in the Primary sector from which 3.74% are cultivators, 5.87% are agricultural labourers, 7.44% are involved in activities like plantation, forestry, fishing and allied activities and 0.57% work in the mining and quarrying sector.

In the GDVA contribution of the primary sector of Thrissur district, crops and livestock have the maximum contribution, according to the Department of Economy and Statistics, Kerala. From the year 2019 to 2021, the percentage share of crops in GDVA has increased from 25.22% to 29.61%. The percentage share of livestock has increased from 33.10% to 33.14%. In 2019, the percentage share of Forestry and logging was 22.16% which reduced to 21.43% in 2021. Fishing and mining & quarrying has the minimum percentage share in the primary sector. The percentage share of fishing was 16.85% in 2019 which reduced to 13.91%. While, the percentage share of mining & quarrying reduced from 2.67% to 1.91%.

For the year 2020, the overall production of agriculture sector was 2,31,998 tonnes, whereas, the production of forestry and fishery sector was 52699 tonnes and 55,953 tonnes, respectively. Milk production, egg production and meat production come under the animal husbandry sector. 200 tonnes, 1617 lakhs and 46.15 tonnes were the production of milk, egg and meat, respectively. Forest materials production was 52,699 tonnes in 2020.

Figure 8.2 GDVA contribution of primary sector in Thrissur. (in %)



Source: Department of Economy and Statistics, Kerala 2019-2022

There are 2615 primary sector based manufacturing and service based industrial units and 9449 people are involved under these industrial units. In the district, there are total of six registered food grain storage warehouses, thirty-five government seed centers and forty-six registered horticulture nurseries available.

Table 8.1 No. of workers in primary sector

	Rural	Urban	Total	Percentage
Cultivators	22,692	12,099	34,791	3.74
Agricultural labourers	32,181	22,357	54,538	5.87
Plantation, Forestry, Fishing and allied activities	33,516	35,647	69,163	7.44
Mining and Quarrying	3,064	2,270	5,334	0.57
Total	91,453	72,373	1,63,826	17.62

Source : Census 2011

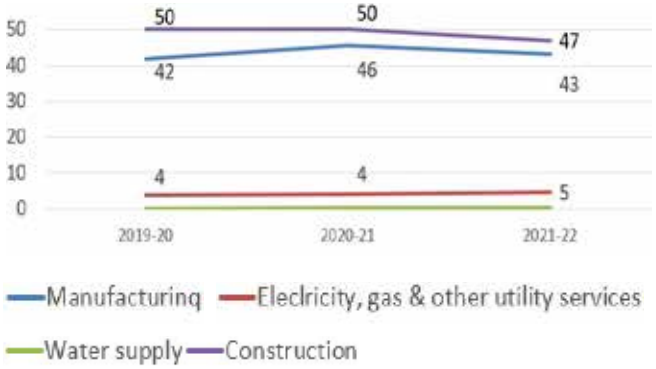
- **Secondary economy**

In the GDVA contribution of the secondary sector of Thrissur it was observed that the manufacturing and construction sectors have been at an all time high while the water supply sector and Electricity, gas & other utility services sector have been at an all time low. From 2019 – 2022 the GDVA contribution of manufacturing sector has gone from 42% to 43%, GDVA contribution of construction sector has gone from 50% to 47%, electricity, gas & other utility services sector has gone from 4% to 5% and the water supply sector has gone from 0.2% to 0.3%.

In 2022-2023 within 250 days Thrissur bagged the third place in the year of enterprises initiative of Government of Kerala. It bagged this position with 13,327 MSME units with an investment of 4.52 crore, 1120 crore turnover turn over generating 27928 employments. In 2022-2023 there have been 80 large scale industries in Thrissur with an investment of 474.44 crore generating 5615 employment opportunities. In 2019 the secondary sector contributed to 37% of Thrissur's GDVA. Today it contributes to 27.91% of Thrissur's GDVA.

While all industries have a potential of growth in Thrissur top 5 industries in terms of per unit turnover are paper products at 84 lakh per unit, general engineering & precision engineering (steel, iron products / fabrication) at 20 lakh per unit, gold industry with 41.9 lakh per unit,recycling, waste management at 19 lakh per unit and other manufacturing activities and building materials 11.3 lakh per unit . The handloom industry of Kerala and specifically Kuthampulli in Thrissur has been given the Geographical Indications tag by the government of India and the development of the same has been mentioned in the 2030 perspective plan of Thrissur. The percentage of Household industrial workers has dropped from 3% to 5% from 2001 – 2011 in Thrissur. According to GDVA of Kerala 2021-2022 Thrissur's secondary sector contributes to 10.62 of Kerala's secondary sector's GDVA.

Figure 8.3 GDVA contribution of secondary sector in Thrissur (in %)



Source: Department of Economy and Statistics, Kerala. 2019-2022

- **Tertiary economy**

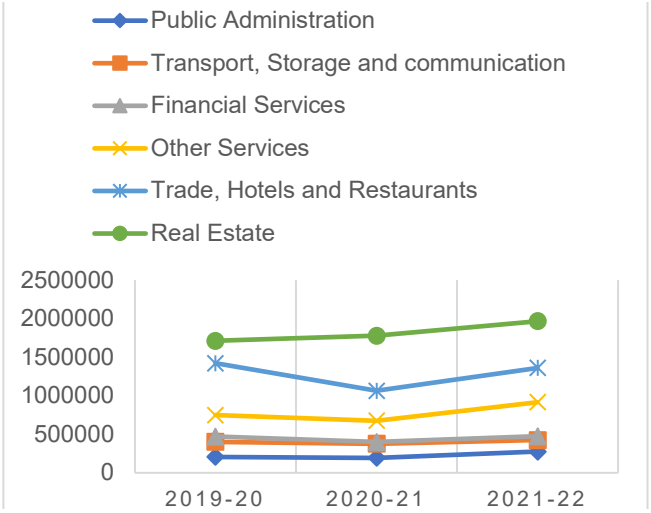
The sector with its most contribution towards the GDVA and GDP of the the district is the tertiary sector. As seen in the Figure 8.4, the GDVA contribution of different sections of the sector. Real Estate contributes to the most in the GDVA and from the trend it is observed that it is increasing its contirbution. The sector has potential to be grown even further with better job oppotunities in the IT sector.

8.1 Tertiary Sector analysis

8.1.1 Real estate

Real estate is the largest contributor to the GDVA of Thrissur district in the tertiary sector. When the trend of the tertiary sector is observed GDVA from the FY 2019-20, the

Figure 8.4 GDVA contribution of tertiary sector

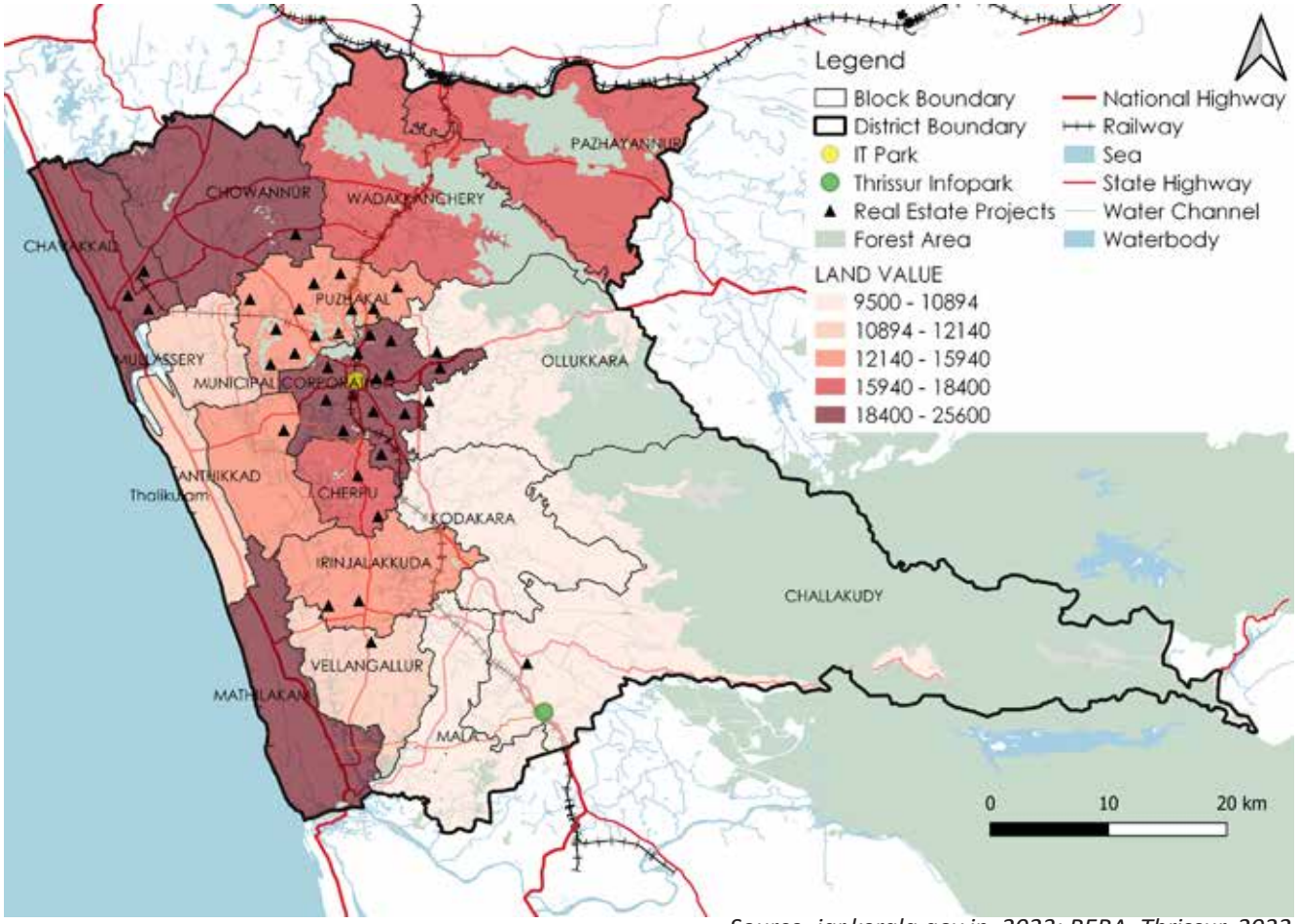


Source: Department of Economy and Statistics, Kerala, 2022

contribution of real estate in the Thrissur district. GDVA has been the highest contributor and the contribution through the three financial years has only increased. Real estate in Thrissur, Kerala, has seen rapid development in recent years, driven by the growing demand for housing and commercial spaces in the city. The real estate market in Thrissur offers a range of options for homebuyers and investors. There are several large-scale housing projects underway in the city, including gated communities, villas, and apartments. These housing projects offer modern amenities such as swimming pools, gyms, and recreational areas, making them attractive to buyers. Commercial real estate in Thrissur is also seeing rapid growth, with several new malls, hotels, and office complexes being built in the city. The growth of the commercial real estate sector is driven by the increasing demand for office and retail spaces, as well as the growth of the tourism industry in the region.

There are currently various projects that are constructed in the Thrissur Municipal Corporation and around it. The projects that are constructed and under construction are shown in the Figure 8.6. From the map it is observed that projects are concentrated in the TMC where the land value is the highest. Moreover, the blocks which have lesser land value are left empty in terms of real estate projects. Therefore, the reason for the same is analyzed and it was observed that there are various shortcomings in the blocks which have less land value (Figure 8.6). These shortcomings are few of the reasons people of Thrissur district are unwilling to invest in the real estate there. Real estate developers have been quick to capitalize on the growing demand for housing in Thrissur, and as a result, several housing complexes have been built in and around the Kole wetlands. This has caused a significant loss of wetland habitat, which has had a devastating impact on the biodiversity of the region. The wetlands serve as an important nesting and feeding ground for several species of birds and other wildlife, and the loss of their habitat has severely impacted their survival. Therefore, it is necessary for the The Kerala Conservation of Paddy Land and Wetland Act, 2008 to make some amendments in order to conserve the land and also for the Kerala Municipal Building Laws to levy heavy penalties on the builders who are degrading the land.

Figure 8.6 Land value and IT Sector of Thrissur



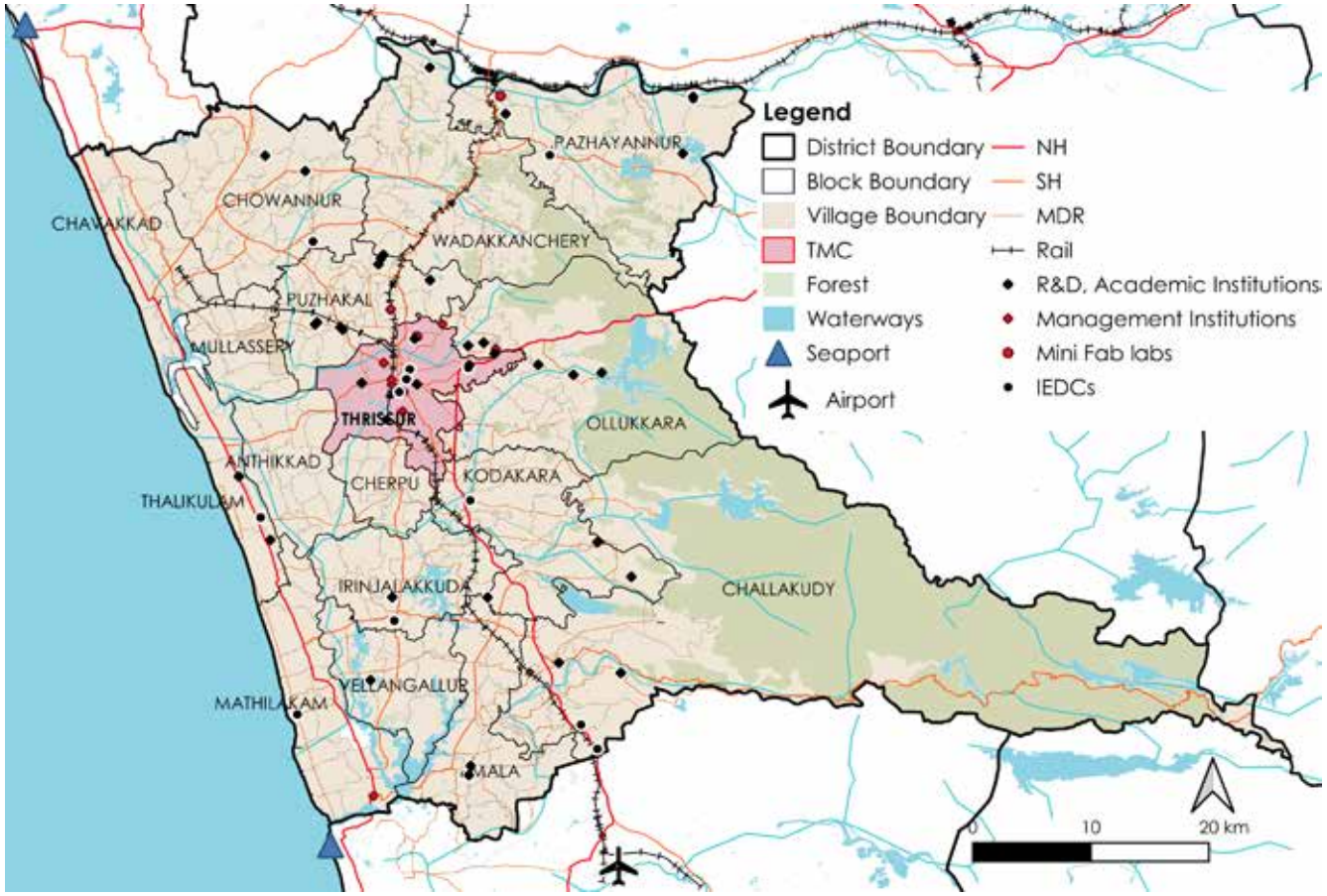
Source- igr.kerala.gov.in, 2023; RERA, Thrissur, 2022

8.1.2 IT Sector

Kerala's Information Technology (IT) industry has been a major factor in the state's economic growth. Recognizing the sector's potential and crucial importance, the state government has worked diligently to develop

the state's digital technology resources and capacities, including ICT projects, e-Governance initiatives, e-literacy programs, etc. The Kerala State Information Technology Mission (KSITM), Technopark, Infopark, Cyberpark, Kerala State Information Technology Infrastructure Ltd. (KSITIL), and other significant organizations play a significant role in the implementation and development of IT-related activities in the State. (Kerala State Planning Board, 2022). According to the state government, the IT sector will grow in the state in a way that will benefit each district. Infopark Thrissur is the first IT park as a spoke model under the hub (Infopark Kochi) in Kerala, which is situated in Koratty in the Mukundapuram Taluk of the Thrissur district. (Figure 8.6) The campus is advantageously positioned on the State's IT map in the middle of the two major cities, Kochi and Thrissur and there are 29 companies and 700 people employed. Also, there are 5 IT units under Kudumbashree in the district. Moreover, there is an IT Park in Thrissur M. Corp. with co-working spaces and has 66 employees but it is not functioning efficiently post-covid. The IT Sector in Thrissur is in hope to attract investments in emerging areas, expand existing firms, and create new firms, and not just rely on established IT activities.

Figure 8.7 R&D, Academic institutions, mini fab labs, IECDs in Thrissur



Source- KSUM Annual Report, 2021, Google Earth 2023

One of the essential challenges to address the growth in economy is the alarming scarcity of land and natural resources. Economic development and infrastructure are closely associated and neither of them can function solely. Thus, a common platform is needed to use the existing infrastructure, innovate new technological solutions for local, regional, and global issues, and generate economies to sustain cities and nations. The establishment of collaboration between academic institutions, environmentalists, industrial partners, startup companies, research and development institutions, local administrations, and entrepreneurs has a high potential for the growth of innovation and entrepreneurship. Figure 8.7 depicts research & development institutes, academic institutions, mini fab labs, innovation and Entrepreneurship Development Centres (IEDC) centers, etc. Thrissur, in the present scenario lacks such collaborations and has the capability of a network of interconnectedness to generate employment, inhibit migration, and promote entrepreneurship through science and technological innovation.

8.1.3 Tourism

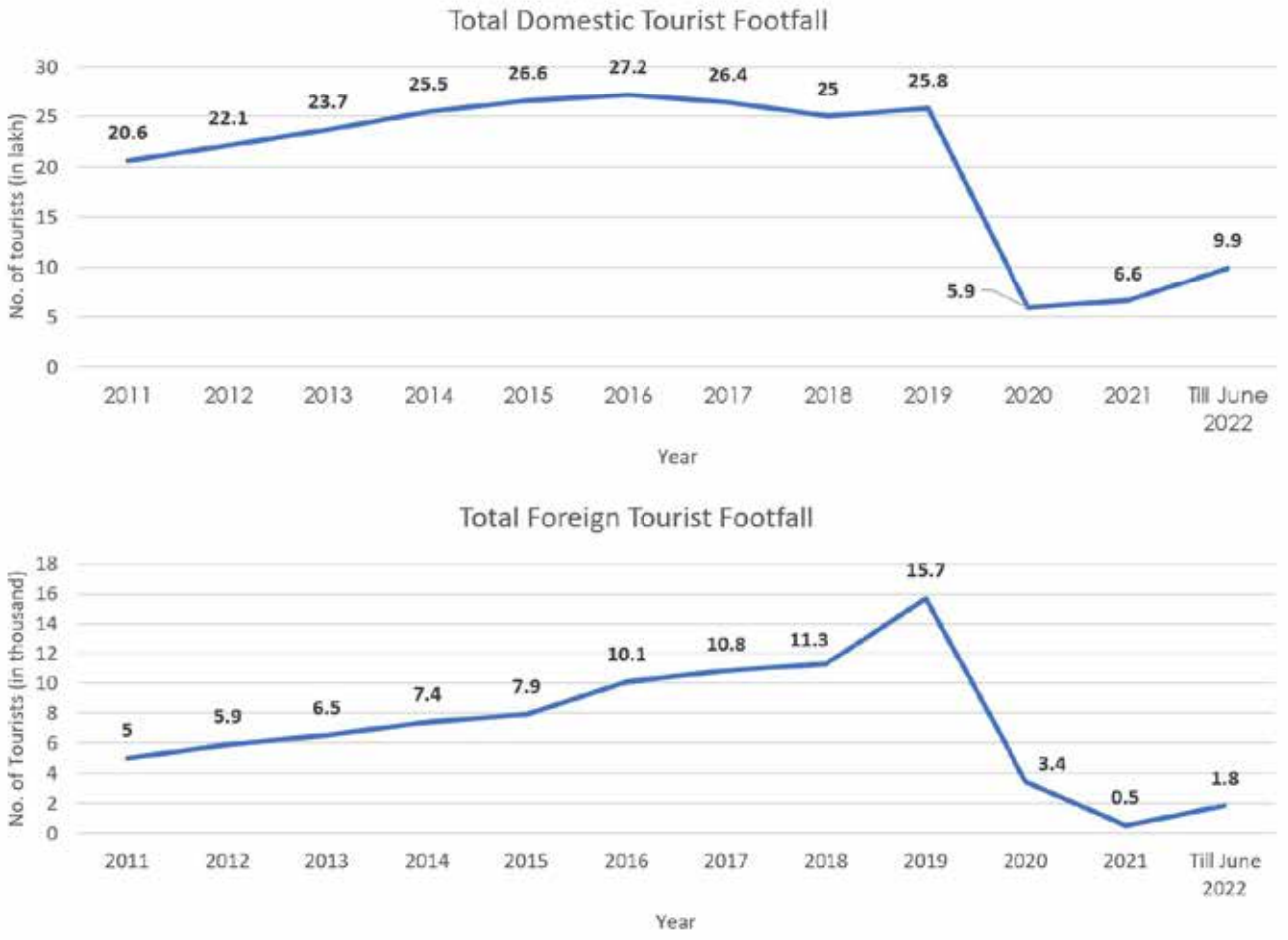
- **Existing Status of Tourism in Thrissur**

Nearly all of Kerala's districts have given the development of tourism a high priority

in terms of economic growth. Kerala State is promoting the industry in all of its varieties, including beach tourism, backwater tourism, eco-tourism, adventure tourism, heritage tourism, etc. The Thrissur district, which is referred to as Kerala's cultural capital and gets its name from the word "Thrissivaperoor," which means Lord Shiva's residence is home to a number of important cultural as well as other picturesque tourist destinations. The most well-known of Thrissur's festivals, "Thrissur Pooram", has given Kerala tourism a new look. Processions from 10 temples around the Vadakkunnathan Temple, separated into the Thiruvambady group and the Paramekkavu group, are part of the festivities.

Being in the center of Kerala, Thrissur is easily accessible from other districts. One of Kerala's most well-known tourist sites, Guruvayoor is located in the district. The United Nations World Tourism Organisation (UNWTO) has recognised Thrissur as a "Emerging Global Destination" at the 2019 Accessible Destination Awards, among other accomplishments. The PANTOU (Promoting Accessible Tourism throughout the World) network, based in Europe, awarded the Thrissur District Promotion Council the coveted designation of a listed supplier in 2018.

Figure 8.8 Domestic and Foreign Tourist Footfall in Thrissur



Source- Kerala Tourist Statistics 2011-2022

8.1.4 Tourism Influx data of Thrissur District

District-wise figures for foreign tourists visiting the state show that in 2021, about 79.82 % of the total foreign tourists and 47 percent of the total domestic tourists visited the central parts of Kerala, as compared to North and South Kerala. Thrissur ranked third in the most visited district in the state of Kerala after Ernakulam, and Thiruvananthapuram in the years 2020 and 2019, but the rank declined to 5th in 2021. As compared to total tourist arrivals in Kerala, the share of tourists in Thrissur decreased from 13.28% in 2019 to 11.09% in 2020 to 8.69% in 2021. Thus, depicting the decline of preference among tourists within the state, and preferring other districts over Thrissur. There is a need for a better tourism perspective plan to upgrade the sector and attract more tourists within the district for overall economic development. (Research and statistics division)

- **Domestic and Foreign Tourist Footfall**

Figure 8.8 shows that the foreign and domestic tourist arrivals in Thrissur had been increasing from 2011 till 2019 but experienced a

drastic decline in 2020 because of the pandemic situation, and are now on the pace for attracting more tourists. Also, the percentage share of domestic tourists is far more than the share of foreign tourists. The most contribution of tourists in Thrissur from other countries as per 2019 statistics include the UK followed by Germany and Malaysia.

- **Revenue generation from Tourism**

According to Kerala tourist statistics (2019), foreign exchange earnings of Thrissur district was Rs.135.46 crores which constituted around 1.31% of Kerala's earnings (Rs. 10,271.06 crores), while the total earnings of Thrissur district from Tourism was Rs. 4,464.8 crores which constituted 10.32% of Kerala's total earnings (Rs. 45,010.69) from tourism.

- **Agencies involved in the development of Tourism**

Various agencies are involved in the field of tourism for encouragement and promotion of Tourism. The Department of Tourism is the state-level body in formulating policies and guidelines for the promotion of Tourism. The Department of Tourism has three major functions, namely, Tourism Development, Hospitality Management of the State government, and Estate office duty. It is also involved in infrastructure and destination development in less developed areas of the state to attract others to invest in these areas. DTPC acts as a District level agency in promoting tourism in the district with the assistance of the Department of Tourism, and monitors and supervises the levels of sanitation in tourist areas. Kerala Tourism Development Corporation is actively participating in building up the infrastructure needed for the development of Tourism in the state. The Directorate of Eco-tourism is charged with the responsibility of developing and creating new eco-tourism destinations throughout Kerala.

- **Recent Policies and initiatives**

In 2017, Kerala Tourism policy came up under which the formation of the Kerala Tourism Regulatory Authority, PPP took place. The green carpet initiative, the first of its kind in the state came up in 2017, which aimed at building a sustainable destination management system in Kerala through participations and partnerships. There are 7 destinations in Thrissur identified under the initiative that include Snehatheeram Beach, Peechi Dam, Thumboormuzhi Dam and Butterfly Park, Vilangan Kunnu, Poomala, Vazhani dam and Athirappally. Also, under the Barrier free tourism initiative, 8 are in Thrissur. In 2021, Caravan Tourism Policy came up under which "Keravan Kerala" is developed on a PPP mode with private investors, tour operators and local communities-key stakeholders.

- **Existing Tourist Circuits**

With its cultural diversity and natural beauty, Thrissur, the cultural capital of Kerala, offers some of the most incredible travel circuits that attract all kinds of tourists. The District Tourism Promotion Council (DTPC), Thrissur, offers six one-day tourism circuit packages that guide an enthralling journey through the district's beautiful landscapes and rich history. The six circuits (Figure 8.9) include:

Blue Circuit- The Blue Circuit, referred to as Water Tourism which includes Thrissur-Vazhachal-Cheppara-Athirappilly-Thumboormuzhy-Munakkal Beach

Yellow Circuit- Yellow Circuit referred to as Cultural Tourism which includes Thrissur-Kerala Kalamandalam-Puppet Art Gallery-Thrissur Sakthan Thampuran Museum-Zoo Museum-Ayurveda Museum

Orange Circuit- Orange Circuit referred to as Heritage Tourism which includes Thrissur-Paravur Synagogue-Kottapuram Fort-Paliam Kovilakam-Paiam Nalukettu-Pattanam Excavation Center & Museum

Brown Circuit- Brown Circuit referred to as Dam Tourism which includes which includes Thrissur-Chimmony Dam-Peechi Dam-Vazhani Dam-Poomala Dam-Vilangankunnu

Green Circuit- Green Circuit referred to as Backwater Tourism which includes Thrissur-Chimmony Dam-Enamavu-Snehatheeram Beach

Red Circuit- Red Circuit referred to as Assorted Circuit Tourism Thrissur-Vilangankunnu-Vazhani Dam-Zoo and Museum Snehatheeram Beach

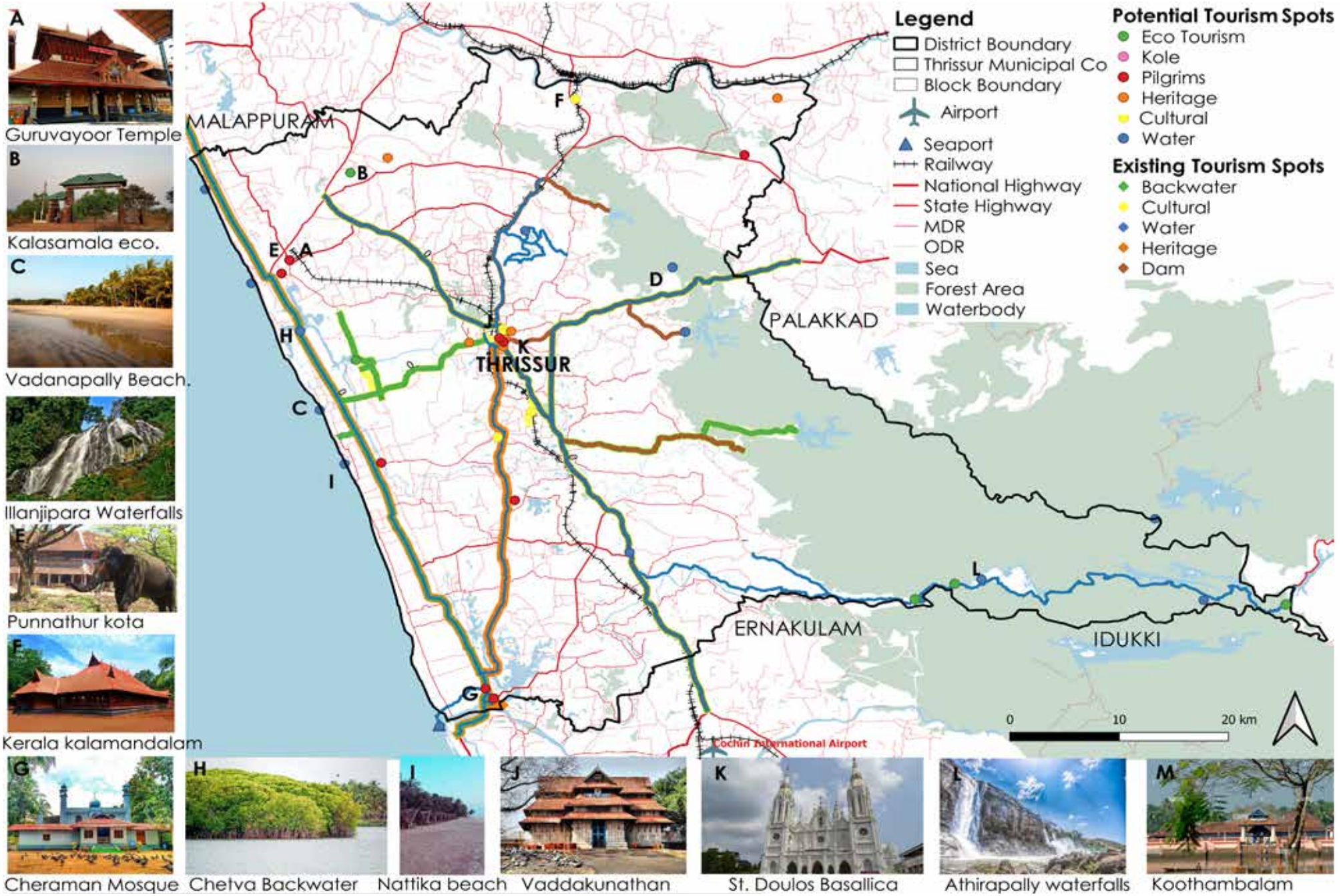
- **Tourism Typologies**

Thrissur district is a frontier of the state in terms of tourism products such as heritage, cultural, pilgrim, adventure, eco, kole and MICE tourism. The details of which are as follows:

- **Pilgrim Tourism**

The pilgrim tourism plays an important part in the Thrissur circuit and attracts a huge amount of tourism. The churches, mosques, and temples in Thrissur give one a sense of the spirit of pleasure, happiness, goodness, and inner

Figure 8.9 Existing Tourist Circuits with Potential Tourist Spots



Source- DTPC, Thrissur 2022

serenity. Pilgrim tourism consist of 12 important sites namely Vadakkunnathan Temple, Guruvayur Sri Krishna Temple, Cheraman Juma Mosque, Palayoor Church, Thriprayar Sree Rama Temple, Mammiyur Mahadeva Temple, Our Lady of Lourdes Church, Basilica of Our Lady of Dolours, Kanakamala Kurisumudi Church, Koodalmanikyam Temple, Sree Kurumba Bhagavathy Temple, Payammal Shathrughna Swamy Temple. Around 23 lakhs pilgrims visit Guruvayoor temple annually, making it one of the most-visited temples in Kerala. On average 25,000 to 40,000 people visit the temple on daily basis.The monthly revenue can go up to 4-5cr. The major issues faced by the pilgrim center is overcrowding and mismanagement and during the festive season as the footfall increases and the lack of Infrastructure worsen the condition.

Vadakkunnathan Temple, located in the center of Thrissur, stands out for its unique architecture made of wood and stone, as well as its stunning murals, elaborately carved wooden figures, and intricate woodworking. It was honored with the 'Award of Excellence' from UNESCO Asia-Pacific Awards for Cultural Heritage Conservation in recognition of its efforts to protect the building's architectural heritage. Every year, the temple is the site of the renowned Thrissur Pooram, known as the "festival of festivals" due to its grandeur, energy, and size.

The 11-day temple celebration, in November or December, features a 17-elephant parade at the Thriprayar Sree Rama Temple. A snake boat race takes place in August or September during the Onam fair. The Sakthan Thampuran bus stop has regular buses that go to Thriprayar. It is located beside the Periyar River which gives it a majestic location.

Also Kodungallur Bharani is the major festival grandly celebrated in the Sree Kurumba Bhagavathy Temple between the months of March and April. The temple is easily accessible from the nearby towns, cities and districts of Kerala. Nedumbassery International Airport in Cochin is the nearest airport to the temple and the nearest railway station is located at Irinjalakuda. The development of Pilgrim centers can be done under Devaswom board, Prashad scheme, etc.

Basilica of Our Lady of Dolours is renowned as the largest church in India. The church can accommodate up to 30,000 people. Every year in September, the Feast of St. Mary is held in the Puthen Pally, making it one of the most popular Marian pilgrim centers in Thrissur. Palayoor Church is the oldest church in India and one of the seven founded by St. Thomas the Apostle. Original small Church structure has been retained at the oldest site.

Cheraman Juma Mosque is the first and oldest mosque ever constructed in India, in Kodungallur, resembles a traditional Hindu temple. From the Table 8.2, it can be seen that the place lacks infrastructural facilities like signages, good food stalls and tourist information centers. Being a place of rich history and the above unique characteristics, the mosque is not very known among Indian tourists.

- **Heritage Tourism**

Several heritage sites and monuments within the district are not identified or protected by any heritage authority. There are very few structures which have been declared protected by the two authorities, Archaeological Survey of India and the State Department of Archaeology and Museums. The authorities involved in heritage tourism are DTPC, Government of Kerala, Muziris Heritage, INTACH and ASI. The major destinations include Shakthan Thampuran Palace, Kottappuram Muziris fort, KollamKode Palace, Alenghat Heritage, Kudakkallu Parambu, Appan Thampuran Memorial, Punarjani cave, Irattachira kovilakam and Sri Adi Shankara Samadhi.

At Cheramangad in Thrissur district lies a prehistoric megalithic burial site, known as Kudakkallu Parambu, home to 69 preserved monuments estimated to be over 4,000 years old. This is an example of Kerala's rich megalithic heritage and is widely regarded as one of the most important sites in the state. Punarjani cave, located in the Thiruvilwamala area of Thrissur District, is a 150-meter-long natural tunnel in a rocky cliff.

Kollengode Palace is a historical legacy of the Kollengode Dynasty, located in the central part of Thrissur district. The District Heritage Museum which was once the property of the Kollengode royalty, was taken over by the Department of Archaeology in 1975. Even after having such prosperous heritage value, the palace is amongst one of the less frequently visited tourist destinations in Thrissur.

For many years, Peruvanam palace had been neglected and became overgrown. However, prior to the Thrissur Pooram in May

2017, the palace was cleaned and provided as a rest house for the elephants taking part in the event. The palace can be used for other purposes during the remaining part of the year. It may be converted into a heritage hotel to give a nice experience to the tourists staying in the palace.

The Irattachira Kovilakam, built in the 17th century, was taken over by the Archaeological department. However, the 300-year-old structure has fallen into a state of dilapidation. There is a need to conserve this prestigious heritage building which has an important relation with the ancient ruler Shaktan Thampuran.

The Kottappuram Fort, also called Cranganore Fort, is presently in a state of disrepair. It is situated by the Periyar River in the Thrissur district and forms a part of the Muziris Heritage Project. Visitors can explore the neighboring Kottapuram market and the Cheraman Juma Masjid from the fort.

- **Cultural Tourism**

Art and culture of India are in a vast continuum which needs to be conserved and preserved. Cultural tourism has the potential to be promoted for their unique culture, art and craft and also as revenue generating sites or as tourist places. The district has rich, vast, and diverse cultural heritage in the form of built heritage and archaeological sites. The authorities involved in cultural tourism are DTPC and Government of Kerala. The major destinations include Kerala Kalamandalam, Archaeological Museum, Kerala Sangeet Natak Academy, Koothambalam and Peruvanam Palace.

Kerala Kalamandalam is an important

Table 8.2 Existing Infrastructure facilities at Tourist Destinations of Thrissur

		Physical Infrastructure					Social Infrastructure	
Sr.No.	Destinations	Signages	Public toilets	Drinking water	Dust bins / Waste facilities	Kiosks/cafeteria /tea stalls	Hotels	Tourist Information centres
1	Vilangan Hills							
2	Kalasamala Eco tourism village							
3	Enamavu Nehru Park							
4	Chimmini Wildlife							
5	Vadanapally Beach							
6	Munakkal beach							
7	Chavakkad Beach							
8	Nattika Beach							
9	Chettuva Backwaters							
10	Athirapally Waterfalls							
11	Vazhachal Waterfalls							
12	Thumboormoozhi Dam & Butterfly garden							
13	Peechi Dam & garden							
14	Poomala Dam							
15	Chimmony dam							
16	Vadakunnathan temple							
17	Guruvayur temple							
18	Cheraman Juma Masjid							
19	Thriprayar Sree Rama Temple							
20	Kodangallur Sree Kurumba Temple							
21	Pazhayannur Bhagavathy Temple							
22	Zoo Museum							
23	Peruvanam Palace							
24	Kudakallu Parambu							
25	Punarjani Cave							
26	Koothambalam							
27	Kerala kalamandalam							
28	Kerala Sangeet Natak Academy							
29	Kerala Sahitya Academy							
30	Muziris Kottapuram Fort							
31	Ayurveda Museum							
32	Appan Thampuran Museum							

Source- Primary Survey, 2023

academy of arts, also a deemed university for Art and Culture. Regular performances and classes take place here. The lack of funding is seen as the salaries are not being paid timely and there is a requirement of 13-15 crores annually.

Kerala Sangeet Natak Academy nourishes and encourages various forms of dance, music, drama and folk arts of Kerala. The Kerala Sangeet Natak Academy also supports the initiatives of those organizations whose programmes are oriented towards the conservation and sustenance of Kerala's cultural heritage.

The Koothambalam, a famous dance theater, located in Thrissur, is a unique traditional theater form of the region. This traditional art form has the potential to be an important part of Thrissur's cultural heritage. Koothambalam has the potential to bring together music, dance, theater, history, and culture from the region, while also providing an important source of income for local communities.

- **Water Tourism**

Being located on India's Malabar Coast, Kerala is home to a wide variety of beaches. In addition to having a significant cultural significance, the Thrissur district is blessed with a variety of beaches and backwaters. Chavakkad Beach, Munakkal Beach, Nattika Beach, Vadanappally Beach, Snehatheeram Beach, are just a few of them. Although these beaches are not particularly well-known or high on tourists' lists, as compared to other districts, their calm beauty is undeniably alluring. The authorities involved in water tourism are DTPC, Kerala Adventure Tourism Promotion Society (KATPS), Kerala Tourism Infrastructure Limited (KTIL), etc.

The Azhimukam, a captivating merging of the river and sea, makes Chavakkad Beach in Thrissur a renowned tourist destination. Chavakkad beach is becoming increasingly overcrowded due to the growing popularity of the beach as a tourist destination. This leads to overcrowding of the beach, leading to a decrease in the quality of the experience for visitors. The beach lacks basic amenities such as toilets, changing rooms, food outlets, and other facilities that are essential for a tourist destination. This results in visitors having to leave the beach area in search of basic amenities, which can be inconvenient and deter them from returning.

Chettuva Backwaters, situated 10 kilometers south of Guruvayoor, is home to a vast mangrove forest and a variety of migratory birds and islets. Boating is a popular activity in the area, with visitors able to hire small boats, motorboats, or houseboats for a leisurely tour of the Chettuva Lake.

Vadanappally Beach, situated roughly 17 km away from the Thrissur Railway Station, is lined with coconut trees and coral reefs. It is also connected to the backwaters and is accessible via NH166 and is also connected by many bus services from Thrissur. A beach festival known as Oruma is celebrated here. As it is less crowded and unexplored, tourists can enjoy the peaceful atmosphere and be close to nature. The best time to visit the beach is from October to February, when the weather is pleasant and the sea is calm.

Enamavu is a lesser-known beauty, situated around 20 km from Thrissur. Backwaters, lake, dam, hills and lush green fields add to the charm of this countryside. Paddy fields near the lake make for a picturesque view. A great way to experience the village and its surrounding area is by exploring a boat ride. Also, houseboats offer plenty of packages to the tourists like sunset cruises.

Munakkal Beach is the largest beach in the Thrissur district, with wide-ranging views of the sun, sea, and sand. As a component of the Tsunami rehabilitation plan, it was also revived. As it is big and can hold enough visitors, the beach can potentially be developed for night beach festivals as an entertainment package.

Nattika Beach, situated 55 kms from the international airport in Kochi and 32 kms from the center of Thrissur was primarily a fishing community beach and was formerly underutilized, until a popular Malayalam film was filmed there, did it become known. It has the potential to draw a sizable portion of tourists due to its distinctive character, but they are increasingly drawn to other beaches, such as Chavakkad, which is already experiencing pollution as a result of increased tourism activities. To equitably draw tourists, it is necessary to disperse the activities to relatively underused stretches like Nattika.

Eco-Tourism

The Western Ghats of Kerala along with Thrissur district, provides a natural advantage for development of Ecotourism. Thrissur being rich in biodiversity has a wide range of tourism resources such as backwaters, beaches, hill stations, pilgrimage centers, waterfalls, wildlife

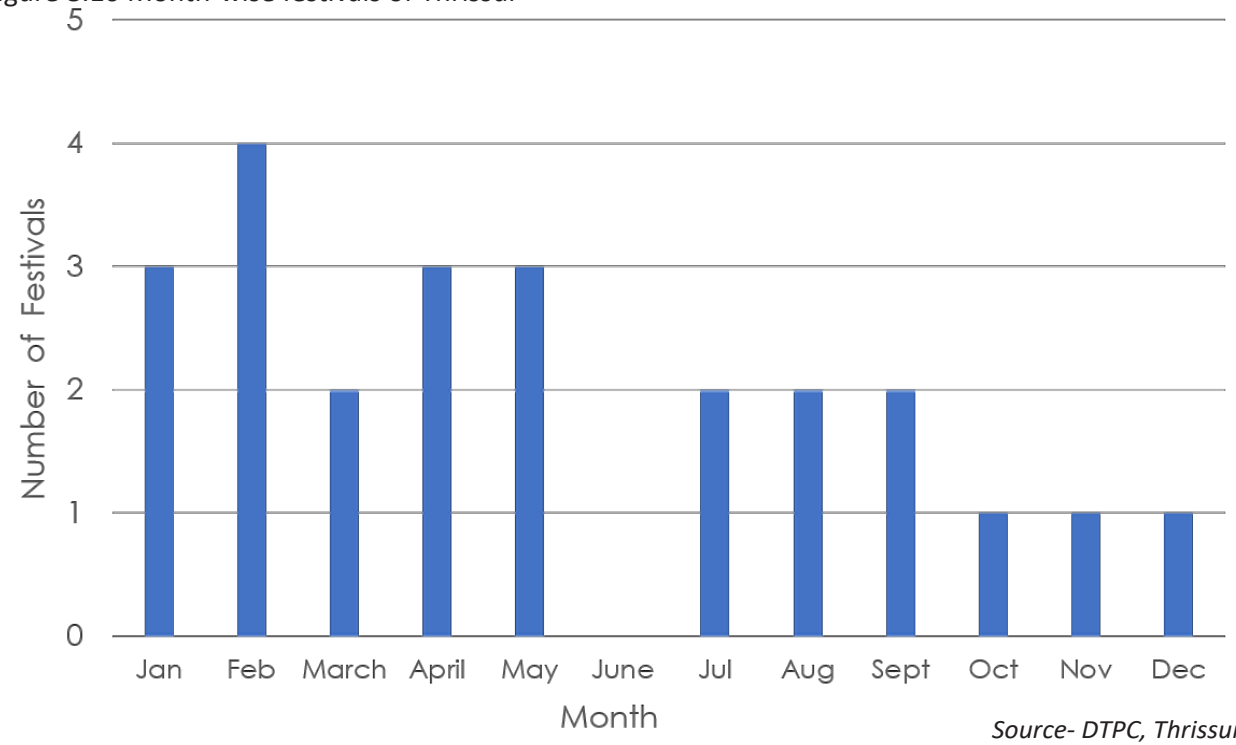
sanctuaries, historical places etc. The tourism department along with the Kerala Forest Department having DFO and VSS works together in management of eco-tourism spots. The Central Government has introduced ecotourism policy and guidelines as part of new tourism policy (2002) to pay special attention on promotion of natural forests.

Kalashamala, formerly a lush green hilltop in Kunnamkulam, now houses an ecotourism center and is recognized as one of the five biodiversity heritage sites in Kerala by the Kerala State Biodiversity Board (KSBB). The best time to visit Kalashamala is during the monsoons when the area transforms into a lush green expanse. With its new facilities and diverse offerings, Kalashamala promises to be a compelling destination for all types of visitors.

The Athirappily and Vazhachal waterfalls are the most popular eco-tourist spots with Athirapally being the largest waterfall in Kerala. it is regularly visited by tourists and is a popular choice among the tourists visiting Thrissur. Forest bathing and digital detoxing can be promoted in the area for tourists to visit here for experiencing wellness and therapeutic benefits. It is at a distance of 58.3 kms via NH-544 - SH-21 (Table 8.3) and takes approximately 74 minutes which is too long for tourists to travel, thus alternative routes need to be identified in order to have better connectivity.

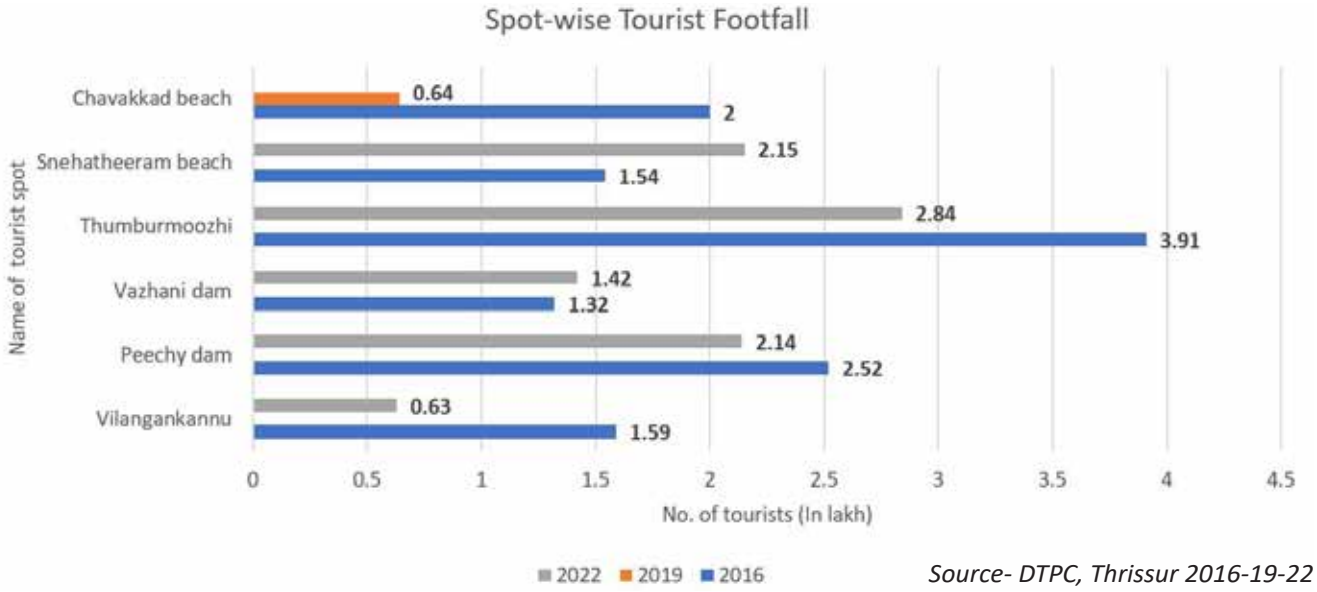
Thumboormuzhi, a massive dam built on the chalakudy river, has a hanging bridge which is another attraction. Despite having a distinctive tourist location and good infrastructure, the number of tourists decreased from 3.19 lakhs

Figure 8.10 Month-wise festivals of Thrissur



Source- DTPC, Thrissur 2022

Figure 8.11 Destination-wise tourist footfall of Thrissur



Source- DTPC, Thrissur 2016-19-22

in 2019 to 2.84 lakhs in 2022 (Figure 8.11). As a result, there is a pressing need to revitalise the tourist destination.

Ilanjippara waterfalls, is a lesser known but amazing cascade for the tourist to visit. Two waterfalls are situated here, which are one hour trek away from each other through the jungle. The best time to visit the place is during August, September, and October when the weather is pleasant.

- **Kole Wetland Tourism**

By offering a dawn to dusk tour that enables visitors to enjoy its wonders and learn about village life, the Kole lands, a low-lying area with alluvium deposits pushed down by rivers, have the potential to draw tourists. Bird watchers are drawn to the Pullu-Manakody kole land stretch by the variety of unique migrating species that congregate there during the season. In comparison to the Chilka Lake in Orissa and the Amipur Lake in Gujarat, which are ranked first and second, respectively, in terms of being an optimal habitat for migrating birds, this kole zone comes in third. So far, more than 250 varieties of birds have been spotted in these kole wetlands. For nesting and feeding, migratory birds travel from many places to this area. With their extensive greenery and profusion of birds and fish, the scenic Kole fields in Thrissur have the potential to become a popular tourist destination. Projects envisaged include boating, fishing, local farming, and cycling tours.

- **Responsible Tourism**

Responsible Tourism encompasses three key areas of responsibility, namely economic,

Table 8.3 Connectivity Analysis of tourist destinations in Thrissur

Sr.No.	Destinations	Distance from Thrissur Municipal Corporation (In km)	Connectivity	Time (In min.)	Alternate No. Of Routes to reach the Destination	Potential
1	Kalasamala Eco tourism village	25.7	SH-69	42	2	View points, Nature Based
2	Enamavu	18.9	SH-75	29	0	Lake view, Sports (Kayaking), Houseboats
3	Pazhayannur	45.7	NH-544 - SH-74	57	2	Handloom weaving, Village life experience
4	Vadanapally Beach	20.3	SH-75	30	0	Water sports (Jet Skiing), Beach Bazaars
5	Munakkal beach	46.8	SH-22	75	2	Fishing hamlet programmes, Night beach festivals, cruise connecting beaches
6	Chavakkad Beach	33.5	SH-75 - NH-66	46	2	Houseboats
7	Nattika Beach	25.7	SH-75 - NH-66	38	2	Water sports, Night beach festivals, Skill development center
8	Chettuva Backwaters	25.4	SH-75 - NH-66	35	1	Boating, Boat Race Festival
9	Illanjipara Waterfalls	0.3	Thrissur Mannamangalam Rd to Marottichal	35	1	Nature Walks
10	Athirapally Waterfalls	58.3	NH-544 - SH-21	74	1	Transformational retreat center (Forest bathing & digital detoxing), Jungle safaris, bamboo rafting, learning center
11	Vazhachal Waterfalls	63	High Road - NH-544 - SH-21	83	1	
12	Thumboormoozhi Dam & Butterfly garden	43.1	High Road - NH-544 - SH-21	54	1	
13	Vadakunnathan temple	0.7	Swaraj Round	2	0	Traditional Festivals, Fairs and Exhibitions
14	Guruvayur temple	26.4	SH-69 - Poovathur-Amala Nagar Road - Chavakkad-Kanjani Rd	44	2	Rejuvenation Of Guruvayur
15	Cheraman Juma Masjid	40	High Road - Ekaduni Road - SH-22	61	2	Facilitation & Interpretation center and rejuvenation of pond
16	Thriprayar Sree Rama Temple	22.4	SH-75 - Vatanappally - Kanjany - Thrissur Road	34	2	Sports like Boat Races and Multimedia Musical fountains
17	Kodangallur Sree Kurumba Temple	46.4	SH-51	65	2	Fairs and Exhibitions
18	Pazhayannur Bhagavathy Temple	42.7	Pazhayannur - Elanad Rd - NH-544	60	1	Traditional Festivals, Fairs and Exhibitions
19	Peruvanam Palace	12	SH22	22	2	Heritage Walk
20	Kudakallu Parambu	24.3	SH69	38	2	Heritage Walk
21	Punarjani Cave	49.9	NH544	65	2	Spiritual experience for visitors, cultural landmark
22	Koothambalam	0.45	Pradakshina Path	5	1	Dance and Music Festival
23	Kerala kalamandalam	28.9	Kodungallur - Shornur Rd and Premji Rd/Thrissur - Kunnamkulam Rd	36	2	Spaces for performing arts; performances
24	Kerala Sangeet Natak Academy	1.6	Kodungallur - Shornur Rd/Swaraj Round W	4	2	Traditional Dance Performances, Drama performances
25	Kerala Sahitya Academy	0.55	via Mahakavi Vyloppilli Sreedhara Menon Rd	7	2	Literature Festival, Educational programs and events, such as lectures
26	Muziris Kottapuram Fort	42.6	SH51	67	2	Boat Races and tours through heritage sites
27	Ayurveda Museum	9	SH69	15	2	Ayurvedic treatments
28	Archaeological Museum	5	Kodungallur - Shornur Rd/Swaraj Round W	2.4	2	Educational programs and events, such as lectures and workshops
29	Appan Thampuran Museum	0.6	SH22	7	2	Educate visitors on the history, culture and traditions

Source- Google Maps, Primary Survey, 2023

social, and environmental. Its aim is to mitigate any possible adverse impacts of tourism activities on the economy, environment, and local community. By doing so, it strives to enhance the economic benefits for the local population and promote their well-being. Moreover, it plays a vital role in safeguarding the world's natural and cultural heritage and preserving its richness and diversity.

Kuthampully village is famous for its traditional cotton-weaving, particularly for producing exquisite sarees. The village is renowned for its designer sarees that feature intricate prints of peacocks, flowers, Lord Krishna, elephants, and Kathakali, which add a touch of grace and charm. The majority of the residents belong to the Devanga community, with their roots tracing back to Karnataka.

- **Meetings, Incentives, Conferences & Exhibitions tourism (MICE) Tourism**

Tourism is one of the fastest growing industries in the world and has shown a significant growth in the past few decades. Among the various types of travel like business, leisure, medical, religious, education etc., business trips are emerging as a new trend in tourism. This has happened because people have started traveling worldwide to attend meetings, conferences, seminars, exhibitions. In short the MICE (Meetings, Incentives, Conferences and Exhibitions) component in tourism is also called the Meetings Industry. Thrissur is located in the exact geographic center of Kerala and the MICE industry has great scope and opportunity in Thrissur. The district would benefit by providing interesting combinations of accommodation and other conference support facilities to hold conferences, meetings, and exhibitions. Thrissur's MICE industry is impeded by various factors such as government policies, taxes, liquor laws, inadequate facilities during festivals, and a lack of support from the District Tourism Promotion Council

- **Hospitality**

The Department of Tourism, Government of Kerala, offers the details of accredited service providers in the state (Figure 8.12). Travelers can get information about accommodation facilities, Ayurveda centers, and tour operators in Thrissur, Kerala. For accommodation, the district offers a wide range of hotels, homestays, ayurveda centers, guest houses, lodges, serviced villas, resorts, and others. (Kerala State Planning Board, 2022). Many of these are located close to popular tourist attractions, such as the Vadakkunathan temple, the Archaeological Museum, and the Dolours Basilica.

The hotels vary in star rating and offer a range of amenities, from basic facilities to luxury amenities. The five-star hotels offer world-class amenities at competitive rates, while the four-star hotels provide mid-range facilities. Budget hotels offer comfortable accommodation at affordable rates. Some of the popular hotels in the area are the Hotel Elite, Joys Palace, and The Garuda Hotel. The district also has a number of homestays, which offer local experiences. Homestays in Thrissur provide a unique opportunity to experience the local culture and hospitality.

Homestays are available in both rural and urban areas of Thrissur. These homestays are often family-run and offer a more personal touch. These homestays offer comfortable accommodations and a chance to interact with the local people. Some of the popular homestays in the district are Alakananda Homestay, Anamala Homestay, and The White Palace. Thrissur has a number of resorts offering luxurious and comfortable accommodations. These resorts offer a variety of amenities such as swimming pools, spa facilities, and outdoor activities. The resorts provide a great opportunity to relax and unwind in the midst of nature.

In addition to the above-mentioned accommodation options, Thrissur also has a number of serviced apartments. These apartments offer the convenience of a hotel with the privacy of a home. Guest houses in Thrissur provide comfortable and economical accommodation. These guest houses offer basic amenities and a homely atmosphere. Most of them are located in the city center and offer easy access to the city's attractions.

Apartments in Thrissur are a great option for long-term stays. These apartments offer a range of facilities and amenities such as fully-equipped kitchens, laundry services, and parking spaces. The apartments are located in the city center and offer easy access to the city's attractions. Overall, Thrissur District offers a wide selection of accommodation options for travelers of all budgets. From budget hotels and resorts to luxury establishments and homestays, there is something for everyone. Whatever their preference, people find something to suit their needs in the district.

- **SWOC Analysis of Tourism Development**

Strength: Rich Heritage and culture,

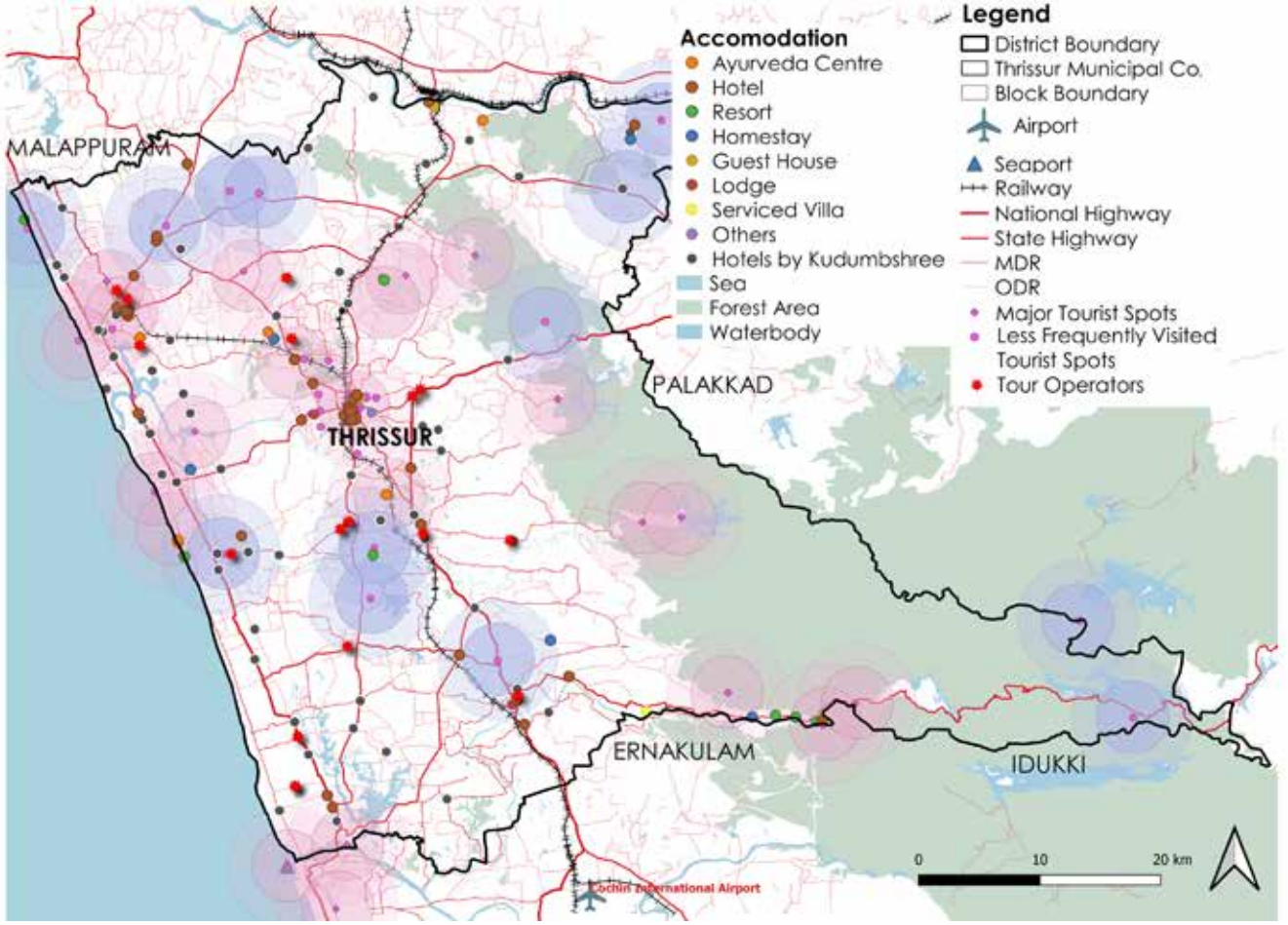
coastal stretch with serene beaches and back-waters, majestic waterfalls in the midst of the dense forest area.

Weakness: Lack of Government support, lack of better connectivity to many tourist destinations, lack of support from DTPC, inadequate infrastructure on many tourist destinations, lack of public awareness, lack of conservation, preservation and promotion of heritage and culture, lack of digital marketing.

Opportunities: Many destinations which have potential are unexplored, increasing interest among people regarding heritage and culture, potential product development for adventure tourism, platform for workcations.

Challenges: Many tourist spots are concentrated in one region which may lead to congestion, overcrowding etc., Forest boundations in Chalakudy, Crowd mis-management at major tourist destinations such as Guruvayur temple, inefficient Tourism Circuits, sharp decline in MICE sector, lack of funding.

Figure 8.12 Accomodation facilities in Thrissur



Source- Kerala Tourism Statistics, 2019

8.1.5 Markets

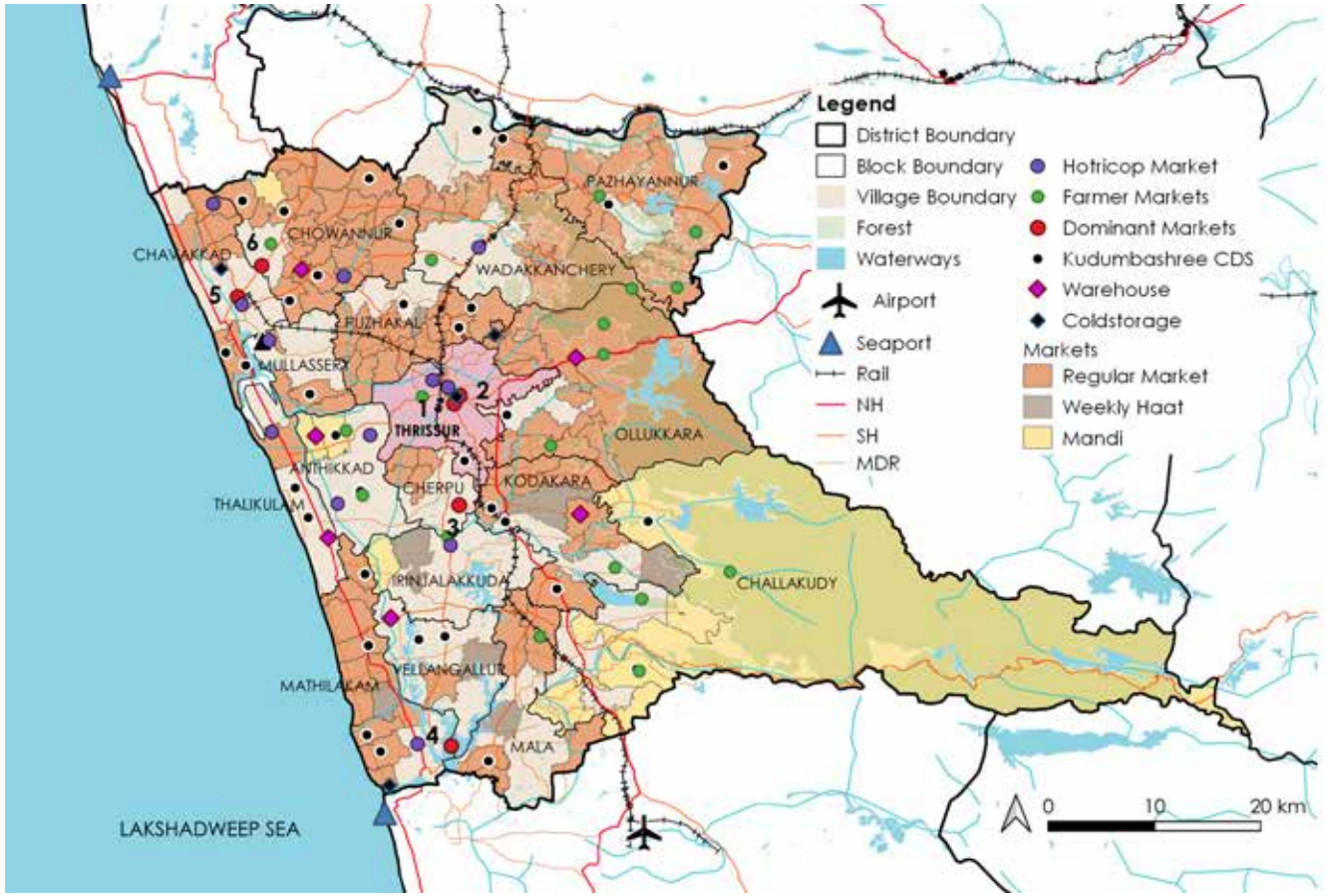
Due to the fact that trade and commercial activities make up the majority of the city's economy, Thrissur is well dependent on them. The city is regarded as one of the major commercial centers of southern India and a significant center for the production of jewellery in the region. The primary location for the jewellery industry is on High Road. The visionary king Sakthan Thampuran was responsible for Thrissur's development. He invited Christian families to the city to start trade and commerce activities, which laid the groundwork for the town's economic growth. A concentration of such activities predominated in this area, notably at Nayarangadi, Ariyangadi, & Erinjeriangadi, which aided in the rise of commercial activity in the city. Initially, a number of local markets appeared that ultimately evolved into wholesale marketplaces. Variety of tiles like roofing tiles, flooring tiles, and decorative tiles were previously distributed around the nation by the Thrissur tile factory. The main centers of the Tile Industry in the district were Karuvannur, Pududkkad, Ollur, and Amballur. But recently, the demand has been on the decrease due to the invasion of ceramic tiles, granites, and marble, and thus the units have shut themselves. Figure 8.13 shows the different types of markets in the district. Dominant markets are - 1) Sakthan Thampuran market one of the largest wholesale markets of Southern India and High road remains to be the hub of the Jewellery business; 2) Erinjeri angadi- Rice market; 3) Chevyoor- Wooden furniture market; 4) Kottapuram- Wholesale

grocery; 5) Chavakkad- Fish, vegetables, and fruits, etc; 6) Kunnamkulam- Stationary and tyre markets (Figure 8.13). The district is a hub of pilgrimage, tourism, and commodities like gold, stationary products, wholesale markets, etc, and thus has a high potential to market its products by using futuristic marketing solutions to a large extent.

Markets in Thrissur are only governed by the Panchayats, Municipalities, and Municipal Corporation and are not regulated by them. There are different co-operatives, Self-Help Groups, etc. regulating the various markets. For example- Agricultural markets are regulated by Farmer producer Organizations (FPOs), Farmer Co-Operative Societies, etc; Handicraft and handloom markets are regulated by Trichur Handicraft Industrial Co-Operative Society Limited (THIWCS), Cherpu Carpenters' Co-Operative Society, etc. According to Mission Antyodaya Survey, 2020, 62.7% of villages (137 out of 254 villages) have markets. The survey further describes that 85.92% of the markets are regular markets which sell all kinds of commodities like vegetables, fruits, grocery items, textiles, etc; 8.14% of the markets comprise Weekly haat which sells vegetables, fruits, and dairy items, etc; and only 5.94% of the markets comprise of the mandis (Mission Antyodaya, 2020). The absence of mandis in most of the markets is because of the absence of the Agricultural Produce Market Committee (APMC) Act which has not been enacted in Kerala.

The FPOs have the Vegetable and Fruit Promotion Regulation Council, Keralam (VFPRCK) which regulates the farmer markets; and Horticorp which regulates the stalls selling horticultural

Figure 8.13 Markets in Thrissur



Source-Agranet, Kudumbashree,Thrissur; VFPCK; Horticorp; Mission Antyodaya,2020; Vyapari Vyavasayi Udyog, Thrissur; APEDA Agri Exchange, CWS 2022

products. The Department of agriculture development and Farmers' Welfare run five District procurement cum marketing center, out of which, is Pavaratti, located in Thrissur district, and 6 wholesale agricultural markets in the state who are registered with National Agricultural Market (e-NAM). At present, the district does not comprise any e-NAM registered agricultural market which suggests that they lack in market intelligence system (Nair, 2021; Shibi, & Aithal, 2022). Though there is high agricultural produce of vegetables and fruits in the district, Chavakkad, Irinjalakkuda, Mathilakam, Mullassery, Puzhakkal, Thallikkulam, and Vellangallur lack farmer markets and Horticorp markets can rarely be seen in the district. Kudumbashree Community Development Societies (CDS) on the other hand is well distributed in the district with various types of products to sell in different markets and fairs. One of the initiatives by Kudumbashree, Vishu

fairs, bags the 3rd position in the state by making sales of Rs 40 lakhs in Thrissur which is envisaged to sell the organic vegetables produced by the Kudumbashree women farming groups (Joint Liability Groups-JLGs) and the products of micro-entrepreneurs (MEs). Kudumbashree products are also marketed through trade fairs organized by local bodies, Supplyco, and the Agriculture Department.

Table 8.4 depicts that the blocks Vellangallur, Puzhakkal, and Thalikulam have less access to a variety of markets like farmer markets, horticorp markets, etc. There are only 4 cold storages and 6 food grain warehouses in the district, depicting the lack of storage infrastructure for agricultural produce. The analysis further suggests that the development of markets and market-related infrastructure in several areas, including the modernization and renovation of the Department of Agriculture's wholesale markets, Local Self-Government Markets, the strengthening of Market Information and Market Intelligence Systems for Markets, Infrastructural for VFPCK Markets, Horticorp, and State Warehousing, can improve the marketing scenario, thus developing Thrissur's market infrastructure, and making Thrissur a commercially competitive district.

Table 8.4 Gap analysis of Markets in Thrissur

S.No.	Blocks/ M. Corp.	Weekly Market	Regular Market	Mandi	Farmer Market	Horticorp Market	Kudumbas-hree CDS	Facilities		
								Cold Storage	Ware-house	Supply-co Depots
1	Anthikkad			2	2	2	2		1	
2	Chalakkudy	1		7	3		2			
3	Chavakkad		6			2	2	1		1
4	Cherpu		4		1					
5	Chowannur		23	1	1	1	6		1	1
6	Irinjalakkuda	1		1		1				
7	Kodakara	2	7		1		3		1	
8	Mala	1	7		1		1			2
9	Mathilakam	1	11			1	4	1		1
10	Mullassery		4			1	1			
11	Ollukkara		9		4		1	1	1	
12	Pazhayannur		21		3		3			
13	Puzhakkal	1	12							1
14	Thalikkulam		1			1			1	
15	Vellangallur	1							1	
16	Wadakkanchery		11		1	1	1			2
17	Thrissur M. Corp.				1	2	1	1		

Source-Agranet, Kudumbashree,Thrissur; VFPCK; Horticorp; Mission Antyodaya,2020; Vyapari Vyavasayi Udyog, Thrissur; APEDA Agri Exchange, CWS 2022

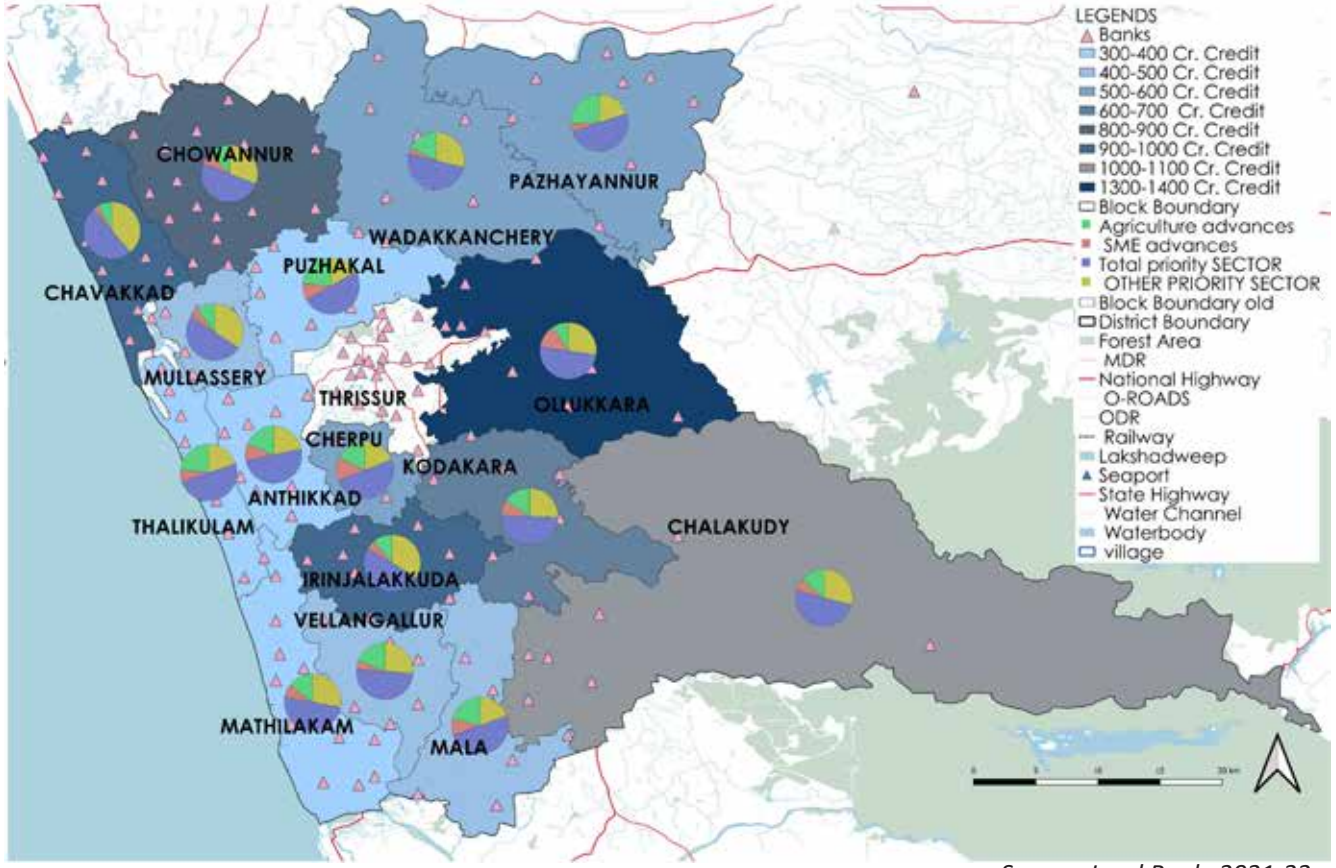
8.1.6 Economic Infrastructure- Banking & Finance

Major banks such as South Indian Bank, Catholic Syrian Bank, and Dhanalakshmi Bank have their headquarters in Thrissur District, Kerala State Financial Enterprise, and ESAF Microfinance and Investments. In Figure 8.9, we can see the share of different Scheduled commercial Banks: Public Sector Bank 30%, Regional Rural Bank 5%, Private Sector Commercial Banks 38% , Small Finance Banks 4%, Co-Operative Banks 23%. The rise of the Chit fund also contributed to the city's financial capabilities. According to the All Kerala Kuri Foreman's Association, Kerala has approximately 5,000 chit companies, with Thrissur District having the most at 3,000.

Figure 8.10 depicts the distribution of bank deposits in Thrissur District by block. According to the analysis of sector-wise contribution to deposits, the Blocks of Chalakudy, Pazhayannur, Wadakkanchery, and Kodakara are primarily agricultural-based. Cherpu and Puzhakkal Blocks have more potential for industrial development. The rest of the district's blocks have a mixed economy. Chavakkad, Irinjalakuda, Mathilakam, Mullassery, Vellangallur blocks have a significant number of NRIs.

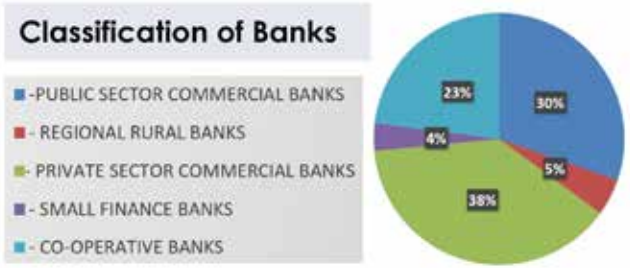
The District has never missed a target set under credit-linked, government-sponsored programmes such as SGSY, SJSRY, PMRY, REGP, PMEGP, and others. Furthermore, the financial

Figure 8.15 Block wise Location of Banks , And Distribution of Credit Plans in Different Sectors 2020; Vyapari Vyavasayi Udyog, Thrissur; APEDA Agri Exchange, CWS



Source- Lead Bank, 2021-22

Figure 8.14 Classification of Banks



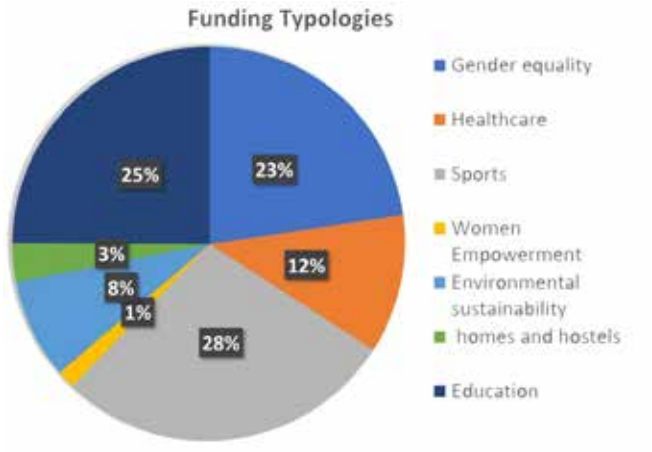
Source- Lead Bank, 2021-22

sector is providing extensive assistance in the implementation of Food Security Schemes such as Milk Shed Development Programme, Pasugramam, Integrated Livestock Development Project, self-employment schemes such as KESRU, Multipurpose services centre, and job clubs, SCA to SCP, Block Panchayat-specific schemes, financial assistance to Kudumbasree NHGs, SHGs, and so on. The Scheduled Commercial Banks in Thrissur District, which have more than 50% of private sector bank branches, have always taken an active role in shaping the next generation, through educational loans, promoting collective activity through NHGs, extending Microcredit through Microfinance Institutions / NGOs, hassle-free Kissan credit cards, and so on. Figure 8.12 shows RAM Credit (Retail, Agriculture, MSME, Corporate & other Credits).

The participation of the Cooperatives in EMS Housing Scheme and extending top-up loans for IAY Home construction by Scheduled Commercial Banks under DRI scheme are the schemes associated with the government in the Housing sector. The role played by NBFCs, Non-Governmental Organizations, Housing Finance Companies, Private Chit Funds, etc., in the District's economic development is significant. Asset management is one of the most important tasks on the financial sector's agenda. In Asset Management, each institution adheres to its corporate methodology. The District Administration and Line Departments' support for the recovery of overdue payments to the finance sector through persuasion, revenue recovery, and the SARFAESI Act is remarkable. In accordance with local demand and corporate vision, the finance sector is also a partner in non-financial areas as part of the Social Banking Activities. Banks participate in trade shows, youth and sports festivals organised by PRIs, State Government Cultural Fests, Mazhapolima, a District administration well-recharging scheme, exhibitions, and other events. The finance subcommittee also examines the allocation and utilisation of funds by various government departments and LSGIs.

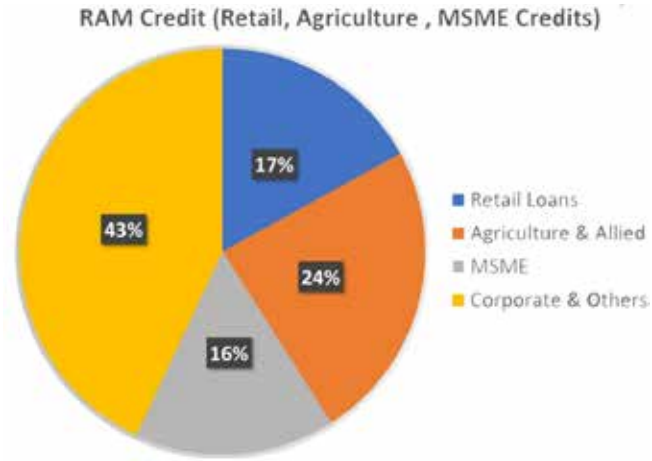
In analysing the performance of credit delivery promotion activities, various Line Departments of GOK and GOI have been identified as promoting credit delivery directly or indirectly. These departments include the Department of

Figure 8.16 Funding Typologies



Source- Lead Bank, 2021-22

Figure 8.17 RAM Credit (Retail,Agri.,MSME & Others)



Source- Lead Bank, 2021-22

Agriculture, Department of Animal Husbandry, Dairy Development Department, Department of Fisheries, Department of Industries and Commerce, Department of Water Resources, Rural Development Department, Local Self Government Department, Groundwater Department, and SC Development Department. We can see in Budget shown Block wise in Figure 8.13 the share of different Primary, secondary and tertiary sectors.

In addition, several bodies have been identified as being involved in credit promotion, including the Poverty Alleviation Unit, Local Self Government Institutions, Poverty Eradication Mission, District Industries Centre, Khadi and Village Industries Board, khadi and illage Industries commission, department of Sericulture, Rubber Board, District Employment Exchange, KSDC for SC/ST, and VFPCK. Figure 8.11 shows the insights into the funding in sectors used by banks to fund their operations and activities.

To ensure a balanced approach to the development of various sectors, particularly on the production side, a provision that strengthens product marketing is required to complete the cash-to-cash cycle. As a consumer state, the state provides an excellent marketing network for domestic products. However, because the cost of production is high due to the high cost of land, labour, and capital, the quality and price must be competitive.

8.1.7 Opportunities

The first opportunity is in the banking sector. The current CD ratio of 61% suggests that there is plenty of room for aggressive lending. This allows banks to lend more money to businesses and individuals, potentially stimulating economic activity and growth. The second opportunity is in the manufacturing and service industries. Both sectors are expanding, and there is optimism for future growth in areas such as the environment, social, and financial sectors. This implies that businesses in these areas may benefit from increased investment and support to help them grow and develop further.

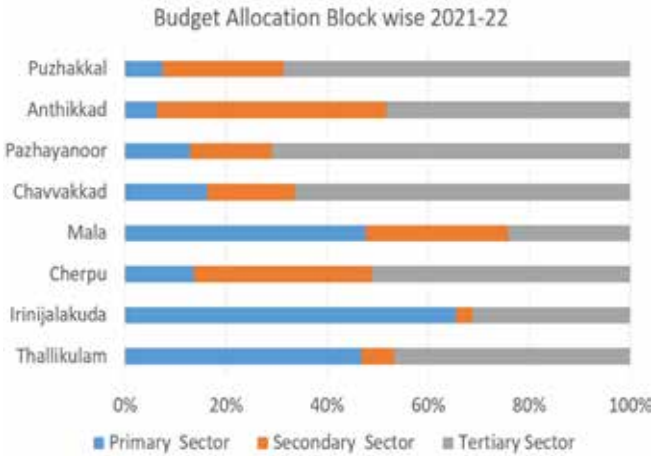
The allocation of budget in each sector depends on various factors such as government policies, economic conditions, and the needs of the community. Figure 8.13 showing the budget allocation in different schemes that comes under Primary/Secondary/Tertiary Sector providing the information of blocks getting the budget allocation in sectors. Finally, the identification of start-up funding as a key segment for accelerated growth creates an additional opportunity. Start-ups have the potential to develop new products, services, and ideas that can help the economy grow and develop. As a result, providing adequate funding and support to new businesses can help them grow and prosper, resulting in job creation and economic prosperity.

These opportunities indicate a bright future for economic growth and development. It is possible to stimulate economic growth and promote prosperity in various sectors by leveraging these opportunities and providing adequate support and investment. As a result, it may be worthwhile for businesses, investors, and policymakers to consider these opportunities when making decisions.

Figure 8.10 shows the contribution of various sectors to the district's deposits. Chalakkudy, Pazhayannur, Wadakkanchery, and Kodakara Blocks are primarily agricultural, whereas Cherpu and Puzhakkal Blocks have the potential for industrial growth. The district's remaining blocks have a mixed economy. Wadakkanchery Block has the potential to grow in the service sector. Furthermore, the Chavakkad, Irinjalakkuda, Mathilakam, Mullassery, and Vellangallur Blocks have a high concentration of NRI deposits. This analysis highlights the sectors' strengths and opportunities in each Block, which

can aid in the development of policies to promote economic growth in the district.

Figure 8.18 Block wise Budget Allocated (2021-22)

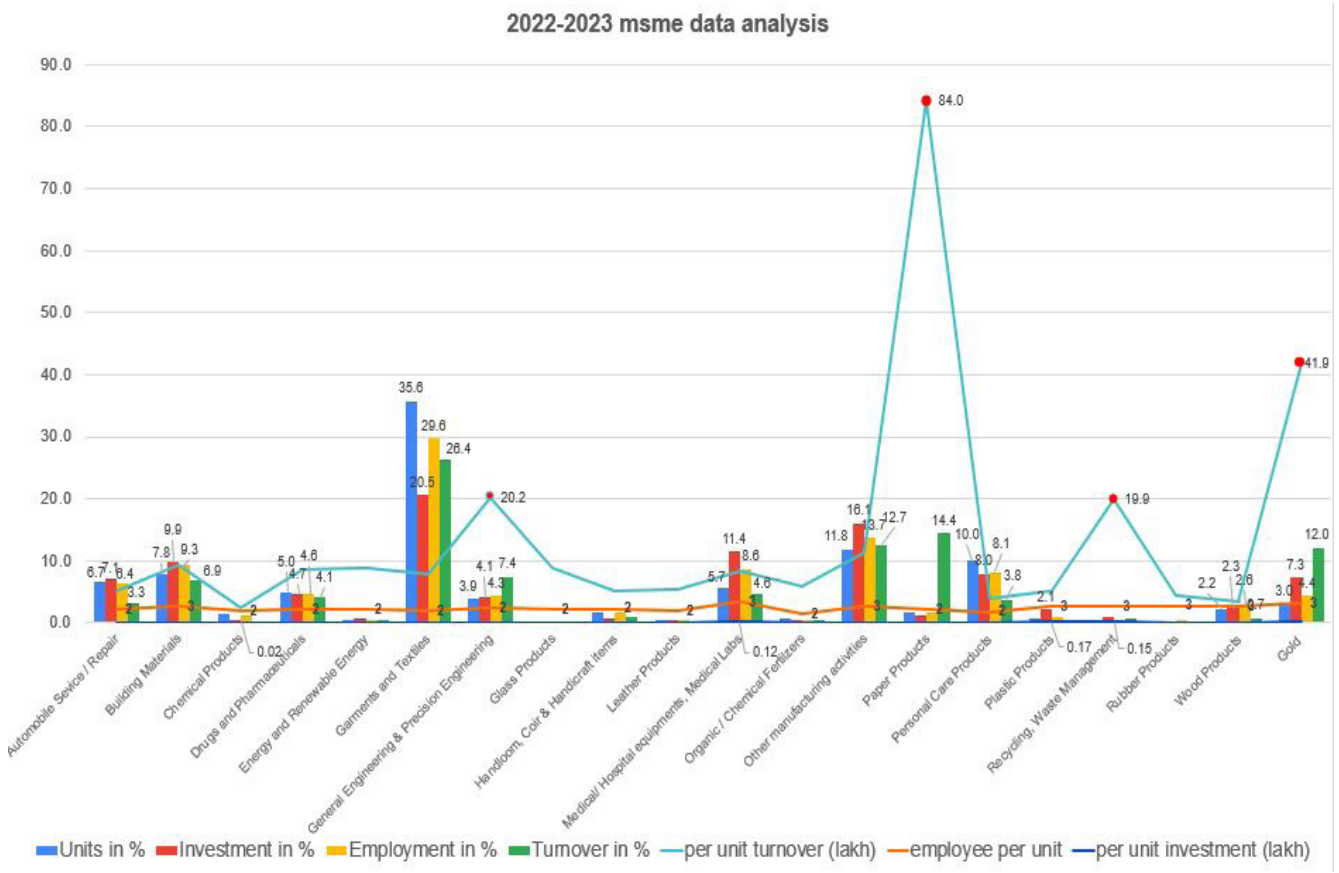


Source- Blockwise Budget Report, 2021-22

8.2 Secondary Sector analysis

The district of Thrissur, which houses the second-highest number of small businesses, is the state of Kerala's cultural capital and a significant contributor to the economic growth of the small business sector. In the district, employment in industry, trade, and related occupations is prioritized. With the inauguration of Poonkunnal Sitaram Mill, a Thrissur city industrial sector, Thrissur's climb to industrial prominence began in 1902. The key industries of Thrissur are gold trade, furniture production, Kuthampulli handloom known for traditional khadi weaving, note book making, plastic based firms, and agro food processing. In 2022-2023 within 250 days Thrissur bagged the third place in the year of enterprises initiative of Government of Kerala with 13,327 MSME units with an investment of 4.52 crore, 1120 crore turnover turn over generating 27,928 employments. In 2022-2023 there are also 80 large scale industries in Thrissur with an investment of 474.44 crore generating 5615 employment opportunities. There are now 13,327 small scale industrial firms operating in the district that are registered. 16.88% of these units work primarily in the agro-food processing industry. There are now 2249 units operating in this sector. Handloom, garments, and Textiles units are 1560 in number. Other manufacturing activities have 491 units. Building Materials, Construction, Architecture, Structural Designing have 327 units. Automobile Service / Repair has 278 units. In addition, traditional industries like those connected to coir, handloom associations, ceramics studios, and handicraft businesses are active. Six industrial estates in the region are home to 212 industrial businesses. There are 125 units running in 11 small industrial parks. 49 of the district's 191 cooperative societies that have been registered are still active. The highest concentration of MSME units in 2022-2023 is in Thrissur Municipal Corporation, Chalakuddy and Chowwannur. The highest concentration of MSME units' employment in 2022-2023 is in Thrissur Municipal Corporation. The highest concentration of manufacturing units in 2022-2023 is in Mala and Thalikulam block. The

Figure 8.19 2022-2023 MSME industries analysis



Source : District Industries center, Thrissur, MSME 2022-2023

highest concentration of service units in 2022-2023 is in Chowwannur and Thalikulam block.

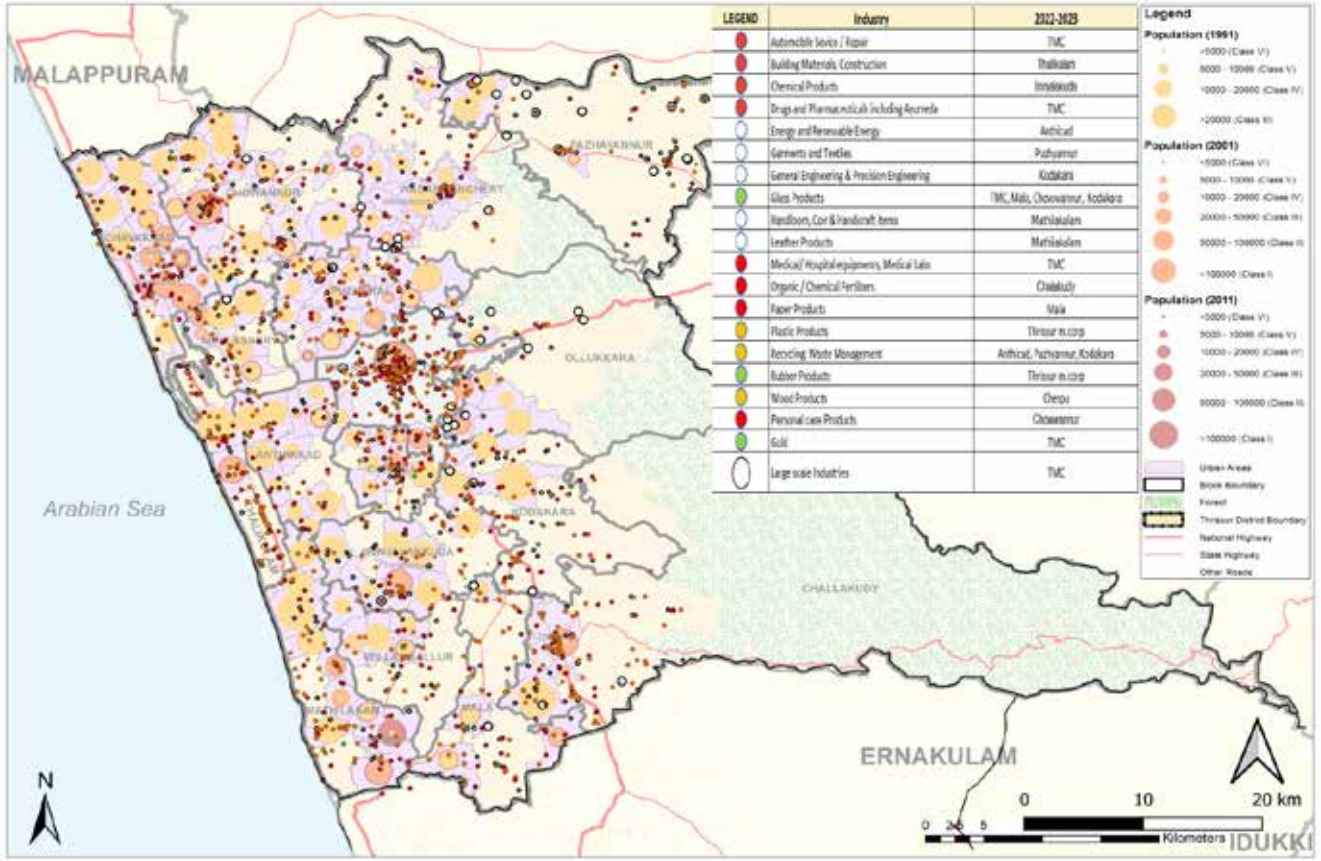
8.2.1 Handloom garments

One of the important traditional businesses located in the Thrissur District is handloom. Under MSME 2022-2023 garments and textiles, tailoring, boutique, apparel designing, ornaments there are 1489 units with 52.7 lakh investment, generating 2760 employment, 11.58 crore turnover. Per unit investment is 0.04 lakh, per unit employee is 2, per unit turnover is 7.8 lakh. In the Handloom, Coir & Handicraft items section there are 71 units with 2.20 lakh investment, generating 164 employment, 0.37 crore turnover. Per unit investment is 0.03 lakh, per unit employee is 2, per unit turnover is 5.3 lakh. In garments and textiles Puzhyannur, Thrissur Municipal corporation, Chowwannur blocks had the maximum concentration of units. In Handloom, coir & handicraft items sector Mathilakalam, Puzhyannur, Chowwannur blocks have the highest concentration. The cooperative sector is primarily responsible for this business. Thiruvilwamala Grama Panchayat contains most of the weavers communities. 4 of the 12 active working teams are in the Kuthampulli area. In Kuthampulli and the surrounding regions, there are about 228 private product branches operating in addition to cooperative societies. Sales at Kuthampulli total 150 lakhs rupees annually. The Khadi sector of the district's spinning and weaving industries employ 350 people. The handloom industry is currently on the brink of collapse. A labourer makes between Rs 125 and Rs 350 per day. As a result, a portion of the current workforce and members of the new generation avoid the profession because the pay is unfair. Raw materials are imported into the handloom industry from other states, including Tamil Nadu. Since this area has not yet been mechanised the output declines. The employees' workload is getting heavier.The absence of products connected to desining and furnishing that are exportable is a significant issue in the handloom industry. The fact that the fabrics made in the handloom industry are also made in powerlooms and sold at extremely low prices, which has an impact on the marketing of handlooms, is a very significant issue.

8.2.2 Wood Industry

The biggest concentration is found in Porathissery Grama Panchayat in 2011, far above the second highest in Thrissur Municipal Corporation. Under MSME 2022-2023 leather products there are 92 units with 6.01 lakh investment, generating 245 employment, 0.30 crore turnover. Per unit investment is 0.07 lakh, per unit employee is 3, per unit turnover is 3.4 lakh. In 2022-2023 Cherpu, Chowwannur and Puzhyannur block have the highest concentration.

Figure 8.20 Location of industries 2022-2023 MSME Units and large scale industries locations.



Source : District Industries center, Thrissur, MSME 2022-2023

8.2.3 Rubber Industry

In 2011 Thrissur Municipal Corporation has maximum concentration, way above the next highest in Kaiparambu Grama Panchayat. It is seen that concentration of Rubber based units are nil in 54 Grama Panchayats. This industry has a low demand from the market. Under MSME 2022-2023 leather products there are 13 units with 0.77 lakh investment, generating 36 employment, 0.05 crore turnover. Per unit investment is 0.06 lakh, per unit employee is 3, per unit turnover is 4.4 lakh. In 2022-2023 the highest concentration of MSME units is in Thrissur Municipal corporation and Kodakara block.

8.2.4 Leather Industry

The district's industrial growth is aided by Tamil Nadu's proximity in terms of leather and rexine products. Even though the district has access to indigenous raw materials, Tamil Nadu also provides leather. There is a big market for leather goods. Under MSME 2022-2023 leather products there are 23 units with 1.15 lakh investment, generating 45 employment, 0.12 crore turnover. Per unit investment is 0.05 lakh, per unit employee is 2, per unit turnover is 5.4 lakh. In 2022-2023 the highest concentration of MSME units is in Cherpu, Chowwannur and Wadakkancherry block.

8.2.5 Paper Industry

There are many factors contributing to the daily rise in demand for paper products. The market value of paper and paper products is rising. The use of contemporary marketing technology should be considered. With the arrival of computers in many businesses, the district is seeing a rise in demand for computer stationery and other products such disposable paper plates, paper cups, covers, etc. These paper products are popular because they are environmentally friendly. Manufacturing facilities for sanitary napkins should be established. The demand for paper and paper products increased along with the growth in the number of educational institutions. Under MSME 2022-2023 paper products there are 75 units with 3.15 lakh investment, generating 168 employment, 6.30 crore turnover. Per unit investment is 0.04 lakh, per unit employee is 2, per unit turnover is 84 lakhs. This section in MSME has the highest turnover per unit. In 2022-2023 Mala, Puzhakkal blocks had the highest concentration of MSME Units.

8.2.6 Building Material and Construction Industry

This industry has seen growth over the years and currently has a maximum number of industries located in the Thrissur M.Corp followed by Kodakara and Chowannur. The building Material and Construction industry includes manufacturing industries of bricks, cement, tiles, doors, etc along with service industries including Architecture Consultancy, Structural Designing, Interior Designing, Civil Works, Welding Work, Painting Works, etc. This industry has seen more Service sector than the manufacturing sector for the year 2023. This sector is ranked 5th for per unit turnover of 9.2 lakhs per unit with 3 employee requirements per unit.

The construction industry is India's second-largest employer, the country's second-largest FDI recipient sector in 2020-21, and the world's third-largest construction market by 2025.

The construction sector contributes 9% of India's GDP. In the previous five years, the construction sector, as a component of manufacturing, contributed an average of 8% to the overall Gross Value Added (GVA). The cement industry is the third largest source of industrial air pollution, including sulphur dioxide, nitrogen oxides (NOx), and carbon monoxide. Despite the installation of pollution control systems, many cement companies' emissions remain high. Periodically, there are reports about cement companies spending tens of lakhs if not millions, of rupees in fines or even shutting down factories for violating pollution guidelines.

Thalikulam, Irinjalakuda, and Thrissur M.Corp blocks are the top three units for building material construction, architectural, and structural design. Chowannur is the services block for the construction sector, Mala block is for manufacturing, and Chowannur is for construction employment.

8.2.7 Glass Product Industry

Glass Product Industry has seen a decline over the years. This industry includes the service sector of optical services, glass works and the manufacturing industry of glass cabins, aquariums, and glass bottles. It includes more manufacturing industries over the service sector and has the maximum number of industries located in Thrissur M. Corp, Kodakara, Chowannur and Mala. This sector is ranked 6th

Table 8.5 Yearly block wise concentration of MSME units

LEGEND	Industry	2022-2023	2019	2018	2017	2016	2015
	Automobile Sevice / Repair	TMC	TMC				
	Building Materials, Construction	Thalikulam	Thalikulam	Mathilakam	Irinjalakuda	Mala	Kodakara
	Chemical Products	Irinjalakuda	Irinjalakuda				
	Drugs and Pharmaceuticals including Ayurveda	TMC					
	Energy and Renewable Energy	Anthicad	Anthicad				
	Garments and Textiles	Puzhyannur	Chavvakkad	Chavvakkad	Mullassery	Chavvakkad	Chavvakkad
	General Engineering & Precision Engineering	Kodakara	Kodakara				
	Glass Products	TMC, Mala, Chowwannur, Kodakara	Chowwannur	TMC	Irinjalakuda	Mala	Chowwannur
	Handloom, Coir & Handicraft items	Mathilakalam	Chavvakkad	Chavvakkad	Chavvakkad	Chavvakkad	Mullassery
	Leather Products	Mathilakalam		Chavvakkad	Mullassery		Chavvakkad
	Medical/ Hospital equipments, Medical Labs	TMC	Cherpu	Cherpu			
	Organic / Chemical Fertilzers	Chalakudy	Chalakudy				
	Paper Products	Mala	Mullassery	Mullassery	Chavvakkad	Chavvakkad	Chavvakkad
	Plastic Products	Thrissur m.corp	Cherpu	Chalakudy	Chalakudy	Puzhakkal	Chalakudy
	Recycling, Waste Management	Anthicad, Pazhyannur, Kodakara		Talikkulam			Thallikullam
	Rubber Products	Thrissur m.corp	Chavvakkad	Chavvakkad	Thallikullam	Chavvakkad	Thallikullam
	Wood Products	Cherpu	Ollukkara	Chavvakkad	Ollukkara	Mathilakam	Thallikullam
	Personal care Products	Chowwannur	Ollukkara	Chavvakkad	Ollukkara	Mathilakam	Thallikullam
	Gold	TMC	TMC	Wadakkanche	TMC	TMC	TMC

Source : District Industries center, Thrissur, MSME 2022-2023

for per unit turnover of 8.9 lakhs per unit with 2 employee requirements per unit.

8.2.8 Other Manufacturing Industry

Other Manufacturing Industries manufacturing sector includes statues, umbrella, pickles, bakery products, fish farming, toilet cleaning liquids, detergents, gold, silver jewellery, floor mat, carry bag, cloth bag, mosquito net, pottery, soap, upholstery work, hair oil, coconut products, food products, flowers, photo fame, brush manufacturing, organic plates, dyes, mattress, tube light, pillow, printing, insulation tape, pen, chips, soda manufacturing, napkin with the service sector comprising of laboratory, cloth printing, hotels, battery water, mobile service and trade, clinic. This industry has a large number of manufacturing sectors over a few service sectors and has a high density in Chalakudy block followed by Mathilakam block. This sector has the 4th largest per unit turnover of 11.3 lakhs per unit with 3 employee requirements per unit. Thus, making it an important industry for growth.

8.2.9 Personal Care Products

It has always been an in-demand industry with its high density in Thrissur M.Corp followed by Kodakara and Chowannur blocks. This industry has less density in the manufacturing sector comprising hair oil, soap, detergent, handwash, face pack, and cosmetics while more density in the service sector facilitating beauty parlour, hair fixing, haircut, shaving, nail lounge, wellness centre, dental clinic, ayurvedic treatment centre, diet care consultant, physiotherapy centre, boutique, tattoo studio, and fitness club. This sector has one of the least per-unit turnovers of 4.0 lakh per unit with 2 employee requirements per unit. Thus, making it an important industry for growth.

8.2.10 Recycling Waste Management

Recycling Waste Management has more manufacturing industries manufacturing crushed plastic waste, biogas plants, plastic bottles, cotton yarn waste and biogas plants with lesser service industries consisting of scrap units and napkin, and pad disposal units. This industry has more density in Anthicad, Kodakara, and Pazhayannur blocks. This industry has a growing scope due to 3rd largest per-unit turnover of 19.9 lakh per unit among other industries along with 3 employee requirements per unit.

8.2.11 Automobile services/repair

The total number of jobs created in this industry in 2023 is 29624. The investment per unit is 0.07, while the turnover per unit is 5.1. There are two employees per unit. Most of this industry is concentrated in TMC, Chowannur, and Kodakara.

8.2.12 Chemical Product

The total number of jobs created in this industry in 2023 is 115. The investment per unit is 0.02 and the turnover per unit is 2.5. There are two employees per unit. Most raw materials for chemical-based units come from outside the state, while they can be manufactured inside. Many of these compounds have additional applications. For example, the rubber industry, agriculture, and so on. The present plants are unable to meet the demand for chemical goods. Chemical processing unit promotion, the development of chemical processing units in the Thrissur area is helping to build agro-based units, food processing units, and other businesses in the area. Most of this industry is concentrated in TMC, Irinjalakuda, and Thalikulam.

8.2.13 Energy and renewable energy

The overall job generation in this business in 2023 is 33. The investment per unit is 0.11, while the turnover per unit is 8.7. There are two employees per unit. Most of this industry is concentrated in Anthicad, Chowannur, and Kodakara.

8.2.14 Organic/Chemical Fertilization

The total number of jobs created in this industry in 2023 is 45. The investment per unit is 0.073, and the turnover per unit is 5.3. There are two employees per unit. The majority of this industry is concentrated in the blocks of Chalakudy, Ollukkara, and Kodakara.

8.2.15 General Engineering and Precision Engineering

This industry will provide 290 jobs by 2023. The investment per unit is 0.06 and the turnover per unit is 20.2. There are two employees per unit. This industry has one of the three highest turnovers in the district. The district's growth rate for engineering-based units is likewise quite strong. One of the issues confronting this industry is a shortage of operating capital. Most of this industry is concentrated in Kodakara, Chowannur, and Puzhakkal.

8.2.16 Plastic products

Plastic products are very convenient to use, but the problem of plastic littering, especially plastic carry bags, is a huge environmental issue that needs to be addressed. In Thrissur District, there is great potential for the tile industry, and promoting plastic moulding units for tiles (both for household and industrial use), engineering plastics, and recycling units could help enhance the growth of the industry while also addressing plastic waste.The largest number of plastic industries were established in Chalakudy block in 2015, with three new industries. The following year, in 2016, Puzhakkal saw the establishment of four new industries. In 2017, Chalakudy, Ollukkara, and Puzhakal each had three new industries established. Four new industries were established in Chalakudy in 2018, while Cherpu saw the establishment of five new industries in 2019. In 2020, Kodakara had two new plastic industries established. The number of new plastic industries established in 2021 was the lowest, with only one in Puzhakal. For 2023, the establishment of a new plastic industry is expected in the Thrissur Municipal Corporation area.

8.2.17 Drugs and Hospital Equipment

The district is a home for 3 large scale medical industries collectively having investment of about 8 crores. Two of these, The Pharmaceutical Corporation of Kerala (OUSHADHI) and Thaikattumooss Vaidyaratnam Oushadasala (P) Ltd, are concerned with production of ayurvedic medicine and other products while Southern Union Pharmaceuticals Kerala (P) Ltd is involved in produc- tion of allopathic medicine. In the financial year 2022-23, 207 small scale industries concerned with Drugs and Pharmaceuticals (including Ayurveda) have generated a turnover of Rs. 17.9 crores and employing over 400 persons. More than 230 small industries in Thrissur are involved in production of Hospital equipment generating a turnover of about Rs. 20 crores and employing nearly 800 persons. The highest concentration of these industries are predominantly in Thrissur Municipal Corporation having 31 Drug manufacturing and 28 hospital equipment industries. The Chowannur block is right behind TMC with 22 and 24 industries respectively. Earlier new medicine related industries industries were mostly concen trated in the Mullasery-Irinjalakuda belt but the trend of newer industries have shifted up north in Chowannur. Among the industries concerned with medicine and health care in Thrissur, Ayurveda drug manufacturing is the major job creator in the past generating employment for over 1000 persons uphill 2020. Thrissur Municipal corpora- tion and Irinjalakuda Bock have the largest no. of Ayurveda Industry Units.

8.2.18 Gold

Thrissur is renowned for its gold and gold jewelery, with around 80% of Kerala's gold ornaments being produced in the city. This has made the city a hub for the gold industry with many medium and small-scale jewelery shops in Kerala relying on the workshops in Thrissur for their supply of gold ornaments. Currently, there are a total of 126 MSME units in Thrissur, with a total investment of INR 18.66L. These units have generated employment for 405 individuals and achieved a total turnover of INR 52.7 crores. On average, the investment per unit is INR 0.15L, the turnover per unit is 41.9L and the employment generation per unit is 3. It is to be noted that most of the manufacturing and service units are concentrated in the Thrissur Corporation, which has led to a concentration of employment opportunities in the gold industry in this area.

In addition to the MSMEs, Thrissur is also home to several private gold companies, including renowned companies like Kalyan Jewellers, Alukkas Jewellers, and Manappuram Jewellers. Kalyan Jewellers, one of the largest gold companies in India, is headquartered in Thrissur. These large companies have made significant investments in the city, with Kalyan Jewellers investing Rs.2000 crore, Alukkad Jewellers investing Rs. 100 crore, and Manappuram Jewellers investing Rs. 37.5 crore. The presence of these companies has further strengthened Thrissur's position as a key player in the gold industry.

8.2.19 Opportunities

From the GDVA contribution, MSME data and Government initiatives it is seen that the Construction and manufacturing industries contribute the most to the economy of the secondary sector. (Department of economy and statistics, Thrissur) The paper industry generates the most turnover per unit followed by gold and general manufacturing industries registered in 2023(District industries center, MSME 2022-2023). Construction industry is India's second-largest employer and the world's third-largest construction market by 2025. From the Kerala perspective plan 2030 the emphasis on augmentation of the Handloom industry is seen along with the decline in the workers from weavers community indicating a declining sector. Thrissur produces 70% of plain gold jewellery in Kerala per day. Thus, it also has a thriving market for augmentation in this sector.

8.3 Primary Sector analysis

The subsectors of the primary sector include agriculture, animal husbandry, fisheries, forestry and plantations, mining, and geology. Primary sector contributes the lesser in GDP, which is 8% in Kerala and 10% in Thrissur district as per 2011-12 data. According to department of Economics and Statistics, 2021-22, in Thrissur district, livestock shares the maximum in GDVA of the district, which is 33.1%, followed by agriculture (29.6%), forestry (21.4%), fishing (13.9%) and mining (2%). Despite having lowest share in the GDP, the sector is an important sector, supporting the other sectors in terms of provision of raw materials and contributing the overall growth.

8.3.1 Agriculture

Agriculture has always been a part of life for many people for employment generation, food security as well as income generation. In the case of Thrissur district, 9.61% of people are dependent on agriculture as cultivators and agricultural labourers according to census 2011.

Agricultural crops are broadly classified as food crops and non-food crops. The total cultivated land area in Thrissur district is decreased from the year 2005-06 and it is 1,72,123.61 Ha. from which 66,859.9 Ha. is dedicated for food crops and 1,05,263.71 Ha. for non-food crops cultivation. As per agricultural statistics reports from 2005-06 to 2020-21, the percentage of fallow lands (land that are kept unploughed out of the net area sown) has been decreased from 5% to 3.35% in district from 2005 to 2020 and a land put to non- agricultural use which is land use for purposes other than agriculture such as construction of buildings, roads, canals, railways, swamps etc. has been increased from 12.08% to 13.76%. (Table 8.1)

Due to various reasons like unavailability of farm machinery, lack of infrastructure, development purposes, etc. total crop area has been reduced from 1,60,528 Ha. in 2015 to 1,49,405 Ha. in 2020 and production from 2,22,294 Tonnes in 2014 to 2,31,998 Tonnes in 2020 according to Agricultural Statistics 2015 to 2020. After the study of an area and production, total crop area is getting reduced in Mullassery, Thalikulam, Kodakara, Pazhayanoor, Cherpu and Mathilakam blocks. While, in Mala, Vellangallur, Chowannur and Wadakkanchery blocks, the area is getting increased but there is a reduction in production due to lack of technology used, farm machinery and unavailability of labourers. (Refer Figure - 8.21)

Table 8.6 Land use distribution

	2005-06		2015-16		2020-21	
Land cover	**Area(Ha)**	**%**	**Area(Ha)**	**%**	**Area(Ha)**	**%**
Fallow land	15,171	5	14,105	4.65	10,149	3.35
Land put to non-agri. use	36,630	12.08	38,313	12.64	41,728	13.76
Barren and uncultivable	345	0.11	254	0.08	69.19	0.02
Cropped area	1,93,187	63.72	1,742,75	57.48	1,72,123	56.77
Food crops area	87,069	28.72	69,745	23	66,859	22.05
Non-food crops area	1,06,118	35	1,04,530	34.48	1,05,263	34.72

Source- Agricultural statistics reports from 2005-06 to 2020-21

- **Major crops in district**

Out of around 30 crops cultivated in Thrissur district, seven are the major crops which are Paddy, Banana, Coconut, Pepper, Nutmeg, Tapioca and Arecanut. Paddy fields are all around the district, coconuts are mostly along

coastal line which are low lands. The high lands are thickly forested which are cultivated for food crops, cash crops and spices like pepper. Pokkali rice, Changalikodan Banana, Malabar Pepper and the Kodungallur pottuvellari are GI tagged products in district. Also, specific varieties of mangoes are transported to centers outside the state such as Bombay, Ahmedabad, Indore and Delhi from district and outflow of jackfruit is mostly to Tamil Nadu and is a high consumer preference in other states.

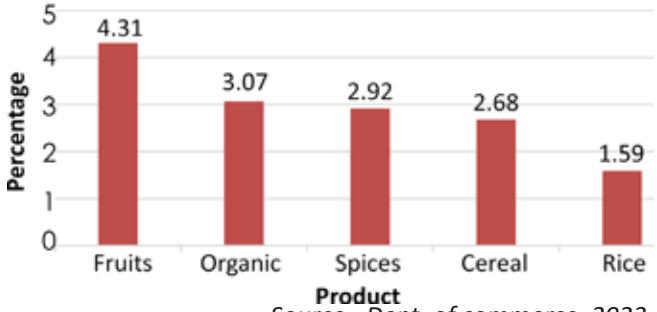
According to agricultural statistics and Kerala corporation, Paddy, Banana and Coconut are the leading crops in the district. Total district area covered by Paddy, Banana and Coconut is 23,945.3 Ha, 2,299 Ha and 80,831.3 Ha, respectively. While, the production of these crops is 87,655 tonnes, 22,972 tonnes and 496 million no., respectively. (Table 8.7) In the district, 344 Ha of Pokkali lands remain uncultivated and 300 Ha land remains submerged during monsoon and faces poor drainage. According to Kerala State land use board 2014, 16,104.87 Ha of paddy field are converted into cash crops and other land uses in the district.

- **Infrastructure facilities**

Looking at the infrastructure facilities available related to agriculture, there are total six food grain storage warehouses, thirty-five government seed centres and forty-six registered horticulture nurseries in the district. Comparing productivity of crops and available agricultural infrastructure in each block, there is a lack of seed centres in Chavakkad, Irinjalakuda, Vellangallur, Chowannur, Wadakkanchery, Anthikad, Cherpu, Puzhakal and Mathilakam blocks. Mullassery, Irinjalakuda, Pazhayannur, Wadakkanchery and Puzhakal blocks lack warehouses for grain storage. Only Chavakkad, Thalikulam, Pazhayannur, Wadakkanchery, Cherpu and Mathilakam blocks and Thrissur corporation have enough horticulture nurseries. Chavakkad, Mullassery, Thalikulam, Cherpu and Puzhakal blocks have insufficient Agro-service centres. (Figure - 8.23) According to Mission Antyodaya 2021, only 5% of total farmers use Organic Farming methods & 61% watershed development projects & 82% community rainwater harvesting projects are working in the district.

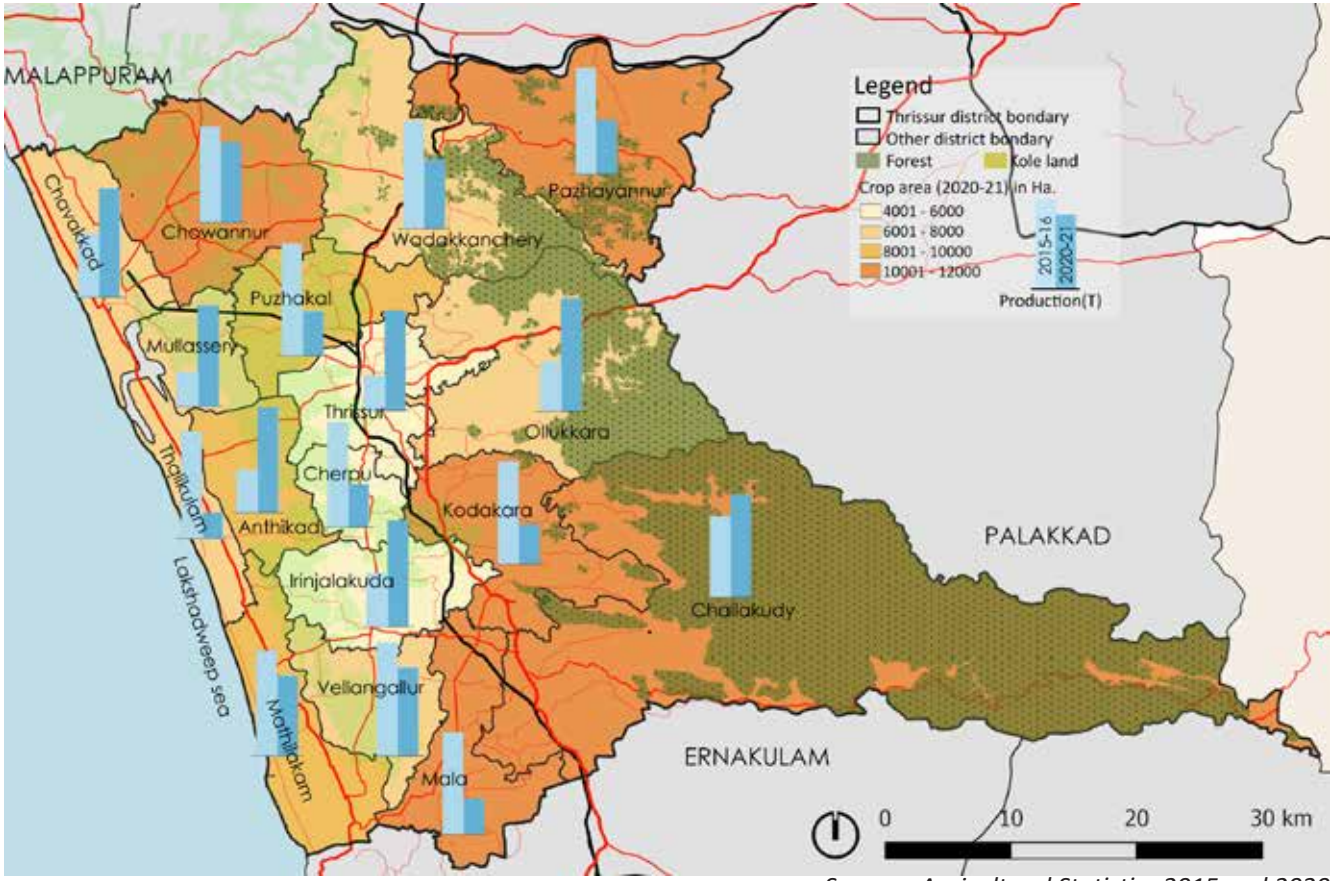
According to Department of commerce, 2023, primary sector in Thrissur district

Figure 8.22 District export performance



Source- Dept. of commerce, 2023.

Figure 8.21 Total crop area and production distribution



Source- Agricultural Statistics 2015 and 2020

contributes only 14.57% of export, which is lowest comparing to all three sectors. (Figure - 8.2)

- **Institutional framework and proposed schemes**

At District level, Agricultural officer is appointed for activities like managing and monitoring the farm's financial performance, controlling activities related to land, keeping farms and farmers updated on new agricultural practices, etc. At block level, Assistant Director of Agriculture (ADA) directs all the staff members to achieve the goals set by the department at block level. Krishibhavanas at Panchayat level and other departments like Agricultural Technology Management Agency (ATMA), Departmental farm offices works under Department of Agriculture Development.

According to Potential Linked Plan (PLP) Projections 2023-24, Rs. 9.73 lakh are dedicated as Credit Potential for Agriculture including Farm Credit, Agriculture Infrastructure and Ancillary activities. Also, there are many agriculture related schemes in the district in all blocks. Major schemes like RKVY-RAFTAAR (Rs. 53,897.20 Cr), One-Product One-District (Credit linked subsidy to maximum of Rs 10 lakh per unit), Rice Development (11,824 L for rice development, 200 L for 'Operation Kole Double'), Subhiksha Keralam 2020-21 (Rs. 3,860 Cr), Coconut Development (Rs. 7,390 lakh) and Organic Farming & Good Agri. Practices (10% beneficiaries will be women) are dedicated for agricultural development.

- **Key issues**

Based on analysis done, key issues in Thrissur are reduction in crop area and production, insufficient export facilities, increasing fallow lands, lesser involment of youth in the sector and lack of infrastructure facilities which should be prioritize first during the development of Thrissur district.

8.3.2 Animal husbandry and dairy development

The field of animal husbandry is crucial in providing work and income to the weaker segments of the population. The growth and preservation of the cattle and poultry industries are crucial to the production of major livestock products that meet nutritional standards.

According to the district's animal husbandry office's 2019 census, the district's total livestock population is 36.74 lakh. Livestock shares in urban and rural areas are 6.77% and 93.19%, respectively. Goats make up 3.5% of the principal species, followed by cattle (3.04%), pigs (0.35%), and buffaloes (0.55%).

In 2017, the Thrissur district's per-capita consumption of milk, meat, and eggs was 213 grammes, 6 grammes, and 0.25 eggs, respectively. This is fewer below the ICMR's recommended daily intake of 280 grammes, 16 grammes, and 0.50 eggs (NABARD PLP, 2023–24). Nearly 10% of farm families have a significant occupation in livestock rearing. The district's cattle population is 90 percent interbred. The majority of the poultry raised in the backyards in Thrissur district places it second in the state for poultry production.

- **Animal Husbandry Performance - Thrissur, 2019.**

According to the Mission Antyodaya 2019 survey, the performance of veterinary clinics and hospitals is 60%, milk collection centres and allied services are 86%, piggery development projects are 7%, goateries are 67%, and poultry are 73%, indicating that piggery development needs to be prioritised in the majority of blocks. In the area of animal husbandry, a few neighbourhoods, notably Mullassery, Ollukara, Vellangalloor, and Mathilakom, have shown strong results.

- **Animal Husbandry Gaps**

Table 8.7 Thrissur district major crops area and production

Year	Paddy		Banana		Coconut		Pepper		Nutmeg		Topioca		Arecanut	
	Area (Ha)	Production (Tonnes)	Area (Ha)	Prod. (Tonnes)	Area (Ha)	Prod. (Mil. no)	Area (Ha)	Prod. (Tonnes)	Area (Ha)	Prod. (Tonnes)	Area (Ha)	Prod. (Tonnes)	Area (Ha)	Prod. (Tonnes)
2005	31074	72951	2919	25285	85366	726	6033	1282	2986	635	1417	28254	8116	10661
2015	24625	78886	2165	19803	81602	489	1790	479	6796	4171	1290	54613	6271	6098
2020	23945.3	87655.27	2299.79	22972.6	80831.3	496	1625.2	460.596	7089.6	3906.15	1176.57	69656	5592.4	4200.09

Source- Agricultural Statistics, 2005-06, 2015-16, 2020-21, Govt. of Kerala

Percentage and number of gram panchayats and gap type is identified on three basis - Strength, moderate and critical(Figure-8.24). Strength and criticality is based on the availability of supporting projects and infrastructure.

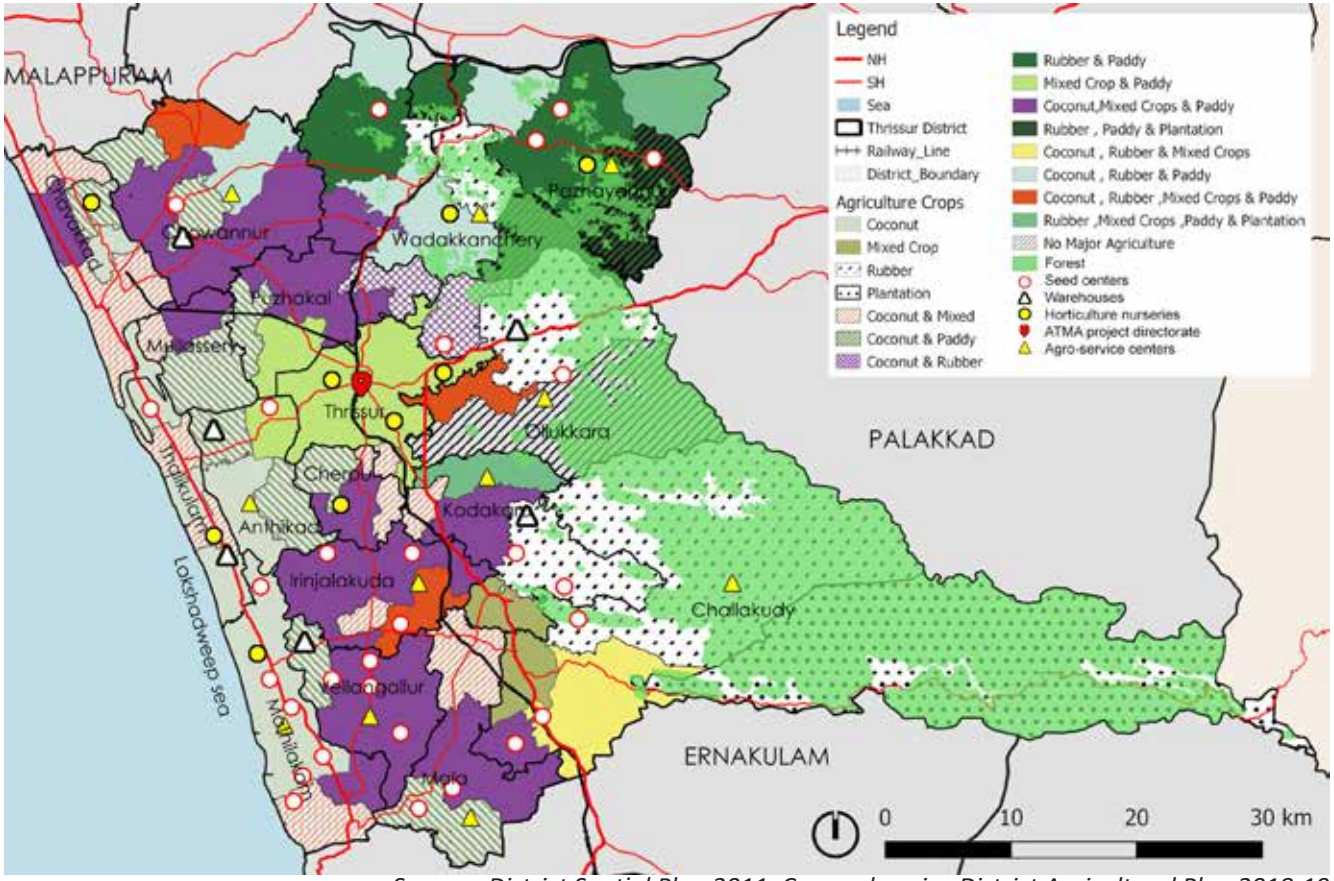
- **Dairy Farming, Milk Industry And Primary Dairy Co-operatives.**

The total number of cattle was 1.32 lakh, an increase over the 1.03 lakh reported in the 19th census. In the district, there are 40 cattle per square kilometre and 3 buffaloes per square kilometre. In comparison to Kerala, where it is 187 kg/day/sq km, Thrissur has a lower milk production density of 143 kg/day/sq km. At the national level, milk availability per person is approximately 307 gms per day (Global average: 294 gm/day), however it is 206 gms per day and 138 gms per day in Kerala and Thrissur, respectively.

Of these, 285 societies provide milk to the Thrissur Dairy unit of the ERCMPU, which has a capacity to handle 60,000 lpd of milk, and 335.48 lakh litres of milk will be purchased from societies in 2019–20 (Source: PLP, NABARD, 2023–24).Figure - 8.25 shows blockwise cooperative societies with cropland that can be used as feed.

From 21.19 lakh metric tonnes in 2006-07 to 27.11 in 2014-15, milk output increased. During 2014–15, the livestock sector generated 27.62% of the State's agricultural GDP. Only 1.85% of the nation's annual milk production was produced in Kerala. (Source: Economic Review 2015, Govt. of Kerala).

Figure 8.23 Thrissur district crops distribution and infrastructure available



Source- District Spatial Plan 2011, Comprehensive District Agricultural Plan 2018-19

Out of 70 lakh families, 5 lakh, according to the state Poverty Eradication Mission through Kudumbasree in Kerala, are totally dependent on livestock for their subsistence, and another 5 lakh depend on livestock as a secondary source of income. More than 55% of cattle keepers tend to two to three cow units, whereas 32% tend to one cow units. More than 60% of Kudumbasree's livelihood businesses are in the animal husbandry industry.

According to the dairy development department, the Thrissur district will purchase 1.71 billion litres of milk annually, or 5.3% of the state, in 2022–2023.

Ollukara, Pazhayannur, and Chalakudy have been designated by the animal husbandry department as "Dairy Blocks" in the district to get specialised attention for dairy development. Two indigenous cow breeds, Kasargod Dwarf and Vechur, are very popular in Kerala.

- **Fodder Development in the Disrict**

Fodder yield per hectare is 200 MT. Fodder cultivation is a common practise in the Pazhayannur, Ollukara, and Chalakudy blocks. 34000MT of fodder are produced annually in the

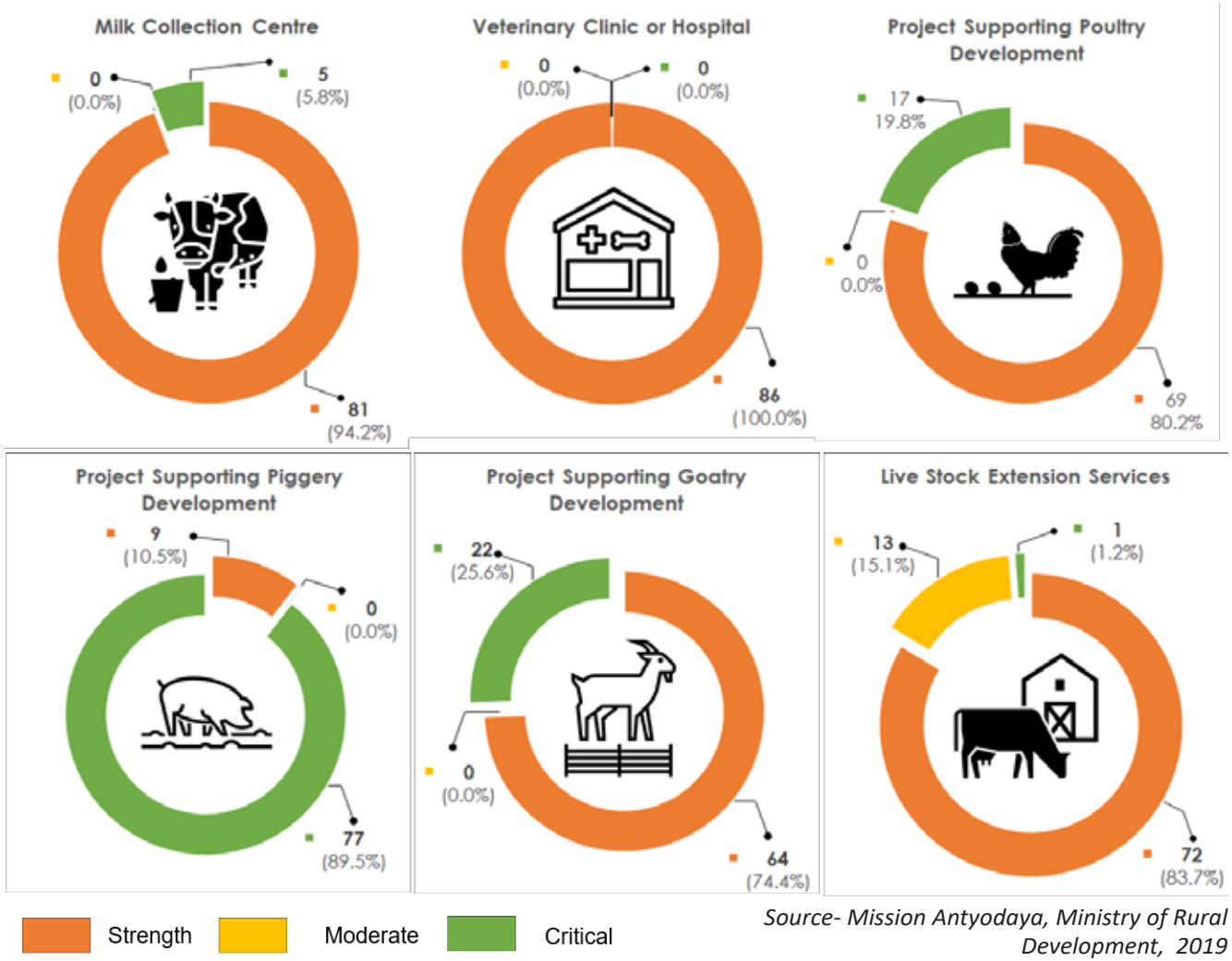
District.There are 23614 MT of straw produced annually.

The district needs 23.43 lakh MT of fodder grass per year, and there is a shortage of 22.49 lakh MT that can be supplied by 3900ha of fallow and uncultivated land.

Due to the lack of grazing ground and infrastructure for animal husbandry, such as in Chavakkad, Mullasery, Thaikulam, and Anthkkad, coastal blocks produce less than other regions. The milk and fodder production in the district is shown in Figure - 8.26.

Dairy and fodder development is possible in the blocks Chowannur, Puzhakkal, Mullasery, Irinjalakuda, and Vellangallur since they have kole wetlands with areas larger than 40 square kilometres.

Figure 8.24 Animal Husbandry Gaps - Percentage Of Gram Panchayats And Gap Type



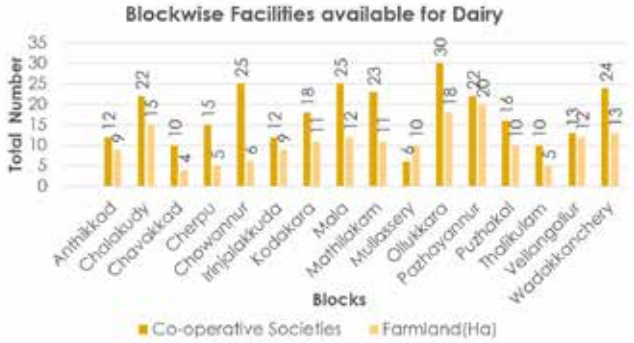
Source- Mission Antyodaya, Ministry of Rural Development, 2019

8.3.3 Meat Production Sector

The district mostly produces meat from chicken, pig, bull, and buffalo. In the district, there are 201 unapproved slaughterhouses and 4 permitted slaughterhouses. In the district, 92.53 lakh hens are annually utilised for meat. Pig farming should be promoted in the Southern Panchayats of the district, such as Pariaram, Varanatharapilly, Matthatur, and Chalakudy, where pig meat is acceptable in nearby villages around Kunnamkulam. Goat numbers increased slightly from 1.26 lakh in 2012.

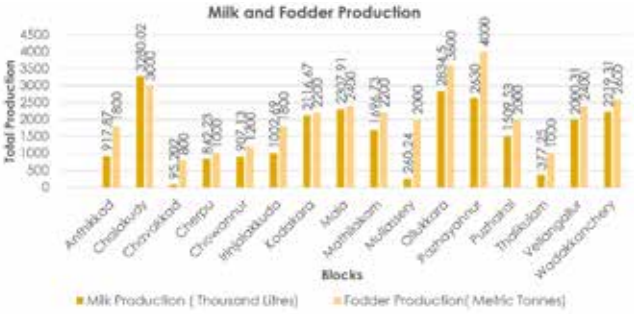
The Ollukara, Chalakudy, and

Figure 8.25 Blockwise facilities available for Dairy in Thrissur.



Source : District Development Perspective, Thrissur, 2017

Figure 8.26 Milk and Fodder Production in Thrissur District.



Source : District Development Perspective, Thrissur, 2017

Wadakkanchery blocks have the most activity. The district produces 19725.16MT of meat, including beef, chevon, chicken, and other meats.

Bulls, buffalo, goats, and pigs all have meat availability values of 8761.78, 7334.11, 1425.09, and 2109.3 MT correspondingly.

There are no processing facilities in the district for byproducts like hide, hoof, fat, and bone that could be used to make organic fertiliser, pet food, rendered fat, meat and bone powder, fresh dog packs, and pet food.

- **Egg Production Center**

As per Sample Survey in 2014–15, it was found that the district generated 2103 lakh eggs from 10.40 lakh laying hens. Eggs from nearby states are imported to fill this deficit. Annual egg imports into the district total 11.33 lakh chicken eggs, 2.65 lakh duck eggs, and 6.30 lakh quail eggs.

1.55 lakh farmers are involved in the poultry farming industry in Thrissur district. In the district, there are also 892 active poultry farms. 1.39 lakh chicks are produced annually in Thrissur district's 11 government-approved egg nurseries. These chicks can produce about 25.16 lakh eggs.

- **Animal Husbandry: Goat, Piggery and Sheep**

According to estimates from the 20th Livestock Census (2019), there are 1.30 lakh goats in the district, a slight rise from 1.26 lakh in 2012. When it comes to raising goats, Malabari and crossbred Jamunapuri breeds are the most suitable.

In the region large white yorkshire and its crossbreds are raised primarily. The Ollukara, Chalakudy, and Wadakkanchery blocks have the most activity in the district's area. In the district, sheep rearing is almost nonexistent.

- **Annual Production of Milk, Egg and Meat - Thrissur District**

Production statistics of previous five years of Thrissur district from 2015-2020 is shown in Table 8.8.

- **Development Gaps in the Region**

There is a vast gap in the demand and poduction of produces from animal husbandry and development department which is leading

Table 8.8 Yearly Production 2015-20.

Year	Milk Production (000 Tons)	Egg Production (Lakh nos)	Meat Production (000 Tons)
2015-16	211.37	2105.4	55.79
2016-17	▼ 199.43	▼ 2031.0	▼ 54.06
2017-18	▲ 206.96	▼ 2007.8	▼ 48.75
2018-19	▼ 196.39	▼ 1983.3	▼ 44.00
2019-20	▲ 200.00	▼ 1617.8	▲ 46.15

Source : District Animal Husbandry Department, Thrissur, 2021

to imports from neighbouring states and an barrier in the developmet of primary sector. Total gaps of milk, meat and egg production is shown in Table 8.9.

- **Contribution to the Economy at state level**

In 2010–11, at unchanged 2004–05 prices, the cattle sector contributed 25.4% of the value of agriculture and related services at the national level. The comparable percentage for Kerala was lower, at 21.7%.

- **Ongoing Schemes for upliftment of Livestock sector**

Table 8.9 Development gaps in the Region.

S. No.	Item	Recommendation	Availability	Gap
1	Milk (Million Litres)	2848	1475	1373
2	Meat (Metric Tons)	34174.95	19725.16	14449.79
3	Egg (Lakhs)	4775.13	2103	2672.13

Source : District Animal Husbandry Department, Thrissur, 2017

Currently 33 schmes are going on the region and these are enlisted in table 8.10 and 8.11.

- **Thrissur Animal Husbandry Infrastructure**

Total animal husbandry institutions list includes one district animal welfare office, one energetic cattle development scheme,

Table 8.10 Ongoing schemes for dairy development.

Agency/ Department	Crop/ Product	List of schemes implemented during 2018-19	Amount spent Annually (lakhs)
Dairy Development			
Milk	1	Rural Dairy extension & advisory services	16.95
	2	Milk shed development programme	110.71
	3	Ksheeragramam	44
	4	Rehabilitation Programme	290
	5	Modernization of Dairy co-operative societies	57
	6	Lab strengthening & quality control activities	70
Feed and Fodder	1	Conservation of fodder in farmers field	46
	2	Distribution of mineral mixture	7
	3	Modernization of DCS	40

Source : District Animal Husbandry Department, Thrissur

one special cattle management scheme, four office regional animal shelter, one District veterinary centre, one central veterinary store, six veterinary poly clinics, twenty two veterinary hospital, eighty nine veterinary dispensary, one rinderpest mobile unit, one animal disease control scheme, one pig breeding centre, hundred veterinary subcentres and in dairy

development department institutions in Thrissur district includes, one office of the deputy director, one quality control office, sixteen offices of block level assistant director. These facilities are marked in Figure - 8.27.

8.3.4 Fisheries

Table 8.11 Ongoing schemes for Animal Husbandry.

Crop/ Product	List of schemes implemented during 2018-19	Amount spent Annually (lakhs)
Animal Husbandry Department		
1	SCA to SCP goat rearing	33
2	School poultry club	32.50
3	SREP cage system of rearing birds	8
4	Model Panchayath	5.05
5	Animal welfare club	1.53
6	Animal welfare club award	0.10
7	Goat satellite units	55
8	Duck rearing	7.20
9	Purchase of milk machine	7.50
10	Construction of manure pit	26.25
11	Pig fattening unit	12
12	Infertility camps	2.50
13	Taluk level entrepreneur meet	1
14	Training on commercial goatery	2.10
15	Hospital development committee	1.77
16	Disinfection and sanitation	1.70
17	Monthly technology advise newsletter	0.25
18	Odd hour service of veterinary surgeons	37.98
19	Purchase of medicine	12.05
20	Strengthening of labs	14.45
21	Block level entrepreneur development programme	0.56
22	Animal welfare activities	0.60
23	Commercial goatery	33.60
24	Interest subvention scheme	29

Source : District Animal Husbandry Department, Thrissur

Thrissur has a long-term fishing tradition and supports aquatic biodiversity. The district has an abundance of coastal and inland water resources, as well as a diverse range of aquatic plants and wildlife that live in these water bodies. The district has a 54-kilometer-long sea coastline that stretches from Azheekode to Kappirikkad (Manthlamkunnu). Fisheries sector in the district consists of both marine and inland Fisheries. The Inland Fishery of the district includes both capture Fisheries and aquaculture.

The coastal line of the district is divided into 18 marine fishing villages. According to Kerala marine Fisheries statistics (2021), Thrissur district has total population of 57384 marine fisherman. Out of these the active marine fishermen population is estimated as 5581 numbers, which contributes 9.72% of the total marine population of the district. It has 8 inland fishing villages in the district. The estimated inland fishermen population of the district is 20277. The active inland fisherman of the district is estimated as 1435 numbers, which contributed 7.07% of the total inland fisherman population.

Table 8.12 Thrissur Fisheries Profile-2021

Thrissur Fisheries Profile-2021		
Fisher Folk Population	**2019-2020**	**2020-2021**
Marine		
Population	57097	57384
Active Fisherman	5261	5581
Inland		
Population	20177	20277
Active Fisherman	1371	1435
Allied Workers	2631	2664
Total		
Population	77274	77661
Active Fisherman & Allied Workers	9263	9680

Source: Kerala Fishermen Welfare Fund Board ,2021

District has a rich diversity for pisciculture, fishing and aquaculture in coastal and inland areas. Development of aquaculture is one of the important features of the fisheries sector in the district as well as in the state. It has been primarily responsible for twice production of inland fisheries in recent years and has resulted in substantial economic growth in allied activities. Thus, aquaculture is increasingly contributing to the fish market of the district.

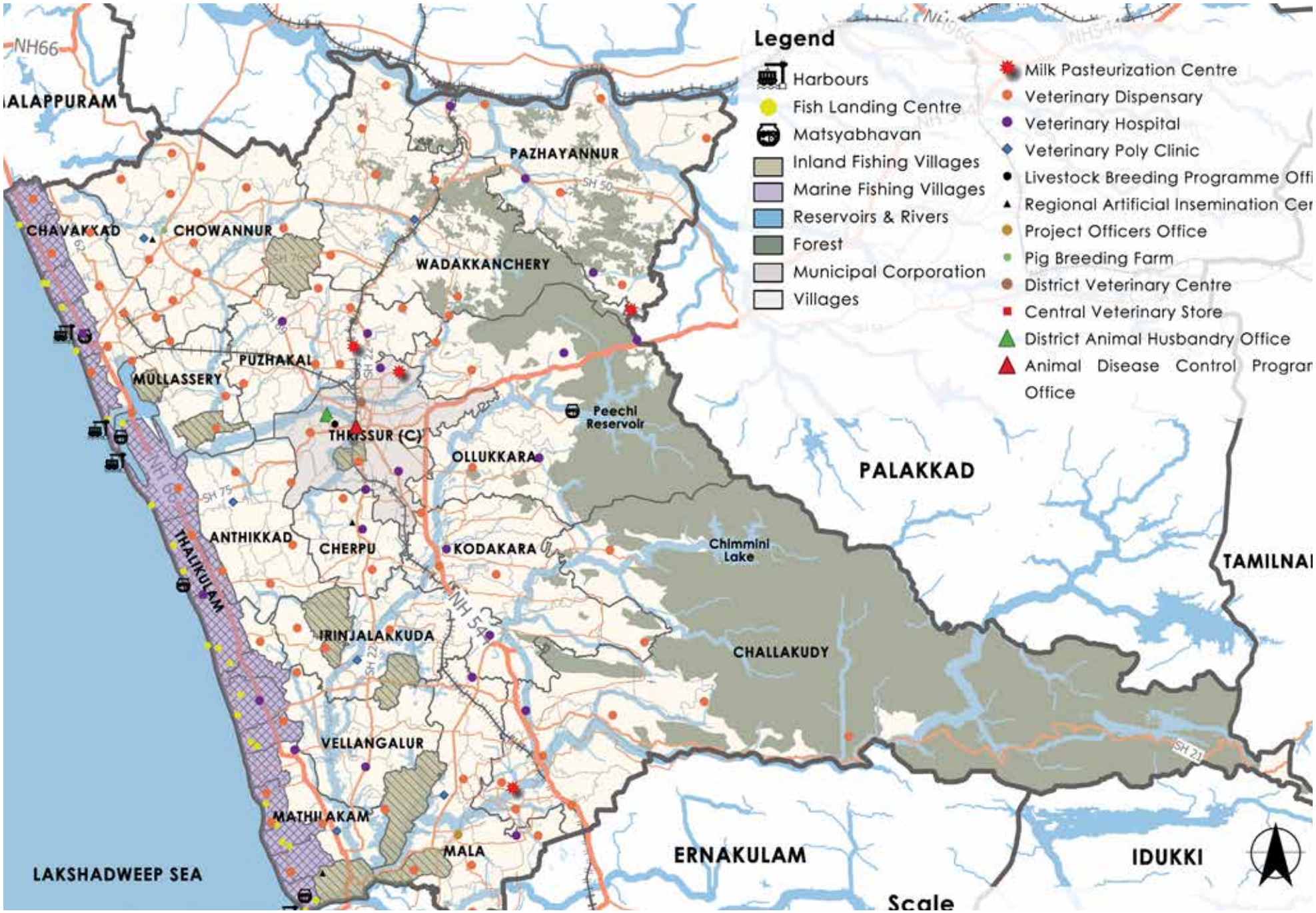
Aquaculture is extended only to 24% in the district with Chavakkad, Cherpu, Mathilakam & Thalikullam blocks developed ranging form 50% - 100%. Aquaculture includes not only food and ornamental fish, but also allied aquatic species such as prawns, shrimp, crabs, clams, oysters, and many more sea species, weeds, ornamental aquatic plants, and so on. In recent

Table 8.13 Inland Water resources, Thrissur

Thrissur District Inland Water Resources		
Sr. No.	**Water Source**	**Area (In Hectares)**
1	Panchayat Ponds	281
2	Irrigation Tanks	455
3	Holy Pond	103
4	Private Pools	535
5	Rivers	4272
6	Quarry is Gone	160
7	Kole lands	11,912
8	Backwaters	1410
9	Water Reservoir	3706
	Total	22834

Source: Kerala Fisheries Handbook, 2020

Figure 8.27 Fishing Villages, Harbours, Fish landing Centres & Matsyabhavan



Source: Kerala Fisheries Handbook, 2020

times, further expansion of the fishery sector is feasible through inland fisheries development. The department of fisheries is putting measures in place to increase fresh water carp fish production to 4500 tons per hectare. Projects are also being developed to promote modern shrimp farming, freshwater fish farming, crab farming, and shellfish farming methods. Pisciculture is currently used in freshwater ponds, rice paddies, lakes, and even manmade tanks and reservoirs. Pisciculture is developed 72% in the district with development around 50% in the villages of Chavakkad, Kodakara, Mullassery & Puzhakkal blocks.

- **Infrastructure Facilities**

Provision of Infrastructure facilities such as different types of fish preservation units, processing, storage, and marketing very close to the landing centre. Thrissur district has 3 major landing centres at Azheekode, Chettuva, Munakkalkadavu and 18 minor Landing centres along the coast. Many of the landing centres are in public/Puramboke lands without any infrastructure facilities.

- **Issues Identifications**

Many issues were identified, i.e., less awareness about the safety of life near sea level, reduction in mangroves, declining trend in catchment areas, and rates of commercially exploited stocks due to existing fishing methods. Lack of quality fish seed is the major issue in the development of inland aquaculture in the district. Other problems include the depletion of fishery resources in inland waters, the lack of a comprehensive inland fisheries act, Spread

Table 8.14 Fish Seed Production, Thrissur District

Fish Seed Production					
Year	2014-15	2015-16	2016-17	2017-18	2018-19
1. Peechi Hatchery	0	0	9.581	8.8	54.59
2.Regional Shrimp Hatchery, Azheekode	41.24	86.28	91.91	125.26	122.67
3. Fish farm Kadapputam	0	0	0	0	0.15
4. Model Shrimp Farm, poyya	0	4.89	10.2	6.46	3.28
5.Fresh Water Prawn Hatchery, Kaipamangalam	213.38	215.25	189.63	204.49	120.31

Source: Kerala Fisheries Handbook, 2020

of fish and shrimp diseases, non-availability of indigenous fish seeds, Underutilization of reservoirs and Kole Fields Lack of diversification of aquaculture practises and their allied activities such as marketing, availability of good-quality seed and feed, etc. Unhygienic and poor infrastructural conditions of the landing centres; most of the marine catches are landed on the open beaches all along the coast of the district, Absence of cold storage facilities in landing centres, Lack of fish marketing strategies both in inland and marine.

Development of Fisheries Sector to enhance local economic growth to promote fish markets, preservation and production units, export and import of marine products, aquaculture farms, trading units, fish seed farms, value added marine product outlet units, production and maintenance units of machineries in the 'accelerated growth zone-marine'. Promote saltwater fishing harvest, fish farming clubs and training for inland fish farming, fishing equipment repair, and fishing skill improvement. 3 lakhs has been earmarked for freshwater fish farming in public ponds. They are not paying attention to the ornamental fish sector. A huge potential exists for shipping ornamental fish. (10 lakhs) for branding and marketing of ornamental fish and construction of aquariums.

- **Acts**

Fisheries activity in marine sector is regulated by Kerala Marine Fisheries regulation Act. The activities in inland sector are regulated by Travancore Cochin Act and Indian Fisheries Act. These Acts ensure the responsible fisheries in Marine & Inland sector. Welfare activities undertaken by the department itself and the various agencies under the Fisheries Department played a crucial role in the upliftment of the social standards of the Fishermen community. Assistance given from the various agencies under Department of Fisheries improved the Marine and inland capture production over years. Aquaculture is supported by Agencies like FFDA, ADAK, MPEDA, MATSYAFED and FIRMA.

- **Stakeholders**

The major agencies involved in the development of fisheries in Thrissur district are the Department of Fisheries under the State Government. The other agencies under the government include MATSYAFED, FEDA, SAF, MATSYA BOARD, Costal Development Agency, and HED. Society for Assistance to Fisher Women (SAF) is working on Economic Empowerment of Fisher Women (Programmes include the development of micro-enterprises, rural marketing executives, dry fish processing units,

value-added fish production units such as dry fish units, pickles, fillets, cutlets, etc.), sustainability of marketing assistance for micro-enterprises, employment generation activities such as toilet soap and accessory items, motivational training programmes, extension activities, etc. Fish Farmers Development Agency (FFDA) works on freshwater aquaculture, brackish water aquaculture, training for farmers, subsidy-linked assistance, the introduction and establishment of new culture techniques, integrated farming, extension, mass communication activities, etc.

The Department of Fisheries is implementing an integrated coastal area development project in Thrissur District through the Coastal Development Agency. Various infrastructure development projects are formulated and implemented under this project, viz., housing, sanitation, drinking, household electrification, roads, culverts, and training; health; education; anganwadi; fish processing; storage and marketing facilities; coastal area protection, etc.

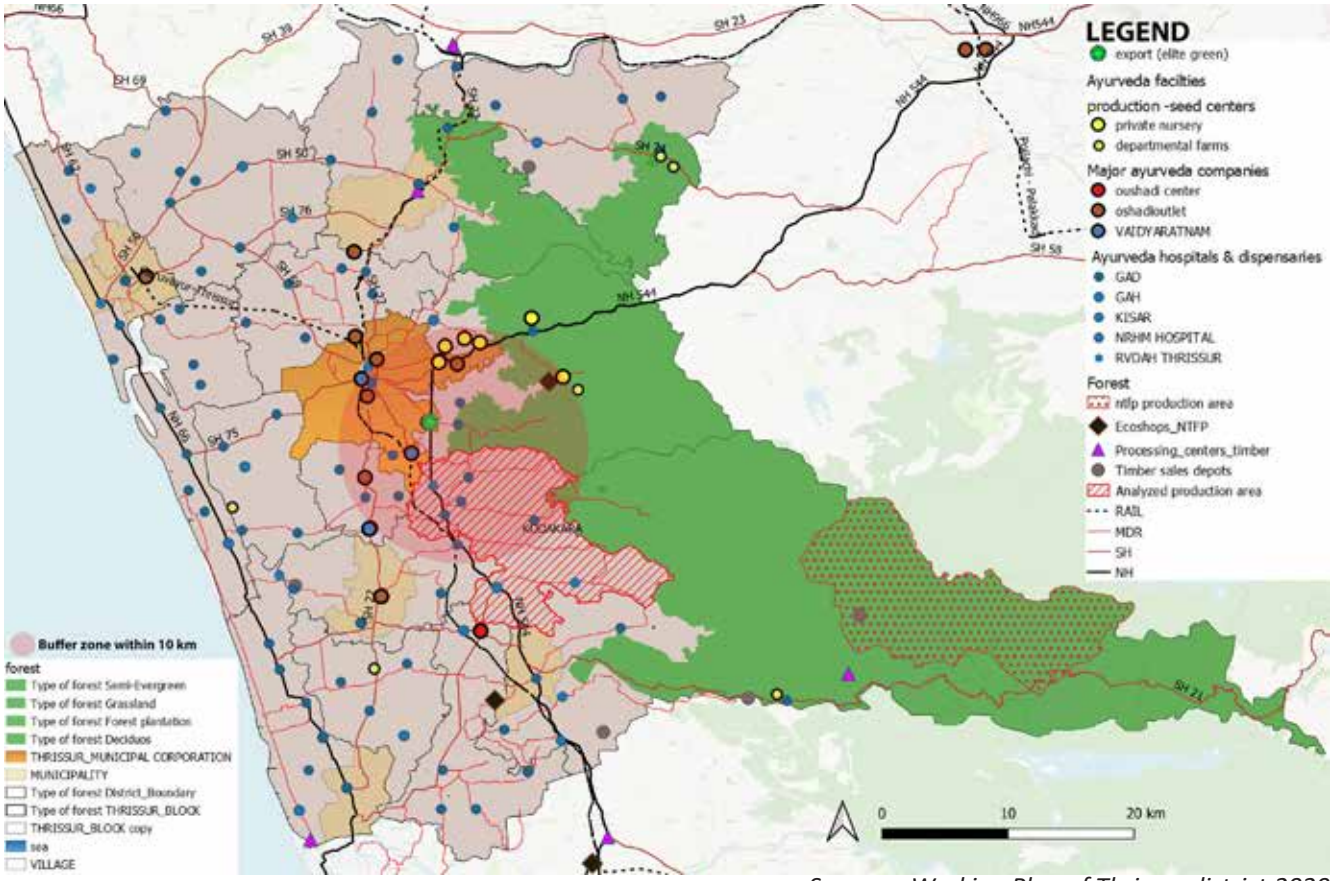
Coastal aquaculture practices should be strictly monitored. There is potential for the development of diversified aquaculture practices such as Reservoir Fisheries, Fish culture in Kole lands and Open water Aquaculture. Sustainable development of marine fisheries sector can be ensured by the implementation of existing Acts and improvement of socio-economic status of fishermen community. As a production sector the development can be ensured by increasing productivity and production.

8.3.5 Forest economy

Thrissur district has forest area of 1036.19 sq.km having highest cover in Challakuddy block (83.94%). The total 69163 population (7.44%) is dependent on forestry, plantation and allied activities for their income. Malsar and kadar are two tribal community with 21455 population along with 21 tribals found majorly in ollukara and chalakuddy blocks are dependent on the forest produce for their livelihood. The forest contributes substantially to the non-tax revenue of the State. The total of Rs. 12.8 crores is the estimated revenue generated from forest and expenditure incurred is Rs. 15.7 crores. annually. The total production is 1047648.65 tonnes in total 359.46 sq.km of the forest cover. The forest management is done by the Forest department of Thrissur district with Division Forest officer working in each division. There are many working circles which are formed for managing each type/part of forest cover area.

The main objective is to analysis and understand the various commercial forest products which can bring economy and employment opportunities on a long term perspective in Thrissur district and also understand the importance of forest products considering both environmental and economical

Figure 8.28 Analysis of commercial plants in Thrissur



Source- Working Plan of Thrissur district,2020

perceptions. This analysis would further bring us to conclusion on how forest product can be globally commercialized with interventions at district level.

- **Analysis of Exisitng status**

Forests can provide a wide range of economic benefits, including timber production, non-timber forest products (NTFPs - such as fruits, nuts, honey, spices), medicinal plants, and ecotourism. The major forest products collected are timber, medicinal plants, bamboo which are commercially important. Mainly, forest revenue is generated from timber and medicinal plants. The district has two major forest-based industries such as wood-based industries (143 units and 685.14 crores investment), paper mills, and other Ayurveda-based industries (195 units and 200 crore investment). *(Source: MSME industrial profile of Thrissur district)*

- **Timber**

The Forest Conservation Act (FCA, 1980) which prohibited felling from natural forests has changed the demand and supply pattern of the Thrissur. The average demand of timber was 1305944 m3 during 2020-2021 and the production was 1054112 m3. The average yield has reduced to 43m3 per hectare. The demand was more predominantly by household sector (55%), tertiary sector (32%) and industrial sector (13%) respectively. The revenue generated from timber is 9.2 crores per annum. The timber is imported from Coimbatore & Pollachi.

Imports are made to meet the demand for various sectors because demand is 24% more than supply and production. The Thrissur district does not export timber. Since there is a greater demand for timber, 5.6% of Household wood requirement like firewood is fulfilled by home gardens of timber.*(Source: KFRI report,2020)*

8.3.6 NTFP (Non Timber Forest Produce)

Major NTFP produce are honey, and spices which are commercially important. The NTFP is managed by Forest department and other committees for sales, collection etc and marketing is done by VSS, EDC and private stakeholders by collecting NTFP from primary collector (Tribals). 68% Tribals depend on NTFP resource for household. The VSS society collects only 35% of the total NTFP produce and provides approximately 75% of the earning share to the tribals. While the private sellers buy 50% of NTFP product and gives only 40% share of the profit to the tribals. The EDC community takes only 15% and provides less profit. The NTFP products are sold by value adding by VSS community called as 'Vanasree cell'. But the sales of the VSS has been declining over the year from 2016, the sales have reduced from 33 lakhs to 18 lakhs in 2020. *(Source: KFRI report, 2017)*

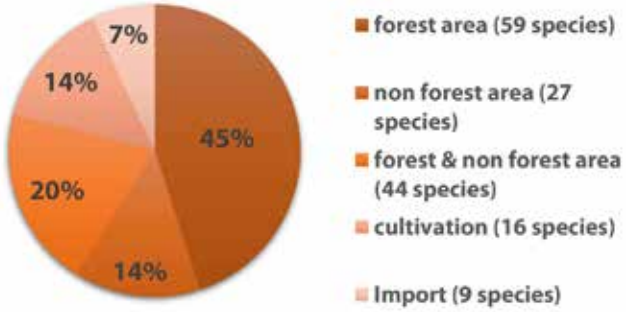
Availability of NTFPs in the forests is quite low ruling out another source of livelihood development for tribals. Collection of NTFP by Societies by engaging private collection agents results in exploitation of the tribals in weight and price.

- **Medicinal plants**

Medicinal plants are considered commercially important as it's a major source of raw medicinal species for Ayurveda industry in Thrissur district. Thrissur is the centre of major old Ayurveda companies like Oushadi and Vaidhyratnam and contributes to 20% of manufacturing units in Kerala indicating a potential of high marketplace in Kerala. Thrissur produces 500 species and 140 are traded medicinal species. Kurunthotti and Nellikkai are the highly consumed medicinal raw species in Thrissur district. Annual consumption of raw medicinal species are over 11,350 tonnes but only 400 tonnes of production is being done in Thrissur. This leads to 30% import of demanded raw species from other districts like Malappuram of Kerala and Tamil Nādu state.

The consumption of raw medicinal plants vary in small, medium and large units as the quantity and type of medicine prepared differs. Annual consumption with regard to plant/ parts e.g. roots/tubers/rhizomes constitute 50 per cent of the total quantity. Fruits and seeds constitute 15 per cent, followed by wood 12 per cent; whole plants (herbs) 9.5 per cent; bark 7 percent; leaves 4 per cent and flowers 2.6 per cent. Figure 8.29 shows number of raw medicinal species obtained from different sources in Thrissur district.

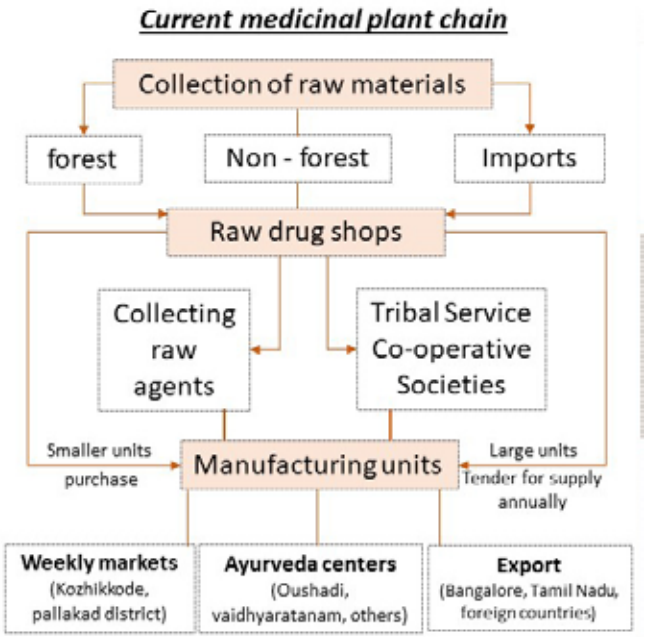
Figure 8.29 Source of raw medicinal plants in thrissur



Source- KFRI report, 2017

Presently, the total area of medicinal

Figure 8.30 Current medicinal plant chain in thrissur



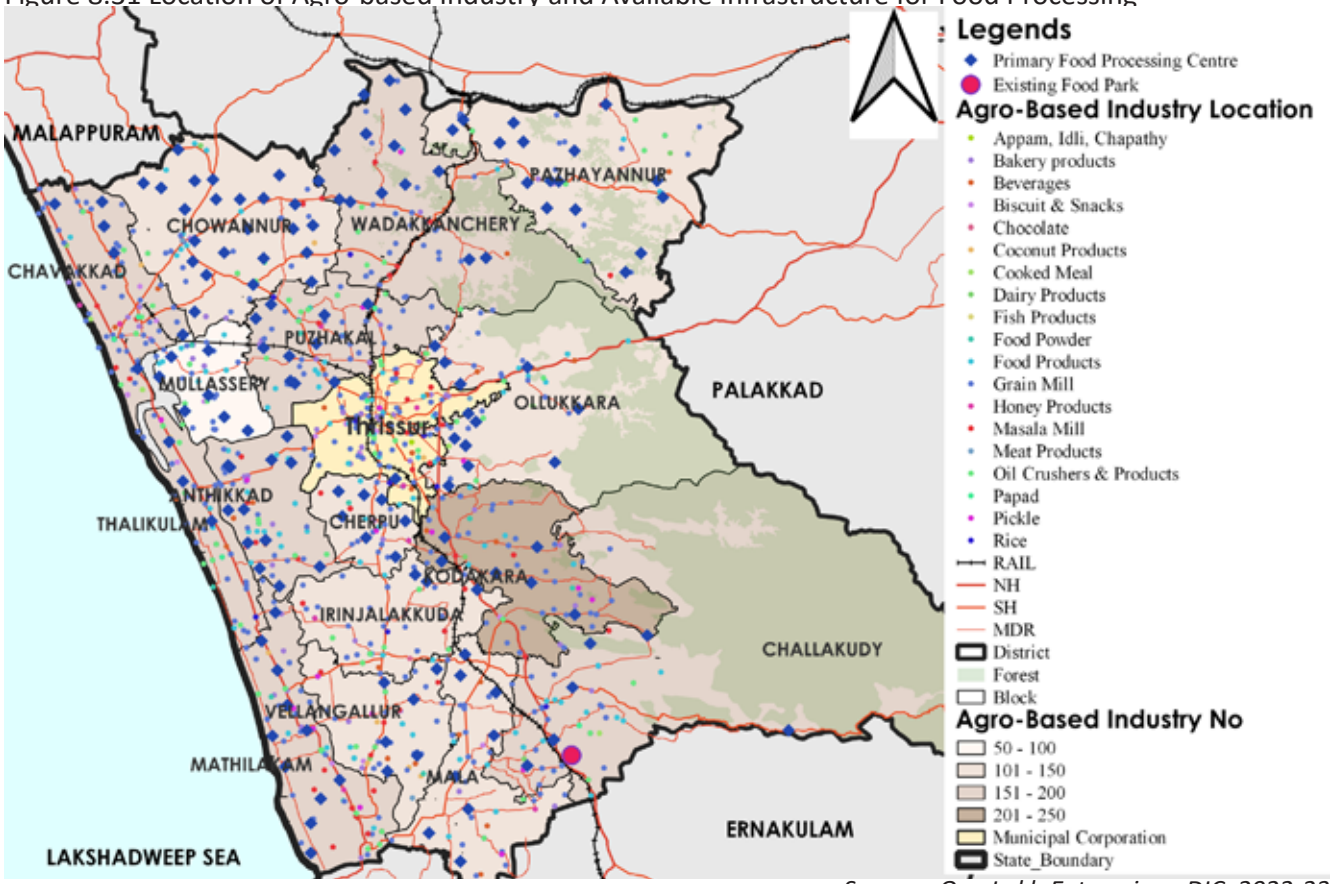
Source-KFRI report, 2020 2020

plant production is 30 hectare in Thrissur district. There has been gradual decrease in cultivation area from highest area covered 256 hectare in year 2014-2015 decreased to 30 hectares in 2018-2019. (Source: Agricultural statistics, 2020). This is due to various reasons. Firstly, the collection of 21 raw medicinal species from the wild which are commercially important has been banned by Forest Department. Hence, the present requirement of raw drugs, especially Parimarunnu (5829 tonnes (51.4%), is met from Kerala and Tamil Nadu state which increases the price of imported raw drugs considerably. Further, their non-availability, restriction for collection and increased price have prompted substitutions.

Considering, the present rate of consumption and growth of the Ayurvedic industry, future requirements can be mainly from cultivation. At present cultivation of most of these medicinal plants is not profitable as it produced at small scale in private nurseries. The major 11 companies have their own small private nurseries, manufacturing units to fulfil their basic raw materials and processing requirement. However, long term planning is essential for meeting the required raw medicinal species for the Ayurveda industry. Other issues analysed are absence of standardization of raw species as supply chain is not proper which limits the trade in Global markets. Lack of use of modern cultivation technologies due to less knowledge of modern techniques to cultivators.

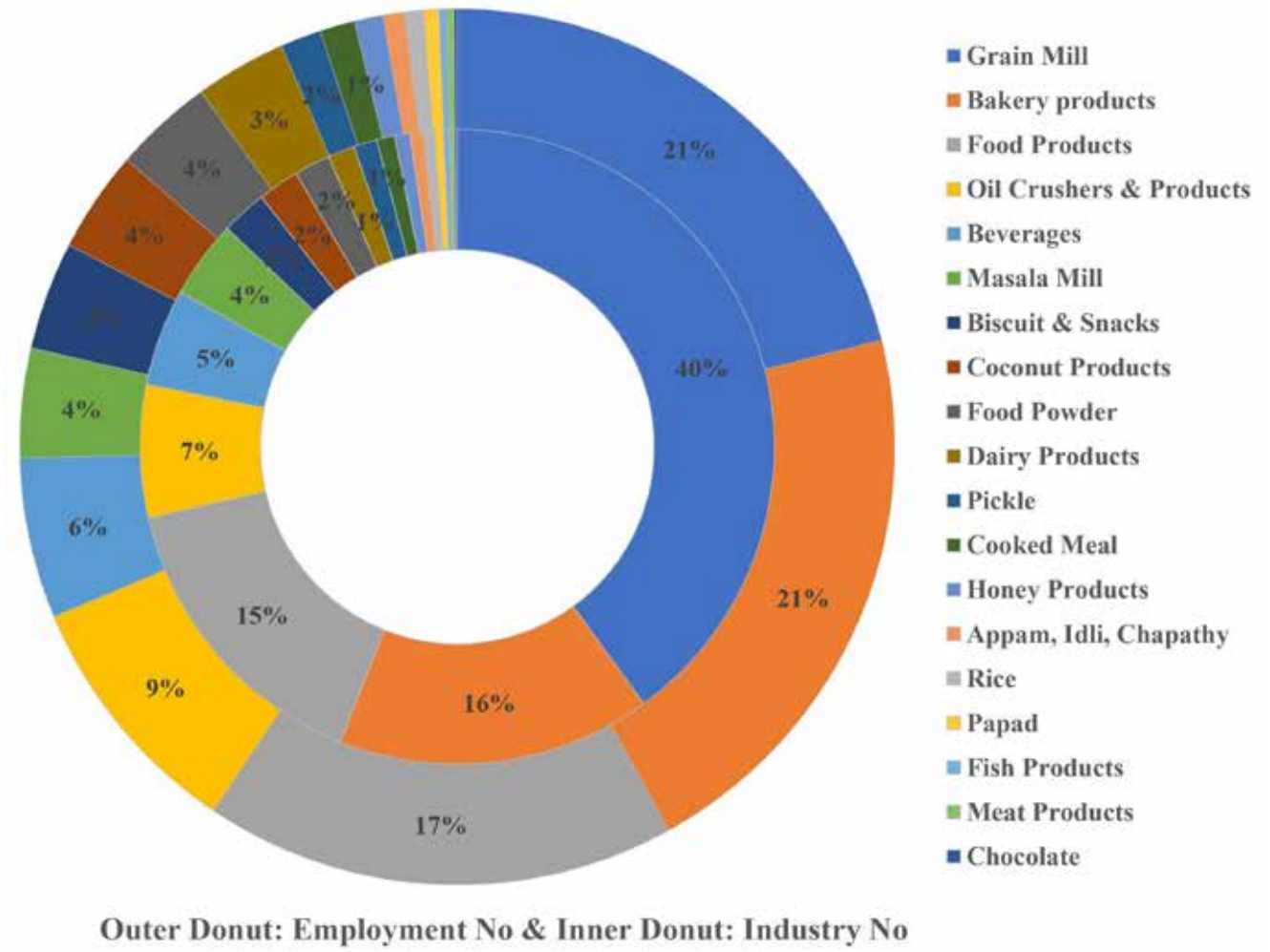
Currently the Ayurveda industry, has a high market in thrissur as two major companies Oushadi and Vaidhyaratnam with GMP certification exports its products in Indian states and foreign countries like USA, Australia, UK from thrissur district. Other companies are not globalised due to certification and low standardization. (Source: KFRI report). Figure 8.30 Shows the current medicinal plant chain in Thrissur district. The figure 8.28 shows commercial plants in thrissur district.

Figure 8.31 Location of Agro-based Industry and Available Infrastructure for Food Processing



Source- One Lakh Enterprises, DIC, 2022-23

Figure 8.32 Industry Number and Employment in Different Industries



Source: One Lakh Enterprises, DIC, 2022-23

- **Schemes & policies**

The ongoing schemes are National Afforestation program with investment of 1208.11 cr. (Kerala) for increasing the production area for timber plantations, Conservation scheme for Medicinal plant resources of 200 crore (Kerala). Other proposed schemes are scheme for forest extension and marketing support with investment of 200 cr. for supporting tribal economy. Various schemes have been launched but its implementation is not done properly.

8.3.7 Agro-Based Industries

The total number of agro-based industries in the Thrissur district is 2615. The total number of people employed in this sector is 9449. The total males and females employed in this sector are 4862 (51.5%) and 4587 (48.5%) respectively. This representation of women of this number shows that women in the district are more interested in this sector of industries.

Almost 40% of the industry in Kerala is agro-based, whereas in Thrissur's case, it is only 12.47% of the overall industries in the district. This shows that there can be more agro-based industries in the district.

The pie chart shows that (Figure - 8.32) more than 78.2% of the total Agro industries belong to Grain Mills, Bakery products, Food Products, Oil Crushers and beverages only. Whereas more than 68.7% of the total employees belong to the above four industries only. The most numbers of agro-based industries are present in the Kodakara block which is 216 (8.26%), whereas in the case of Mullassery the number is only 96 (3.67%).

Coconut and Rice are the major crops in the district whereas there are only 23 industries based on them employing only 114 people. This shows that there is huge potential of the crops to make value-added products.

Blocks like Pazhayannur, Challakudy, Mala & Kodakara have the most quantity of raw materials available. Major raw materials produced in the district are Nutmeg (23%), Rice (13%), Coconut (11%), Plantain (9%), Fish (7.2%), Jackfruit (5.6%), Arecanut (4.5%), Milk (1.1%), Raw Cashew (1.72%) (Percentage showing the value from total production in the state Kerala).

Table 8.15 Average Annual Growth Rate (AAGR)of Different Industry in period of 1997-2022

Block / Municipal Corporation	Average Annual Growth Rate (AAGR) of Different Industry												
	Grain Mill	Backery Products	Food Products	Oil Crusher	Beverages	Masala Mill	Biscuit & Snacks	Coconut Products	Food Powder	Dairy Products	Fish Products	Rice Products	Papad
Anthikkad	18%	57%	132%	20%	61%	100%	40%	7%	50%	0%	40%	20%	20%
Challakudy	28%	124%	37%	29%	47%	85%	90%	20%	20%	20%	20%	0%	40%
Chavakkad	43%	92%	84%	18%	32%	70%	95%	0%	50%	40%	50%	0%	0%
Cherpu	26%	107%	36%	30%	60%	17%	63%	17%	67%	57%	60%	20%	0%
Chowannur	22%	67%	146%	24%	61%	43%	50%	73%	0%	40%	40%	0%	40%
Irinjalakkuda	28%	130%	112%	12%	55%	62%	85%	53%	40%	90%	80%	60%	0%
Kodakara	52%	115%	105%	27%	37%	47%	80%	20%	80%	40%	40%	0%	0%
Mala	51%	98%	179%	23%	82%	67%	60%	30%	0%	20%	20%	0%	0%
Mathilakam	63%	61%	89%	70%	50%	70%	0%	30%	40%	40%	60%	0%	0%
Mullassery	26%	102%	157%	43%	0%	0%	40%	0%	60%	20%	20%	0%	0%
Ollukkara	28%	182%	91%	61%	34%	50%	0%	0%	20%	47%	47%	0%	0%
Pazhayannur	35%	122%	129%	18%	80%	24%	20%	20%	0%	47%	47%	0%	0%
Puzhakal	32%	83%	149%	26%	60%	20%	30%	20%	43%	20%	20%	20%	20%
Thalikulam	28%	60%	83%	45%	69%	32%	93%	22%	10%	80%	100%	40%	40%
Vellangallur	29%	39%	224%	22%	42%	32%	60%	24%	40%	60%	20%	0%	0%
Wadakkanchery	24%	103%	71%	42%	92%	16%	0%	40%	60%	60%	60%	20%	0%
Thrissur Corporation	29%	64%	34%	57%	37%	89%	62%	13%	20%	10%	13%	7%	20%
AAGR of Dist	**33%**	**95%**	**109%**	**33%**	**53%**	**48%**	**51%**	**23%**	**35%**	**41%**	**43%**	**11%**	**11%**
Total Industry	**1045 (40%)**	**419 (16.0%)**	**402 (15.4%)**	**177 (6.8%)**	**129 (4.9%)**	**104 (4.0%)**	**61 (2.3%)**	**55 (2.1%)**	**48 (1.8%)**	**36 (1.4%)**	**8 (0.3%)**	**15 (0.57%)**	**12 (0.45%)**
Total Employment	**1992 (21.1%)**	**1973 (20.9%)**	**1649 (17.5%)**	**874 (9.2%)**	**560 (5.9%)**	**299 (3.4%)**	**401 (4.0%)**	**346 (3.7%)**	**377 (4.0%)**	**355 (3.8%)**	**100 (1.05%)**	**27 (0.28%)**	**52 (0.55%)**

Industry having good growth rate Industry having modorate growth rate Industry having low growth rate

Source: One Lakh Enterprises, DIC, 2022-23

The availability of raw materials for industry like Pickles, Honey Products, Meat Products and Chocolate are very less in the district. This shows that the growth of the above industry in the district is minimal Analyzing the average annual growth rate (AAGR) of the agro-based industry numbers from 1997-2022 (Refer table 8.15) it is found that industries like Grain mill, Bakery products, Food products and Oil crushers are growing at a good pace organically, so there is no need of intervention in the above industries. The beverages and Masala mill industry's AAGR is moderate. Whereas industries like the Masala mill, Biscuits-snacks, Coconut products, Food powder, Dairy products, Fish products, Rice products and Papad AAGR is very low. The above two types of industries category need intervention so that they can create income as well as employment because the required raw materials available for these industries are abundant in the district.

- **Infrastructure Availability**

There are a total 165 primary food processing facilities available in the district which cover up to 65% of villages. Which include facilities for weighing, cleaning, sorting, grading, packing, Warehouses, etc. According to the National Mission on Food Processing for effective backward linkages and empowerment of farmers, processing and preservation facilities at the village level could be provided.

There is a primary processing center at Koratty in Chalakuddy block, which act as a center for pre-processing of agricultural produce for the KINFRA Mega Food Park present at Palakkad. The primary processing center at Koratty has facilities like Which include facilities for weighing, cleaning, sorting, grading, packing, cold Storage, dry Warehouses, quality control laboratory, individually quick-frozen (IQF), etc.

- **Agencies involved**

Directorate of Industries and Commerce (DIC) is the functional arm of the Industries & Commerce Department of Govt. of Kerala. DIC implements the policy, scheme and programme of both the state govt. and central govt.

departments like the Ministry of Food Processing Industries.

Kerala Industrial Infrastructure Development Corporation (KINFRA) is a statutory body set up by Govt. of Kerala. KINFRA's core competency is in the area of industrial infrastructure development with a predominant focus on setting up ready-to-use industrial parks with modern facilities and amenities across the State of Kerala.

- **Central and State government programmes and schemes**

The Indian government has launched several schemes to promote employment and entrepreneurship. The Prime Minister's Employment Generation Programme (PMEGP) provides support to micro-enterprises, including farmers' producer organizations, self-help groups, and producer cooperatives, throughout their value chain. The PM Formalisation of micro food processing Enterprises Scheme (PM FME Scheme) is a credit-linked scheme that supports new viable micro-enterprises and village industry projects costing above Rs.10 lakh.

The Pradhan Mantri Kisan SAMPADA Yojana aims to create modern infrastructure with efficient supply chain management from farm gate to retail outlet, through various schemes such as Mega Food Parks, Food Processing and Preservation Capacities, and Infrastructure for Agro-processing Clusters. The Entrepreneur Support Scheme (ESS) and Margin Money Grant to Nano Units provide financial assistance to micro, small, and medium manufacturing enterprises. These schemes aim to promote entrepreneurship and generate employment in India.

8.3.8 Conclusion

Primary sector plays a crucial role in comprehensive growth and supporting different sectors. Agriculture, however, encounters various issues like decrease in crop area and production, insufficient export facilities, increasing fallow land, lack of involvement of youth, and lack of infrastructure facilities.

There is a vital role of animal husbandry and dairy development sector in providing income and employment to weaker sections of the society. However there are few gaps and challenges needs to be addressed like the shortage of fodder, low milk production density, and the dependence on imports for meat and eggs.

District's fishery sector inculcates marine as well as inland fisheries with a considerable role of aquaculture in economic growth. It entails depletion of fishery resources, lack of quality fish seed, and inadequate infrastructure. For enhancement, the local economy and promotion of sustainable fisheries, inputs should be concentrated on infrastructure development, marketing strategies, fish seed production, and the regulation of fishing practices.

Significant forest area is present in the district and a chunk of population is dependent on forestry and allied activities. Non-tax revenues is geerated by forest with timber and medicinal plants as the major source of revenue. The challenges in this sectors focuses on reduced timber yield, low availability of non-timber forest produce, and declining sales of value-added products.

There is a considerable count of agro-based industries, with more percentage of women in this sector. The Kodakara block holds the highest number of agro-based industries. The categories with low growth rates, such as masala mills, biscuits and snacks, coconut goods, food powder, dairy products, fish products, rice products, and papad, require assistance, according to an analysis of the average yearly growth rates of various businesses.

Addressing important challenges is crucial to ensuring the agriculture sector in the Thrissur district grows sustainably. Agriculture development, improved infrastructure, youth involvement, and increased export capacity should be prioritised. Along with critical infrastructure upgrades and ongoing programmes for livestock upliftment, promoting piggery development and indigenous cow breeds will help the animal husbandry and dairy industries expand. Modern agricultural methods that are standardised can be advantageous to the forest sector. Agro-processing sector development in Thrissur and across India can be boosted by targeting micro-enterprises and contemporary infrastructure development, as well as by utilising the latent potential of rice and coconut crops for value-added goods.

8.4 Summary

In the tertiary sector, the banking sector has room for aggressive lending, stimulating economic activity. Manufacturing and service industries, particularly in the environment, social, and financial sectors, are expanding and

offer prospects for increased investment and support. Start-up funding is also identified as a key segment for accelerated growth, contributing to job creation and economic prosperity. In the secondary sector, industries such as construction, manufacturing, and gold jewelry production contribute significantly to the economy. Augmentation of the handloom and gold jewelry industries presents opportunities for growth. Opportunities abound in the primary, secondary, and tertiary sectors for economic growth and development. In the primary sector, there is a need to address issues such as decreasing crop area, insufficient export facilities, and lack of infrastructure. The animal husbandry and dairy development sector holds potential for income and employment, but challenges like fodder shortage and low milk production density need attention. The fishery sector, both marine and inland, offers opportunities through infrastructure development, marketing strategies, and fish seed production. The forest sector, with its significant forest area, can generate non-tax revenues through timber and medicinal plants, but efforts are required to tackle challenges like reduced timber yield and declining sales of value-added products. Overall, leveraging these opportunities and providing adequate support and investment in the primary, secondary, and tertiary sectors can lead to economic growth and development.



9. Population Projection

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9. Population Projection

9.1 Introduction

As the statistics so far suggested that the percentage of population aged 60 and above with a growth rate of 24.67% will exceed that of working age group aged 15 to 59 with a growth rate of 11.86% in the district. Old age people too desire just, equitable and progressive opportunities in the society they live in. Therefore, there is a need to address the multifaceted challenges faced by older people such as access to respect, universal accessibility to places, health and employment. Older people's participation in the labour market, their invaluable contribution to families as care givers, to communities as volunteers, leaders, decision-makers and to society as well as economy at large increasingly needs to be recognised and acknowledged. Along with the opportunities and contributions that older people present, ageing poses a number of challenges for governments, society and older persons themselves, which require urgent policy responses, as well as anticipatory policy measures to prepare countries for meeting these challenges.

Apart from this, the population of Thrissur poses a complex problem of migration with 34.2% and 57.6% of the total district's population in 2001 and 2011 being migrants. Overall, the district has experienced significant population growth due to the influx of migrants. However, the youth tends to migrate out of the district hence this issue needs to be looked with the lens of strategic investments in education, health, energy, skills, economic reforms and good governance. Tapping youth's potential as active citizens for development needs to be relooked as an agenda for the empowerment of youth with objectives to encourage active citizenship to promote young change-makers whose leadership will catalyze the achievement of SDGs in Thrissur.

The age distribution statistics suggest a gradual decline in the percentage of population between 0-14 with 28%, 24%, and 23% in 1991, 2001, and 2011 respectively. The sex ratio suggests more females than men compared in the district however, Thrissur has become the district with the lowest birth rate of girl child in the State. Hence the local self-governments must partner with communities and agencies to help ensure the goals deliver results for and with every child. The statistics so far suggested a low workforce participation rate of women (15% in 2001 and 19% in 2011) as compared to men (50% in 2001 and 53% in 2011). However, only by ensuring the rights of women, justice and inclusion, decent work and economies that work for all, and sustaining our shared environment now and for future generations can be attained. Hence achieving gender equality and women's empowerment is integral to each of the development goals.

Figure 9.1 Population projection methods

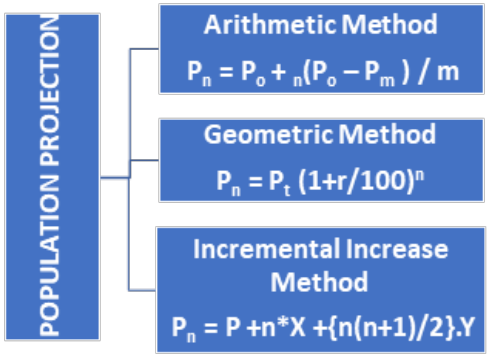
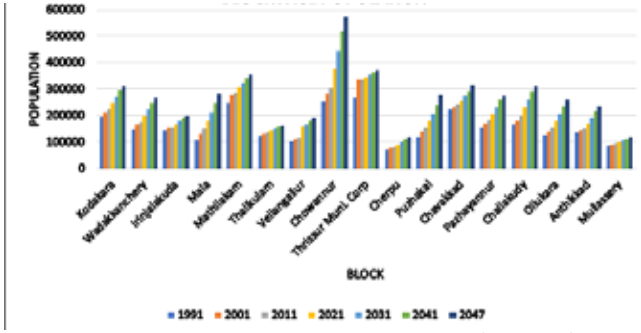


Figure 9.2 Blockwise population



Source: Census

Thus demography serves as a foundation for planning and development with an objective to provide maximum benefit to maximum number of people. Hence it is important to analyze the population by studying the population and its projection along with other demographic parameters.

9.2 Population projection methodology

The past pattern of population growth must typically be understood and assumed in order to continue projecting the current population to the desired future. The census population records contain current and previous population estimates for the city or district. The population at the end of the design phase is projected us-

Figure 9.3 Growth rate of Thrissur

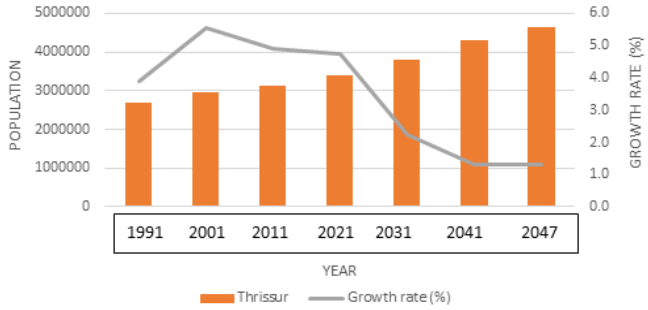
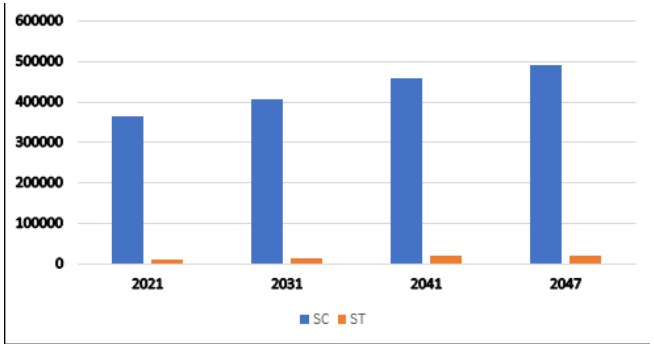


Table 9.1 Blockwise population

S.No.	Block	1991	2001	2011	2021	2031	2041	2047
1	Kodakara	196115	210843	223657	t247238	271225	295649	312124
2	Wadakkanchery	149085	165861	176257	198443	222716	247458	266098
3	Irinjalakuda	142591	153775	157107	168410	180070	192115	201340
4	Mala	107810	130157	150348	178349	209934	247308	285002
5	Mathilakam	249349	280226	289748	306001	322860	340363	355939
6	Thalikulam	123172	131351	133917	141937	150153	158575	165041
7	Vellangallur	103979	111786	117584	158157	169504	181305	190779
8	Chowannur	250940	282066	304599	374105	445932	520163	570139
9	Thrissur Muni. Corp	268864	334515	337090	345304	354079	363490	373621
10	Cherpu	70334	79920	82618	90670	99636	109630	120686
11	Puzhakal	119478	137850	156550	180735	208706	241106	278240
12	Chavakkad	223781	230541	242311	257259	274398	293767	314467
13	Pazhayannur	155421	171772	182810	207534	232708	258381	275040
14	Challakudy	167386	181598	201439	231331	261498	291957	311279
15	Ollukara	129569	140921	153697	180129	207959	237295	258031
16	Anthikkad	136815	145575	152761	171319	191747	214220	234044
17	Mullassery	86773	91806	94679	100057	106092	112855	120506
18	TOTAL	2737311	2974232	3121200	3536978	3909215	4305637	4632377

Figure 9.4 SC ST Population



ing a variety of methods deemed appropriate for that city or district in light of the growth after these population data are collected.

For the 2047 projection, we used the geometric increase method for calculating census towns (as census towns are fast-growing), and for villages, the incremental increase method was used where they have slightly less growth decadal-wise.

9.3 Urbanization and Growth Rate

Since the district's population growth rate has been steadily declining over the last three decades, Thrissur's growth rate has decreased from 5.4% to 1.33% between 2001 and 2051. The population growth rate in Chowannur, Kodakara, Thalikulam, and Cherpu blocks has been observed to be the highest among other blocks; therefore, if the current trend continues, the district's gross population density will not increase significantly. A number of factors influence population changes, including an increase due to births, a decrease due to deaths, an increase/decrease due to migration, and an increase due to annexation. According to projections, the Thrissur district's growth rate has also steadily decreased from 4.9% in 2011 to 1.33% in 2047.

9.4 Occupational structure

In this section the economic base of the District based on the occupational structure of the District is projected for years 2021, 2031, 2041 and the target year for the regional plan i.e. 2047 based on analysis of data as per census 1991, 2001 and 2011. Thus the changes that might happen in the economic base of the district over a period of time are also probed into. This would help identify the opportunities and challenge areas which could be worked upon to tap its full potential.

For this exercise simple growth method has been used because the other two methods required age wise distribution of population which is difficult to coaliberate due to insufficient data post covid.

Table 9.2 Blockwise projected WPR for Urban & Rural

Year	2021			2031			2041			2047		
Block	Urban	Rural	TOTALWPR	Urban	Rural	TOTALWPR	Urban	Rural	TOTALWPR	Urban	Rural	TOTALWPR
Kodakara	38.42	38.42	38.42	35.805	38.42	37.1125	37.57	38.42	37.995	36.6875	38.42	37.55375
Wadakkanchery	36.73	36.73	36.73	36.67	36.195	36.4325	38.16	36.4625	37.31125	37.415	36.32875	36.871875
Irinjalakuda	36.66	36.66	36.66	34.1925	36.66	35.42625	34.53	36.66	35.595	35.7	36.66	36.18
Mala	33.64	33.64	33.64	34.57	32.405	33.4875	34.105	33.0225	33.56375	34.3375	32.71375	33.525625
Mathilakam	34.71	34.71	34.71	32.615	34.71	33.6625	33.6625	34.71	34.18625	34.4	34.71	34.555
Thalikulam	30.35	30.35	30.35	30.075	30.51	30.2925	32.83	30.43	31.63	33.57	30.47	32.02
Vellangallur	34.13	34.13	34.13	33.685	33.655	33.67	33.9075	33.8925	33.9	33.79625	33.77375	33.785
Chowannur	34.12	34.12	34.12	32.9425	34.12	33.53125	33.53125	34.12	33.825625	34.06	34.12	34.09
Thrissur Muni. Corp.	34.12	0	17.06	33.7175	0	33.7	35.12	0	35.12	37.4		37.4
Cherpu	34.21	0	17.105	35.5975	0	35.5975	34.90375	0	34.90375	36.44		36.44
Puzhakal	36.82	36.82	36.82	36.58	36.3	36.44	36.7	36.56	36.63	36.64	36.43	36.535
Chavakkad	25.9	25.9	25.9	27.4225	25.9	26.66125	30.46	27.17	28.815	30.5	26.535	28.5175
Pazhayannur	34.3	34.3	34.3	34.13	36.73	35.43	34.215	35.515	34.865	34.1725	36.1225	35.1475
Challakudy	38.35	38.35	38.35	34.695	38.35	36.5225	36.5225	38.35	37.43625	35.60875	38.35	36.979375
Ollukara	40	40	40	38.1825	40	39.09125	38.9	40	39.45	38.54125	40	39.270625
Anthikkad	33.91	33.91	33.91	33.735	34.91	34.3225	35.1	34.41	34.755	34.4175	34.66	34.53875
Mullassery	31.72	31.72	31.72	31.44	31.18	28.6	32.3	28.4	30.35	31.87	29.79	30.83

9.4.1 Work-force of the district

Population, workforce and employment are closely interrelated and change in the size, composition and distribution of population alters the structure of the labour force and vice - versa. The workforce participation rate of the district as per the projection would 33.19 % in 2021, 33.76% in 2031, 34.04 % in 2041 and 34.41 % in 2047. This trend shows a gradual increase in the the workforce participation rate over the next 3 decades. Table 9.2 shows the blockwise urban-rural workforce participation rate projections for 2021, 2031, 2041 and 2047. It is observed that the work participation rates in both rural and urban areas are almost equal which indicates the parity between urban and rural. This indicates the equal opportunity of working in both rural and urban areas is increasing in proportion to the growth of population in the district. When the WPR of urban areas are compared, WPR of Thrissur Municipal Corporation is greater than all the other blocks. This maybe because Thrissur Municipal Corporation acts as a growth centre for the Thrissur District and provides home to a large number of workers. Amongst the blocks Mullassery, Chavakkad, Vellagallur, Chowannur, Thalikulam and Mathilakam have WPRs lesser that the total WPR of the district as estimated over the three decades.

9.4.2 Four-fold classification of workers

The block wise four fold classification of workers that is cultivators, agricultural labourers, Household industry workers and Other workers (Primary workers like fishermen, workers engaged in mining and plantation activities etc) of Thrissur district in years 2011, 2021, 2031, 2041 and 2047 is shown in Figure 9.5. From the graph it is observed that there is a fast decrease in percentage of cultivators and agriculture labourers while there is an increase in percentage of workers in other sectors. This boils down to assert that a large segment of workers are engaged in other services . With 20% of the workers involved in agriculture and cultivation Pazhayannur has the highest percentage of workers in these sectors when compared to other blocks. More or less similar pattern exists with the respect to workers classification in the remaining blocks of the district. It is clear from the graph that workers in primary sector are concentrated in Pazhayannur, Ollukara, Chalakuddy, Thalikulam , Mala and Kodakkara. This trend remains more or less constant in the upcoming decades in Kodakkara, Mala, Thalikulam, Pazhayannur and Ollukara. Other blocks notice a steady decline in the workers in Primary sector. This decline may be consid-

Figure 9.5 Projected blockwise four-fold classification of workers



ered to be a shift from rural to urban.

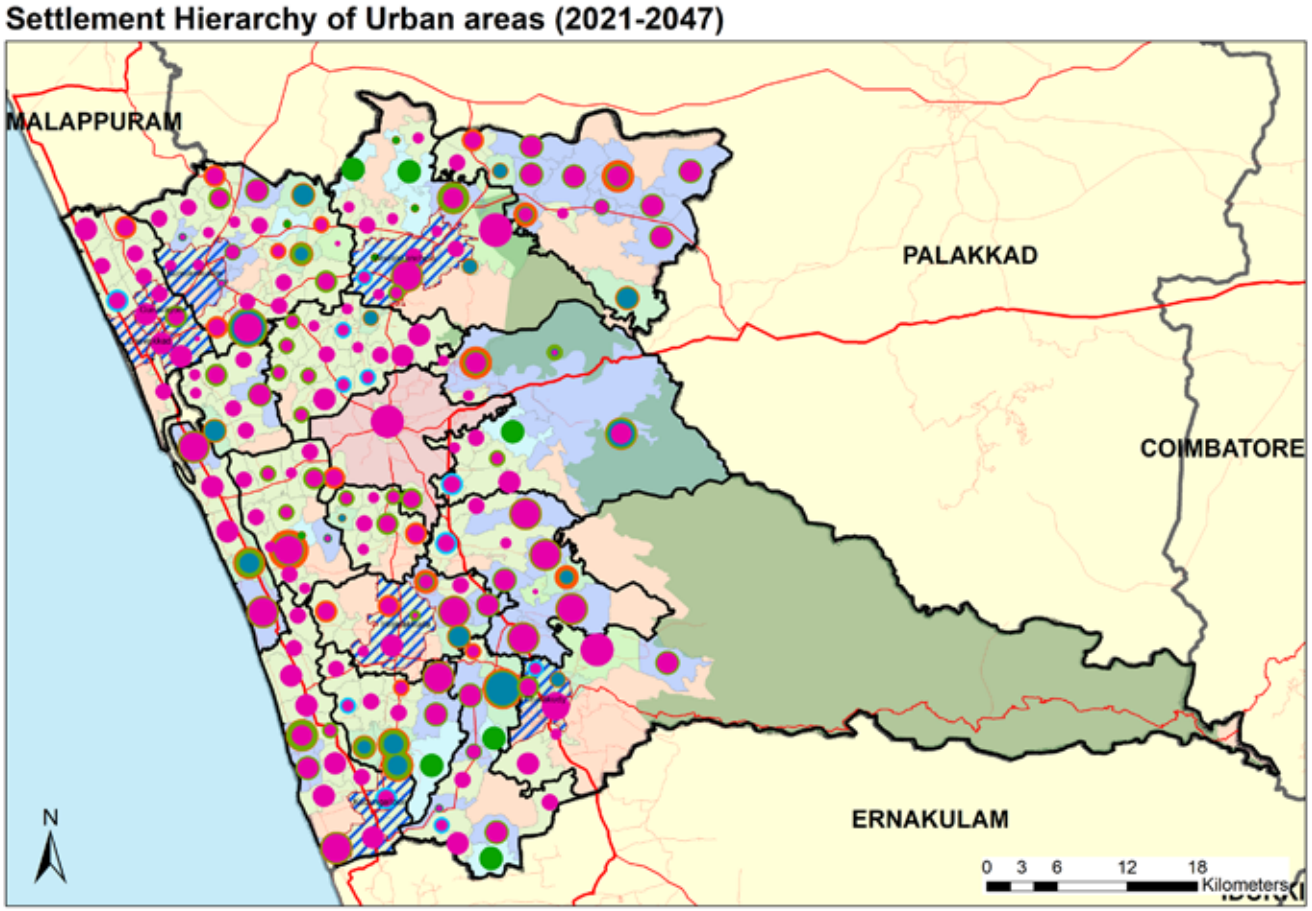
9.4.3 Proposal for settlement hierarchy

Currently in the year 2023, there are an estimated total of 178 urban settlements in the Thrissur district including seven municipalities and one municipal corporation with 170 census towns at present in the district. The settlement hierarchy for the emerging urban areas and declining rural areas have been identified based upon three factors, as mentioned by Census of India to determine an area as an urban area. They are:

- Population – Should be more than 5,000
- Population density – Should be more than 400 persons/sq.km
- Occupation of male main working population – More than 75% should be engaged in non-agricultural activities.

The population and growth of settlements of the district have been projected according to these parameters. These parameters specify the increase in population, the density of the residing population and the activities associated with them in a particular settlement. According to Figure 9.6, there is a possibility that blocks like Chavakkad, Chowannur, Cherpu and Mala blocks will see a major increase in number of urban areas as they are seeing a growth of population due to the influence of Thrissur city. Towns, which are villages now will see growth in population near to the municipal towns like Chavakkad, Chalakkudy and Guruvayur in the coming years. The developing fringe areas of Thrissur, which primarily lie in Puzhakal like Edakkalathur, Alur, Tholur,

Figure 9.6 Proposed Settlement Hierarchy of Urban areas (2021-2047)



Velur, Chhitilappilly, Killannur, etc. are seeing the upcoming developments just outside the main Thrissur city.

As the district was 67% urbanized according to the Census 2011, it is estimated to be approximately 80% urbanized presently and is projected to keep a steady pace of urbanization till 2047. Projecting the growth of urban areas and decrease in rural areas, it is estimated that the district will get 90% urbanized till the year 2047 with only 23 villages remaining.

As per the proposed population of 46.23 lakhs for the year 2047, it is expected that there will be 207 urban areas including the present statutory towns of the district. Thrissur Municipal Corporation as well as the municipalities will hold the maximum population out of all the statutory towns in the future too, as it is the main growth point of the whole district.

In the current times and future, it is estimated that there will be most number of class III, IV and V towns at any point in the coming decades.

The rural settlements are constantly decreasing over the years and is blocks of the district. These settlements have relatively slower growth rate and shall possess the rural characteristics till then and can be beneficial also to continue the agricultural practices in the district. There will be an evident shift of population from rural to urban areas and also shift of occupation from farm activities to non-farm activities.

The growth of urban areas and the evident shift from rural to urban of the settlements is quite evenly distributed all over the district, except the Chalakkudy block because of the forest area which covers most of the block and a large chunk of the district, where small settlements like Pariyaram are present. Other than that, most of the district will be urbanized by the year 2047.

9.5 Growth Centres

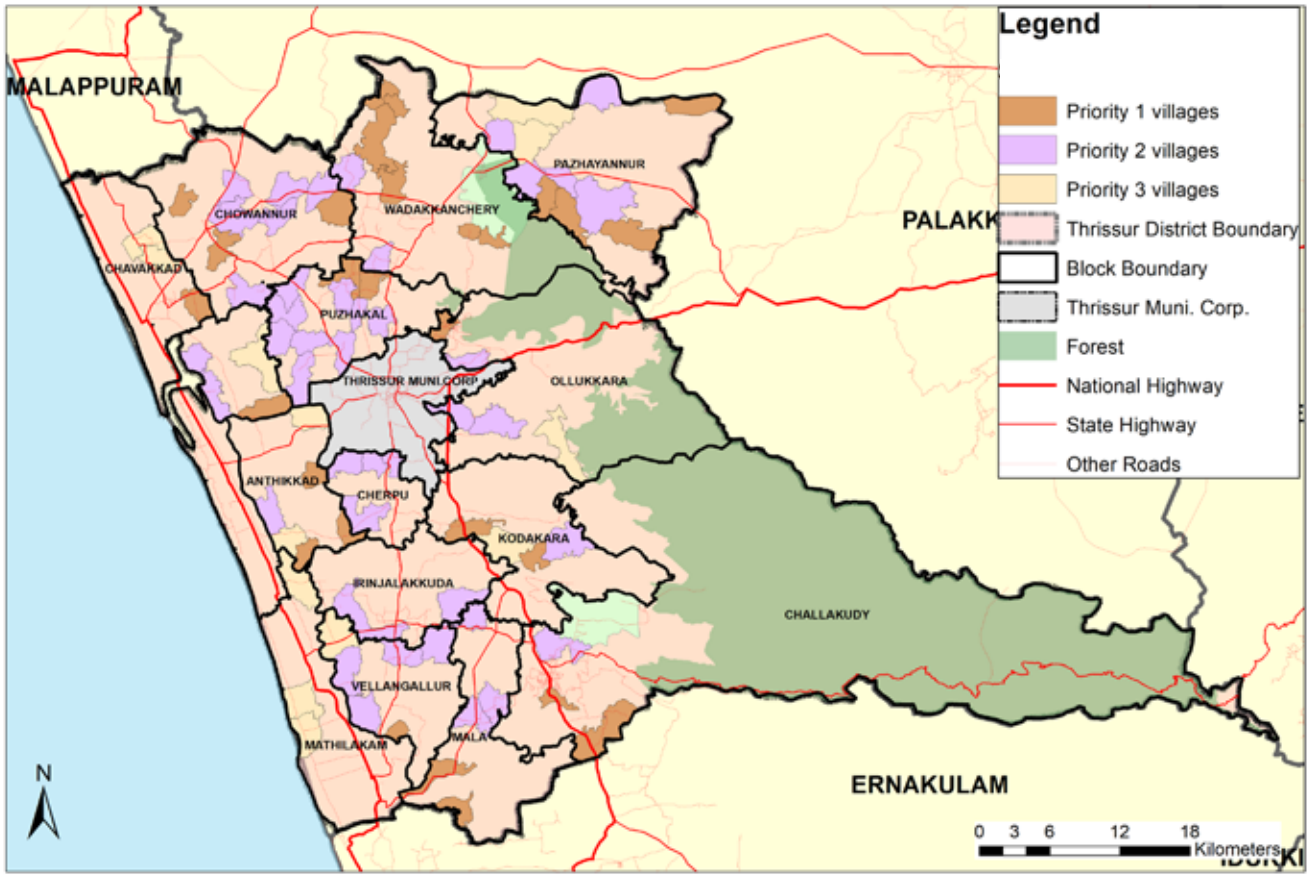
For the future Growth centres we have to refer the existing situation of the four tier hierarchy of the settlements in Thrissur. In chapter-3, we have seen there are three growth points, seven service centres, seventy central villages along with one growth centre in Thrissur municipal corporation. By developing the functions provided in the proposal for Thrissur we have found the changes in the number of growth centres, growth points, service centres and central villages.

The development of growth centres should receive regional attention in order to change the people's way of life and promote sustainable growth in the growth centre's catchment area, which is found to be a growing location for providing services. A place's functional ability to meet the requirements of those in the immediate vicinity is how centrality measures how important a location is. It depends on the quantity and variety of current amenities or the

Table 9.3 Hierarchical arragements of the settlements in Thrissur

Blocks/ Muni.Corp.	No. of Growth Centres	No. of Growth Points	No. of Service-Centres	No. of Central Villages
1. Thrissur Muni. Corp	1	0	0	3
2.Wadakkanchery	1	1	0	2
3. Irinjalakuda	0	0	2	3
4. Mala	0	0	0	2
5.Mathikalam	0	0	1	5
6. Thalikulam	0	0	1	2
7. Vellangallur	0	0	0	2
8. Chowannur	0	0	1	9
9.Kodakara	0	1	1	3
10.Cherpu	0	0	0	3
11.Puzhakal	0	0	0	6
12.Chavakkad	0	0	2	3
13. Pazhayannur	0	0	1	3
14.Chalakudy	0	0	1	3
15.Ollukara	0	0	0	6
16. Anthikkad	0	0	1	1
17.Mullassery	0	0	0	1
Total	2	3	12	72

Figure 9.7 Map for selected villages for Ferterlity Policy



weighted average of all the services offered by the central location. By the previously discussed existing scenario we have come across any central location's centrality score is calculated by multiplying its weighted average by the total number of its functions and also we came to learn that , a place's functional ability to meet the requirements of those in the immediate vicinity is how centrality measures how important a location is. It depends on the quantity and variety of current amenities or the weighted average of all the services offered by the central location. Any central location's centrality score is calculated by multiplying its weighted average by the total number of its functions.In Table-4 , the computed number of four-tier hierarchical arrangements in the settlements for 2047, on the basis of functional characteristics, has been given.

9.6 Demography

In the wake of aging societies, pro-natalist policies have been used around the world to promote childbearing in developed countries in an attempt to offset future demographic and economic challenges.

For us as policymakers, fertility is a sort of good news-bad news story. The good news is that the Indian total fertility rate remains near one of the highest among developing nations. The bad news is that the good news is fading fast as seen in case of Thrissur district. The level of fertility is positive, but its rate of change is negative.

While personally people are affected right away by the choice to have fewer children, collectively some impact may be felt by policy interventions that look at family planning at two levels – Policy level and Service level. The policy level includes the policy interventions by the Central and State Governments. The service level interventions include the provision of services through service providers like the health care units, the health care workers , the ASHA workers etc.

9.6.1 Policy Level Interventions

Government's support to family planning - Access to family planning and reproductive health services is critical to the health of women and children worldwide. Improving access can help to prevent maternal deaths and improve child bearing capacity of women to impove health of mother and newborn child. Target 3.7 of the Sustainable Development Goal (SDG) 3 on "Good health and well-being: Ensure healthy lives and promote well-being for all at all ages" calls on

countries "to ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes".

Initiatives that consider Better Family conditions - Couples considering divorce would be required to reminisce about their relationship first, in hopes they can work it out and have children.The service is ensured through provision of improved management of the existing child care centres and revision of new facilities.

Policies that facilitate work family balance - Researches show that the best way to encourage births is to set up a society in which marriage and family is well-aligned with other goals shared by most adults. This can be done by encouraging a 5 - day work schedule.

Child care or generous family leave policies – Provision of offering 40 - 60% of salary for private employees and upto 70% salary for government employees during maternity leave. Offering paid paternity leave during the last month of pregnancy to ensure proper care and healthy family conditions. Ensuring job security post child birth as and when deemed fit. Allocation of funds to Local Self Governments for smooth functioning and maintenance of child care units. Provision of running all of the district's child care centres for free.

"Baby bonuses" per child - financial incentives to families with children, such as tax breaks, housing assistance, or discounts on public services.

Base line and end-line Surveys - of adolescents and young personals must be conducted in tieup with the local NGOs to list the reasons for delay in marriages, choice to have fewer to no children, issues faced during pregnancy , post pregnancy and in parenting.

Some other policy interventions might include policies to discourage adolescent childbearing, incentivizing migrant and immigrant couples to settle in the district and have their offspring there itself for better job opportunities, better living standards etc.

Targeted villages and blocks

The ULBs begin by shortlisting possible villages/towns/blocks based on the population trend in the block, the number of poor households and the socio-economic break-up of the block to identify the percentage of the different vulnerable groups in the district as well as with the total number allotted to it. These villages/towns/blocks are depicted geographically in Figure 1. In what is known as a 'Fertility Policy,' the villages are expected to register for the selection by accepting an undertaking of agreement to the parameters stated within the time frame indicated. This information in the forms will have to be evaluated by the Mission Director and the evaluation has to be presented to the Family Planning Committee for approval. The final list of the selected villages/towns/blocks would then be issued online.

9.7 Conclusion

The total population of Thrissur district is forecasted to increase from 31.21 lakh to 46.32 lakh between 2011 and 2047 conditioned by certain assumptions using Census data from 1991 to 2011 at an average growth rate of 9.2% (calculated using geometric increase in urban areas and incremental increase in rural area respectively). It is evident that the growth is not evenly spread across the region rather different blocks expanded or declined at different rates. For instance, Kodakara declined by 1.43% while the Chalakkudy and Chavakkad increased by 2.44% and 2.08% respectively. Much of Puzhakal's and Cherpu's growth is driven by Thrissur M. Corp. and the upcoming estimated growth centre Wadakkanchery. They account for almost 22.4% of the district's population.

Between 2011 and 2047, the fertility rate is assumed to decline as per the trend observed. Thus, the proportion of population aged under 15 years is projected to decline by 4.52% approximately . The proportion of the working age-group (15- 59 years) and the older ages (60 years and above) are set to increase considerably. This leads to an increase in their share to the total population from 24.67% to 31.46%. Following this the proportion of population in the working age group 15-59 years is expected to fall from 65% in 2011 to 42.41% in 2047 with a shift

in workforce participation rate from in 32.34% 2011 to 34.96% in 2047. There is a workforce shift in work profile from cultivators and agricultural labourers to others.

The hierarchy of settlements shows an increase in Class IV and Class V towns by the year 2011, which shows early signs of urbanisation and conversion of rural areas to freshly transformed urban areas. Thus the population of the district is set to become urban with 91% of the settlements turning urban by 2047. By developing the provisions of functions through proposals for Thrissur and using the centrality index method, it has been inferred that due to these proposals two settlements will be potential Growth Centres, three settlements into Growth Points, twelve into Service Centres, and 72 central villages in Thrissur.These trends suggest that Thrissur has entered the next stage of demographic transition with population growth set to slow further in the next three decades along with a significant increase in the share of older population.

Table 9.4: List of projects and schemes for GrowTh at village, block, municipality and block level

Policy	Village	Block	Municipality	District
Policy for Population Growth	Conducting surveys	Parivar Vikaas Centre and Health Action Trust	Extension of Family Courts	Technical Support Units (TSUs)
Description	This would provide periodic community, age group, gender wise estimates	to track coverage of health programmes, conduct survey of skills of health care providers and deliver services at CHCs and PHCs	to promote and secure speedy settlement of disputes relating to family affairs	formulate key family planning indicators, provide technical support and prepare micro plan and implementation strategies
Benefits	would help in evidence based planning	improve community and primary health conditions, facilities, and data supply systems	unity building	improvement of key Family Planning services
Stakeholders	NGOs, ASHA workers	Block health officers, PHCs, social health activist	Family courts, NGOs and agencies	TSU committee, LSG, representatives of high priority villages
Beneficiaries	communities, women and adolescents	health service providers and frontline workers	Families, children and communities	communities, women and adolescents
SDGs earmarked	11, 17	3, 8 and 11	16, 3,4,10, 11	16, 17, 11, 8, 3,4,10
Barrier free public spaces	Conducting surveys	Project Implementation & Maintenance Department	Social Welfare Bureau	Technical Support Units
Description	provide periodic community perspective	revise and apply standards to buildings and monitor implementation of ongoing projects	develop and update friendly building portal and accessibility rating system	to advise governments through technical assistance and capacity building.
Benefits	would help in evidence based planning and encourage community participation	physical and social mobility, provides accessible housing to all especially poor persons with disabilities	faster grievance redressal system and evidence based planning	would help to develop and implement plans for the improvement of accessibility services
Stakeholders	NGOs, SHGs and social health activists	Officers, Advisory Group, Inspectors and social workers	Managing departments of buildings, chief architects, social heath activists, NGOs	TSU committee, LSG, representatives of high priority villages and blocks
Beneficiaries	users and occupants of buildings, children, women, elderly, specially abled	Primarily persons with special abilities and elderly	users and occupants of buildings, children, women, elderly, specially abled	users and occupants of buildings, children, women, elderly, specially abled
SDGs earmarked	8, target 9 c, 1.5, 11.5 and 13	4, 6, 11 and 16, target 17.18	3, 4, 5, 8, 10, 11	3, 4, 8, 11, 16, 6, 13
Labour Mapping Cell	Migration Tracability, information and data analysis sytem	Emigration and Immigration cell (EIC) , Health Action Trust	Extension of Family Courts and labour division under Social Welfare Bureau	Implementation Committee and Technical Support Units
Description	develop system for registering migrant workers, system and application development and training	to track coverage of health programmes, deliver services at CHCs and PHCs, conduct survey of skills of labours and evaluate the area of interventions	to promote speedy settlement of disputes and organise communication campaign to promote peaceful coexistence	to advise governments on the ways and means of translating policy frameworks into programmes through technical assistance and help build capacities for implementation
Benefits	mapping of workers for provision of services and organisation of programmes	mapping of skills help in better job opportunities which in turn helps in growth of economy, promotes health	promotes social integration and equity	develop and implement plans for improvement of labour mapping and social integration
Stakeholders	NGOs and agencies, LSGs, Labour Department	NGOs and agencies, LSGs, Labour Department and EIC	Family courts, NGOs and agencies	TSU committee, Local Self Governments, representatives of high priority villages and blocks
Beneficiaries	migrant workers and their families along with the LSGs	migrant workers and their families along with the government and employers	migrant workers and their families along with the employers and the native population	migrant workers and their families along with the government and employers
SDGs earmarked	1 (target 1.1, 1.3), 11	1, 3 (target 3.1-3.3 and 3.8), 5, 8	1 (target 1.3), 3 (target 3.4), 4, 5, 10, 16	8, 10, 13, 11, 17


Chettuva Lake
Peechi reservoir
Vazhani dam reservoir
Aloor River
NH 66
THRISSUR
PALAKKAD
CHALAKUDY
ERNAKULAM
MALA
MAITHILAKAM

Proposals

10. Proposals

The Regional Plan for Thrissur 2047 is a comprehensive and forward-looking document that presents a set of proposals to guide the sustainable development of a climate resilient district. These proposals are based on a thorough analysis conducted in various aspects, including the three pillars of symbolic economy; environment, infrastructure, and economy. The regional plan envisions Thrissur as a vibrant, inclusive, and environmentally conscious region that leverages its unique strengths to create a prosperous and resilient future. The environmental proposals in the Thrissur Regional Plan 2047 aim to protect and enhance the natural environment, conserve biodiversity, and mitigate the impacts of climate change while the infrastructure proposals in the Thrissur Regional Plan 2047 focus on enhancing connectivity, improving accessibility, and creating a robust and sustainable infrastructure network. The economic proposals work on the employment generation and economic growth. The proposals in the report start from the environment and infrastructure and economy related proposals are followed up later.

10.1 District Resilience Plan

Resilience refers to the capacity of a system to withstand disruptions and recover to its initial state. This idea was first introduced by Canadian ecologist C.S. Holling to help us comprehend how natural systems endure and adapt to human intervention, which has been a prevalent factor in their function for the past few hundred years (Holling CS., 2004).

Need for resilience

It is predicted that by 2050, approximately 70% of the world's population will reside in cities, which is a significant increase from the 14% recorded at the start of the 20th century. While urban concentration promotes growth, it has a significant drawback. Due to climate change, cities are under more strain than ever, and the poorer sections of society are at a greater risk. The Global Facility for Disaster Reduction and Recovery (GFDRR) estimates that disasters cost cities approximately $314 billion annually. To combat poverty and climate change, resilient cities are necessary. By 2030, it is anticipated that approximately 325 million people in 49 countries will be exposed to natural hazards and climate extremes in South Asian and Sub-Saharan Africa. Frameworks such as Sustainable Development Goals (Goal 11) and the Sendai Framework for Disaster Risk Reduction 2015-2030 have prioritized Resiliency and Disaster Risk Reduction.

According to Wilson GA. (2012), resilient systems possess certain characteristics that enable them to withstand various challenges. These qualities include reflectiveness, robustness, redundancy, flexibility, resourcefulness, inclusiveness, and integrity. Reflectiveness implies the system's ability to acknowledge and embrace the changes happening in the world today. Robustness refers to the system's ability to withstand pressure or stresses. Redundancy means having spare resources available in case of emergencies. Flexibility implies the system's capacity to adjust to any changes or transformations effortlessly. Resourcefulness means using available resources to achieve goals and targets. Inclusiveness implies that everyone is included in the decision-making process, and integrity refers to decision-makers' alignment with the system's needs.

Regional Resilience

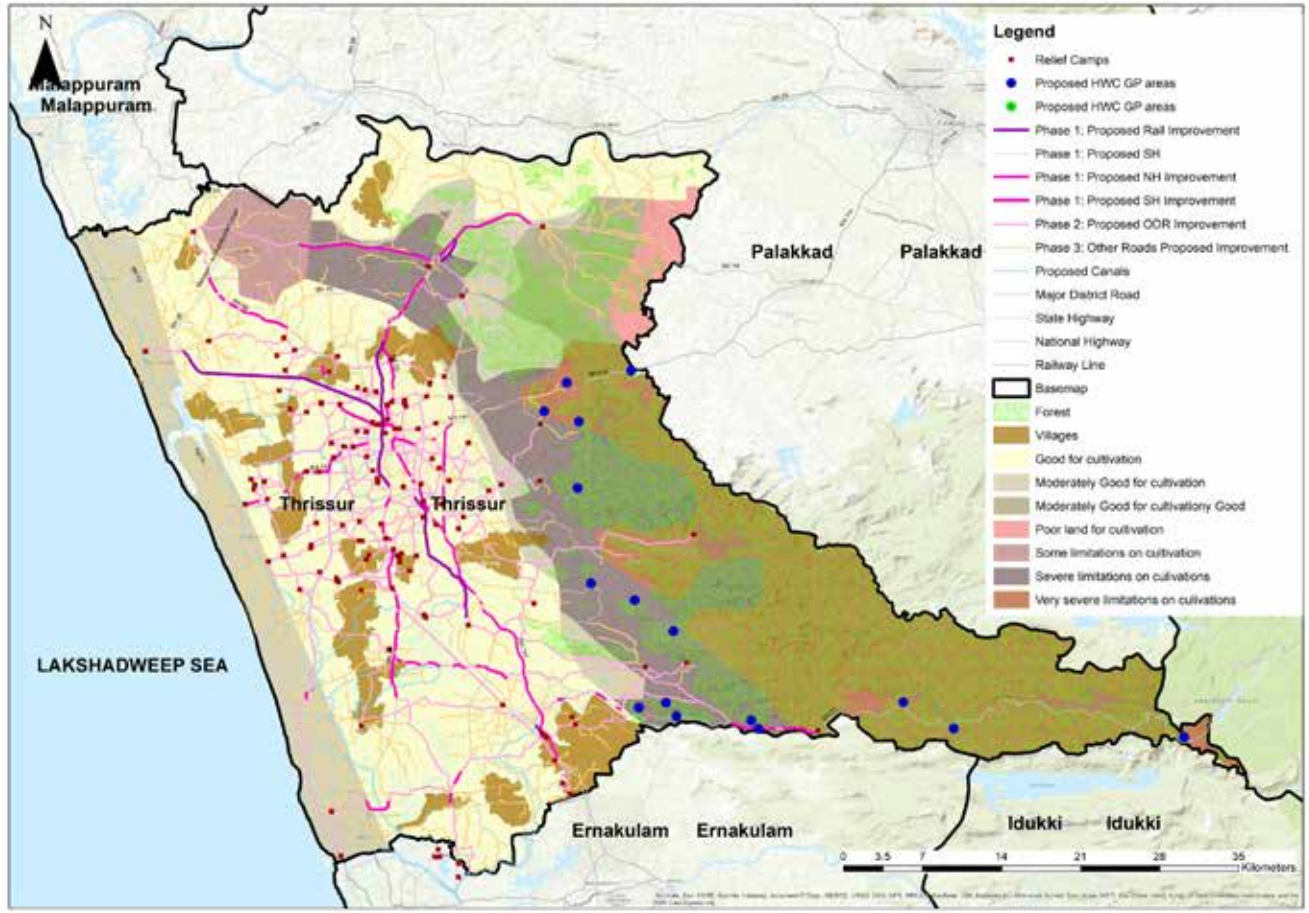
Regional resilience refers to the ability of an urban system and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity (Meerow S., 2016). This definition indicates that Urban Resilience is dynamic in nature and that there are multiple ways to achieve the same. Cities which do not plan, or are unable to recover, will accumulate the negative stresses will eventually crumble and fail its people. Resilience is critical for the Thrissur district regional plan because it enables the region to adapt to changing circumstances and maintain its desired functions in the face of disruptions or challenges. With the increasing frequency and severity of natural disasters, pandemics, and other crises, building resilience into the regional plan can help mitigate the negative impacts on the community and the environment. By enhancing the capacity of the region's socio-ecological and socio-technical networks to recover quickly from disturbances, the regional plan can ensure the long-term sustainability of the region and its communities. Therefore, incorporating resilience into the Thrissur district regional plan is crucial to ensuring the region's prosperity and well-being.

Proposed District Resilience Plan

The proposed regional planaims to transform Thrissur into a hub of symbolic economy and achieve economic prosperity and balanced regional development based on the pillars of symbolic economy. To achieve this vision and aim, the report outlines several objectives, including the analysis of the existing resource base and economic base of the district, identification of potential sectors, assessment of the existing infrastructure and estimation of future requirements for symbolic economy, and recommendation and facilitation of regional development strategy and programs for sustainable symbolic economy development.

The proposed district resilience plan aligns with these objectives and aims to address various challenges, including climate change mitigation, carbon mitigation through water transportation, flood resilient connectivity routes, river development, coastal area development, Kole area development, air and water pollution, land-based development through Agri-villages, and proposed strategy for human-wildlife conflict. Each proposal of the district resilience plan is interconnected and essential for achieving the vision and aim of the proposed regional planning report. The plan focuses on mitigating carbon emissions through the shift to IWT mobility, which is an economic, environment-friendly and fuel-efficient mode of transportation. Additionally, agro villages can reduce environmental impact, promote resource-use efficiency and fulfill all major pillars of symbolic economy by setting up efficient agro-ecosystems and promoting skill and knowledge-based tech-agri practices.

Figure: 10.1.1 District Resilience Plan - Connectivity



The plan also emphasizes the rejuvenation and development of water bodies to pave the way for water resilience of the district, while balancing the development and conservation of coastal areas to guide development in a sustainable manner. Furthermore, the conservation and regulation of development in the Kole area will help conserve natural resources, increase the productivity of agricultural crops, mitigate floods and recharge groundwater, and generate the economy through rejuvenating canals and proposing lotus farming activities, contributing to developing Thrissur into a hub of symbolic economy. Lastly, the proposal for flood resilient connectivity routes is crucial for achieving the objective of assessing and estimating future infrastructure requirements for the sustainable development of symbolic economy in Thrissur, thereby contributing to the vision of transforming the district into a hub of symbolic economy and achieving economic prosperity through balanced regional development.

10.1.1 Human Wildlife Mitigation Strategies

We may infer from the data analysis that preventing wild animals from invading agricultural fields and human settlements should be the top goal.Physical barriers and other deterrent strategies should be developed in order to achieve this.Early warning systems are necessary to enable the population to be alerted early and drive away wild animals before any damage occurs as a supplement to detethering methods. This proposal would recommend following broad strategies to mitigate the HWC in the the district

Physical Barrier: In the nine Gram Panchayats identified, SPF to be built over EPTs. Hanging SPFs to be built alongside the transportation route in high-conflict areas. 2. Installation of an Early Warning Electronic System (one per division) to prevent animal-human contact

The proposal will involving departments that are in line with HWC. The Department of Agriculture, which is developing a crop insurance programme, will be given responsibility for crop damage compensation. The proposal includes maintenance of fences under the NREGA programme to ensure ongoing funding availability & job creation for communities and enrichment Planting by promoting fruit plantations in degraded forests to keep animals from stealing crops for food and water.

Physical Barriers

1. Elephant Proof Trench (EPT): Given that this technique has been used for a long time in several regions of the nation, it could perhaps be considered a traditional technique. The trench was approved as a mitigation strategy in part due to its effectiveness against larger wild animals like elephants. In locations with frequent strong rains, this method is ineffective, and the durability greatly depends on the soil. For a higher level of protection, solar fences and trenches are often erected, and they have typically shown to be highly successful.

2. Solar Power Fence (SPF): If installed and maintained correctly, SPF is an extremely effective elephant deterrent. Regularly removing vegetation from around the fence and having a group of people guard the fence at night (human presence) will increase the fence's efficacy. SPF serves as a psychological barrier but does not offer a long-term fix, particularly in regions where crop raiding elephants are a regular occurrence.

3. Hanging Solar Power Fence (HSPF): This approach modifies SPF and uses wires suspended from the main line, which is maintained out of the reach of elephants, to safeguard it. Every 15 feet from where stainless steel wires swing,

Table: 10.1.1 Coastal Regulation Zone

Name	Length (In Km)	Issues	Proposal
D1	5.1	Erosion, Accretion and Cyclone Vulnerable	Breakwater and Revetment
D2	5.9	Accretion	Mangrove Plantation
D3	4.5	Erosion and Storm Surges	Coastal embankment, seawalls
D4	5.4	Erosion and Accretion	Seawall, Geobag, Mangrove Plantation and Breakwater
D5	4.8	Erosion	Seawall, Geobag and Breakwater
D6	5.2	Erosion, Accretion and Flood	Sills and Edging
D7	2.9	Erosion	Seawall, Geobag and Breakwater
D8	8.1	Accretion	Mangrove Plantation
D9	5.1	Erosion and Accretion	Seawall, Geobag, Mangrove Plantation and Breakwater
D10	5.8	Erosion, Accretion and Flood	Sills and Edging
D11	8.2	Erosion, Accretion, Flood and Storm surges	Breakwater and Revetment

Source: Ganjam Regional Plan, 2041

pillars with a height of 15 to 20 feet are placed with HSPF. These pillars hanging wires are elevated above the ground. When an elephant comes into contact with the wires, it receives moderate shocks that do not endanger its life. Solar electricity is transmitted to the wires like in the case of normal SPF. To stop elephants from entering from the woods, such fences are built across the edges of the forest. This is said to be extremely effective because the amount of harm is almost absent, and it is very popular in the states of Karnataka and Tamil Nadu. This approach has been recommended as a good resolution, particularly in wetlands and high conflict zones.

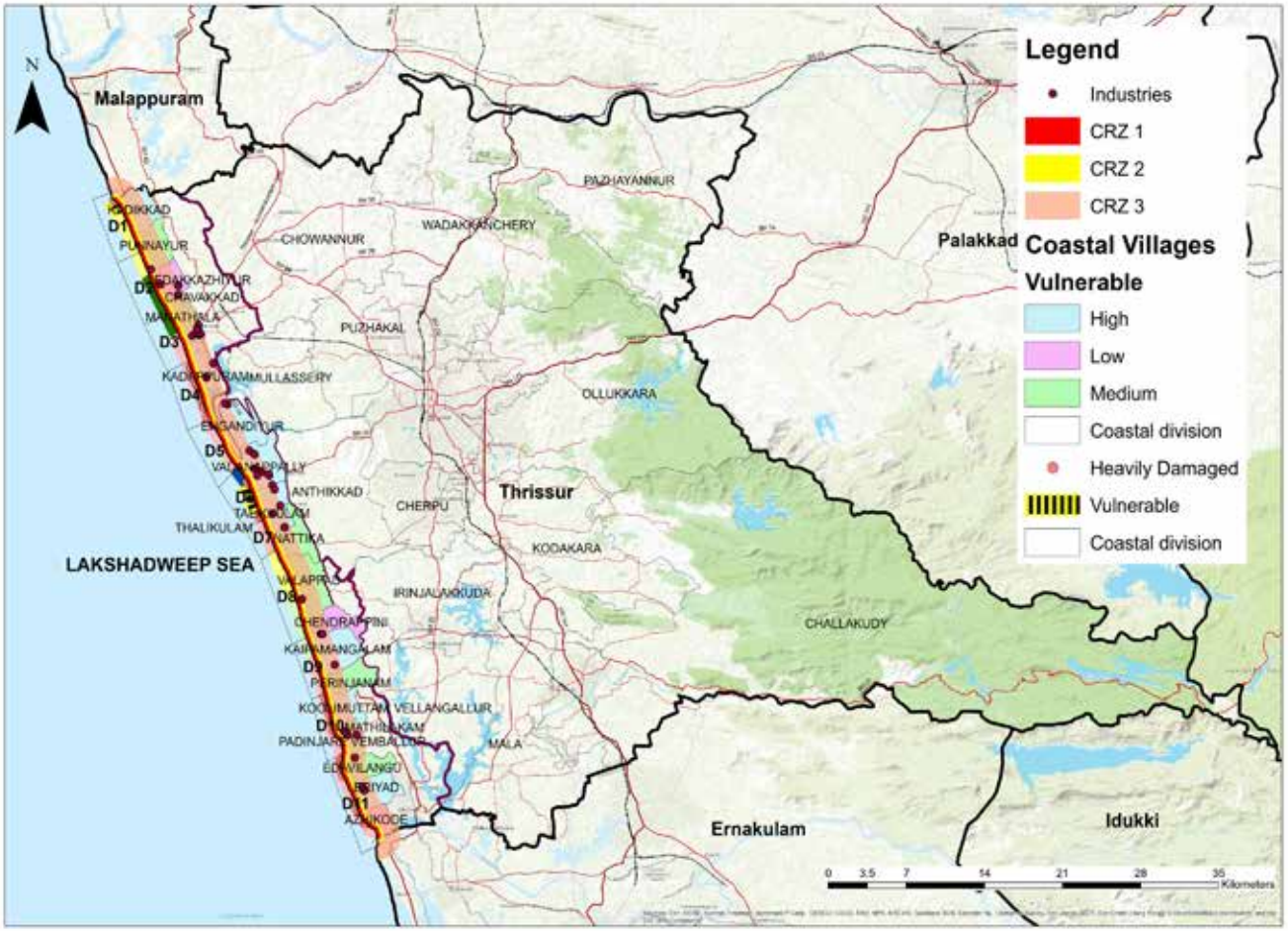
Stakeholders for the proposed development project will be Kerala Forest and Wildlife Department, Local Self Governement Department, Gram Panchayats and Department of Agriculture.

10.1.2 Coastal Zone Management

Coastal areas are high density areas with rapid urbanization putting pressure on land. To regulate the development in sustainable areas, three Coastal Regulation Zone have been proposed to guide the growth as shown in figure 10.1.2. Table 10.1.1 shows the prohibited, permitted and infrastructure activities in each proposed regulation zone. Coastal Regulation Zone I (CRZ 1) is from 0-250m from the coastline which is the most vulnerable areas. CRZ II is from 250-500m and CRZ III is from 500-2000m.

Coastal pollution is another major issue which is caused mainly due to the presence of red and orange industries that release chemical effluents and hazardous waste in the coastal belt. As figure 10.1.2 shows the location of

Figure: 10.1.2 Coastal Management Map



Source- Kerala Coastal Zone management authority, 2011; Coastal District Committee, 2019, Central Ground Water Board, 2021

industries along the coast. These lack wastewater treatment plant to treat the discharge. Also due to intensive sand mining the coastal areas are affected. Mathilakam block has no sewage treatment plant and the total sewage generated in the block is 8504160 LPD. The waste is directly discharged into the coast thereby affecting the fisheries. The short-term plan is **guideline regulation** that ensures that the effluent producing industries strictly adhere to guidelines. The mid-term plan is **effluent monitoring** which ensures periodic testing of effluent to tackle rising quality issues. Inspection should be done to ensure compliance of norms. For long-term the goal is to develop a **wastewater management plant** in the block of 0.148 MLD to cater to the needs of the existing industries. To guide coastal planning, development and policy-making, coastal hazard

Table: 10.1.2 Coastal Regulation Zone

Coastal Regulation Zone	Prohibited Activities	Permitted Activities	Infrastructure Activities
CRZ I (0-250m)	Setting up and expansion of industries, Discharge of Untreated wastewater, Dumping of Solid waste and chemical effluents, Land reclamation, Harvesting or drawl of groundwater, Setting up fish processing units (Except hatchery and natural fish), Port & harbor projects in highly eroding stretch, Sand mining	Eco-tourism, Installation of weather radar for cyclone movement monitoring, exploration of natural gas,, storage of non-hazardous cargo, construction of trans-harbour, buildings on landward side, temporary tourism facilities	Pipelines, Transmission lines, construction of civic amenities like schools, public toilets, roads, physical infrastructure required for traditional inhabitants
CRZ II (250-500m)	Setting up and expansion of industries, Discharge of Untreated wastewater, Dumping of Solid waste and chemical effluents, Land reclamation, Setting up fish processing units (Except hatchery and natural fish)	Agriculture, Forestry, Horticulture, Gardens, Parks, Mining of rare minerals, Tourism projects, Reconstruction alterations of existing authorized buildings, Construction of non-polluting industries relating to IT	Construction of houses for locals, Construction of units for domestic sewage, treatment and disposal, Facilities required for local fishing community
CRZ III (500-2000m)	Discharge of untreated wastewater, dumping of Solid waste and chemical effluents, Any kind of encroachment	Traditional fishing & allied activities, exploration & extraction of oil, natural gas, Eco-tourism, Buildings on landward side, Agriculture, Forestry, Horticulture, Gardens, Parks, Mining of rare minerals	Construction of houses and related infrastructure for local communities, Construction of units for domestic sewage

Source: Kerala Coastal Zone Management authority , 2011

mapping is very important. It helps us to determine the vulnerability of the coastal villages. For this coastal villages have been categorized as low-risk, medium-risk, and high-risk areas on the bases of occurrence of cyclone or storm surges, occurrence of flood, violation of CRZ norms, and degree of erosion and accretion as shown in figure 10.1.2. Low-risk areas are Edakkazhiyur, Chendrappini and Azhikode. These are proposed to have recreational facilities, drainage works and works to make the existing development relocatable. The medium-risk hazard areas are Punnayur, Manathala, Vattika, Valappad, Perinjanam, Padinjare Vemballur and Edavilangu. These have to carry out coastal protection works, provide access pathways for relief, tourism development and timber fencing and railings. High-risk hazard areas are Kadikkad, Kadappuram, Engandiyur, Vadanapally, Thalikulam, Kaipamangalam, Eriyad and Koolimuttam. These areas should remove the existing dwelling and replace with single dwelling on landward side and provide paving and landscape structures to prevent erosion. The goal of the risk assessment and any associ-

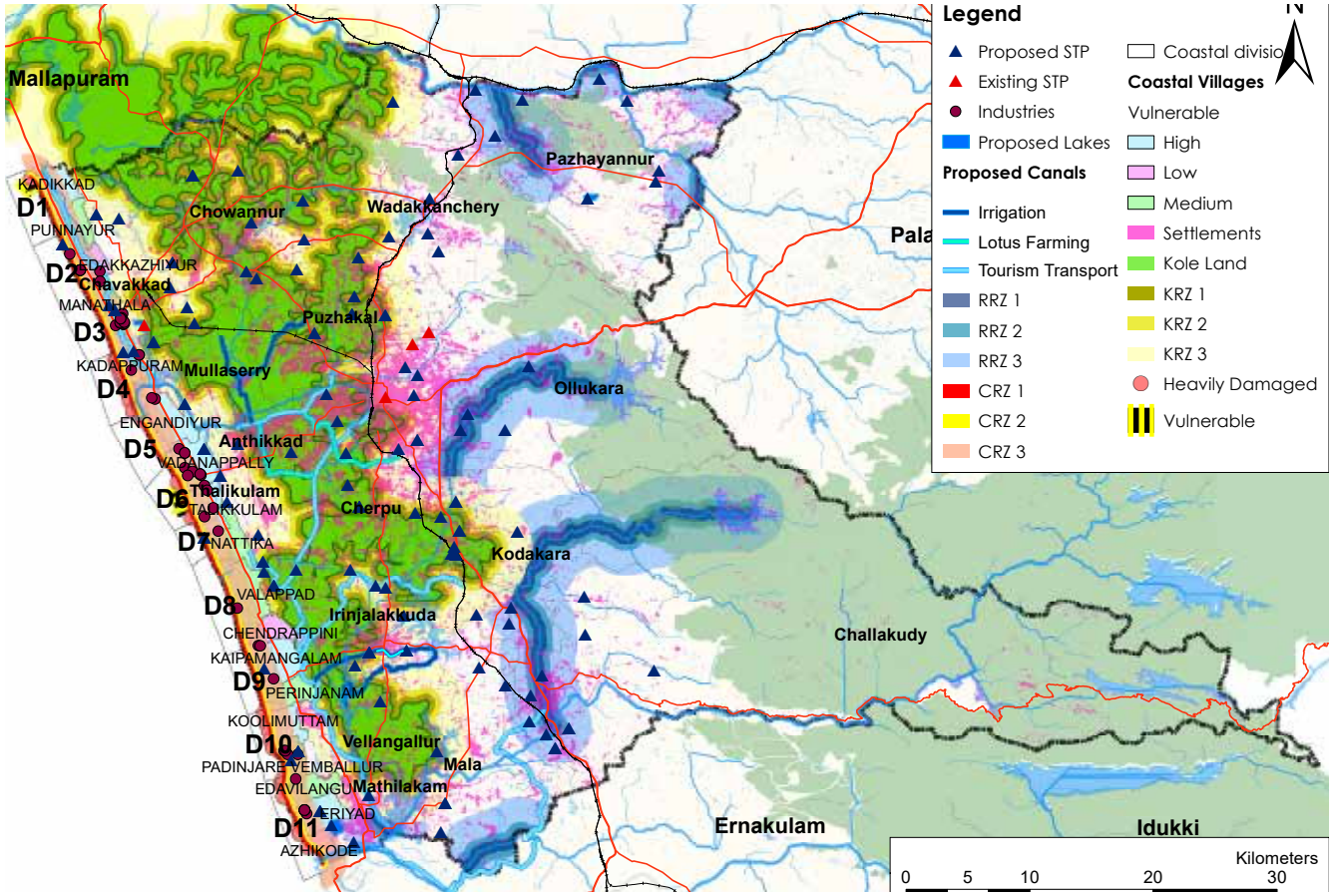
ated mapping should be to determine how likely or unlikely it is that the coastal danger will occur. In order to make informed adaptative planning decisions, densely populated coastlines and places with substantial values are expected to need more thorough coastal erosion hazard evaluations.

Site-based assessments and mapping of the erosion potential are necessary to prevent erosion, and mitigating measures may also be needed to support decisions linked to vital infrastructure as stated in table 10.1.2. For this the coastline is divided into twelve coastal divisions with the issues in each division identified and proposals recommended. These structures help in mitigating the coastal hazards.

10.1.3 River Development

The proposal of the river development has been divided into 3 parts. The short-term plan focus on the immediate actions that need to be taken to rejuvenate the river thus monitoring the release of effluent, identification of inlet points, and removal of the solid waste dumped into the river is given the most priority. The mid-term plan is about the development of water management infrastructure such as provision of STP for wastewater, having proper solid waste management, and covering or blocking of all the inlets that release untreated wastewater into the river. The mid-term plan also focuses on proving guidelines and regulations for river regulation zones and categorizing the activities as prohibited and permissible. Integration of wastewater management at the hotspot with the city's central wastewater management to improve the overall quality of the rivers is the main focus of the long-term plan.

Figure: 10.1.3 Proposed district resilience plan -regulations and development



River regulations zones (shown in figure 10.1.3)

RRZ 1 -The area up to a radius of 500m from the river is considered under this zone. Activities such as discharge of untreated wastewater, dumping of solid waste and chemical effluents, disposal of agriculture waste, any kind of encroachment, construction of new embankments, withdrawal of water for commercial purposes, and construction and expansion of buildings and industries are prohibited in this zone. permissible activities include a bio-diversity park in case adequate land is available in the vicinity of ponds or lakes, and the introduction of recreation facilities such as paddle boats. infrastructure such as the installation of sewage treatment plants with detention facilities at the outfall points and effluent management of adjoining peripheral areas are required in this zone.

RRZ 2- The radius of 500m to 1km of the area around the river falls under this zone. this

zone has prohibited activities such as any type of construction especially construction activities especially police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for flood response activities before, during, and after the flood. activities such as traditional organic farming, traditional capture fisheries, and grazing are permissible in this zone. infrastructure should focus on the removal of all blockades at the inlet or outlets should be ensured to avoid stagnation or blockage of stormwater.

RRZ 3- This zone caters to an area of a radius up to 3km from the river, activities such as the discharge of untreated wastewater, dumping of solid waste and chemical effluents, and any kind of encroachment are prohibited in this zone. Permissible activities include groundwater withdrawal by hand pumps for local use, discharge of domestic wastewater from cities or towns only after treatment, and purely temporary structure.The infrastructure provided in this zone covers small and tiny units and not allowing the discharge of effluents either individually or combined.

Infrastructure provision

KecheryRiver in Chowannur block needs quick action to be taken due to river pollution and encroachment,the quality of the waterbody has been declining rapidly. To address the issue of the discharge of wastewater from the area surrounding the river, an STP plant has been proposed. Chowannur block which has a wastewater generation of 445.93 KLD, has no STP in the block. To cater to the needs of the surrounding 1km radius of the river, which is the major contributor to the wastewater discharge to the river. The capacity of the STP is 280 KLD, with approx. the construction cost of 1.49cr.

To prevent encroachment on the banks of the river, recreational activities which are safer for the management of the river quality have been proposed. Facilities such as running and cycle tracks, kid's play area, and plantation of trees to mark the buffer is provided. This will help in preventing the construction of buildings and other activities which can affect the river's health.

10.1.4 Kole Wetlands

Kole wetlands are an ecologically sensitive area that provides many goods and services to the residents of the district and helps in mitigating flood needs to be conserved and have regulations for different activities.

Proposal of Kole Regulation Zones (KRZ)

The Kole lands are the wetlands or marshy lands which act as the flood plains for mitigating the adverse effects of floods, so the regulations zone for the Kole area should be prepared with a detailed listing of permitted and prohibited activities. Kole Regulation Zones (KRZ) are prepared as per the guidelines of flood plains and wetland conservation with the Kole area having three zones KRZ 1, KRZ 2, and KRZ 3 (Table 10.1.3). The details of regulation zone areas and a list of permitted, prohibited, and required infrastructure activities are given in table 1. The settlements coming into the Kole area and regulation zones are restricted to their boundaries and not allowed to further expand in the Kole areas, however, they are allowed to densify within their existing boundaries.

Land & Project Management Interventions

The shortcomings and issues related to land and project management of the Kole areas led to unregulated developments. There is a need to rectify these issues either with the help of the wetland act or with the help of other policies. The list of these issues with their coverage in the wetland act and the proposal of including other policies to solve these issues is given in table 10.1.4.

Policy Intervention Guidelines

The Kole Lands despite having the Kole Land Development Authority and Wetland Act, 2018 lacks in having the required set of Land records, infrastructure improvement, maintenance, and encouragement of economic activities other than paddy production. To improve these shortcomings, guidelines are proposed for the working of the administrative system with the help of local government, self help groups and community participation. The major points covered for policy intervention are The Databank Preparation Guidelines, Improving Infrastructure Services, Encouraging the Economy generating activities, and Community participation in the Kole area for its sustainable and progressive development (Figure 10.1.4).

Databank Preparation Guidelines

The Spatial and Land Records Data Bank has to be prepared in three major categories under Kole Area: Paddy Fields, Existing construction under allowed construction activities of wetland act, and Other Unregulated Construction hap-

pening in the Kole Area (Figure 10.1.5). The financial support for preparation of databank is provided from the funds allocated for Kole area under RAMSAR funds, Agriculture Promotion Fund under the wetland act, Corporate Social Responsibility (CSR) Funds.

Improving Infrastructure Services

The construction and maintenance of various infrastructures like Check Dams, Irrigation Canals, Dredging, Desiltation, Sluices & Regulators, Pipelines, and Other Infrastructure in the Kole area need to be regulated and maintained from time to time (Figure 10.1.4). The financial support for the improvement of infrastructure services is provided from the funds allocated for the Kole area under the RAMSAR Funds, Agriculture Promotion Fund under the Wetland Act, and other Central and State Schemes like MGNREGA, AMRUT, etc. Development Fund of respective departments, and Gram & Block Panchayat Development Fund.

Community Participation

There is a need of developing awareness drives to increase community participation for reconnecting the people with the Kole lands. The public awareness drives have to be conducted at Gram panchayat and village levels emphasizing the importance of Kole lands in flood mitigation, agricultural cultivation, as a source of water for drinking and irrigation, and its importance for food security. The drives will be conducted with the help of the Department of Agriculture, Environment, and Irrigation including gram panchayat administrations and self-help groups like Kudumbshree, Kole Krashaka Samiti, Kole Padavu Committee, and others for interaction at the local level.

Encouraging Economy Generating Activities

Kole Lands indirectly encourage the economy by mitigating flood, groundwater recharge, wastewater treatment, air purification, and carbon sequestration. But the vast area of Kole lands also supports the economy directly through paddy and other crop cultivation, pisciculture, poultry/fowl farming, animal husbandry, lotus farming, and tourism. The practice of paddy cultivation, pisciculture, and animal farms are already having reforms under further pro-

Table 10.1.3 Detailed list of activities under Kole Regulation Zone

KRZ	Prohibited Activities	Permitted Activities	Infrastructure Activities Required
KRZ 1 (0 - 500m)	Any kind of Encroachment, Construction of New Embankments, Withdrawal of water for commercial purposes, Construction and Expansion of Buildings and Industries, Discharge of Untreated wastewater, Dumping of Solid waste and chemical effluents	Green Belts, Ecologically Sensitive Uses, Organic farming, Fishing, Animal grazing, Treated wastewater discharge, Construction and upgradation of Irrigation Canals, Public Parks and Recreational Facilities	Spatial and Land Records Databank of Kole Fields, Rejuvenating and Maintaining Irrigation Channels – Desiltation, Cleaning, and maintenance, FSSM and decentralize waste management for Existing Buildings
KRZ 2 (0.5 - 1 Km)	Any kind of Encroachment, Withdrawal of water for commercial purposes, Construction and Expansion of Industries, Discharge of Untreated wastewater, Dumping of Solid waste and chemical effluents	Construction of New Embankments, Construction and Expansion of Residences and Small building Units except large scale industries, Tourism Facility	Guidelines for new construction and expansions facilities with provisions of green belt and rain water harvesting, Check for feasibility of FSSM and decentralize waste management
KRZ 3 (1 - 3 Km)	Any kind of Encroachment, Discharge of Untreated wastewater, Open dumping of Solid waste and chemical effluents	Withdrawal of water for commercial purposes, Construction and Expansion of Industries with proper Waste and effluent treatment facilities, Construction of Infrastructure Services like STP, ETP, Solid Waste Treatment Plant	Green Belt and Water Conservancy Norms for industries and buildings, Regulate flow of untreated Wastewater into irrigation channels or directly to fields, Check for feasibility of FSSM and decentralize waste management, Norms for withdrawal of water for commercial purposes

Source: Flood Plains & Wetland Regulation Zone Guidelines of different Master Plans

Table 10.1.4 Land and Project Interventions

Land and Project Management Interventions in Kole Area		
Issue	**Wetland Act, 2018**	**Proposals**
List of Permitted & Prohibited Activities		As per Kole Regulation Zones Proposed
Guidelines for allowing construction	Check of Water Conservancy Factors	Check of stormwater management, waste disposal and treatment facilities as per CPHEEO guidelines
Already Constructed Projects		EIA Report, Application of Polluter Pays Principle
Fallow Land	Cultivation by farmers and govt through SHGs	Inclusion of Model Tenancy Act
Barren Land		Seek feasibility for Poultry Farming and Recreational Infrastructure

Figure 10.1.4 Kole Policy Interventions

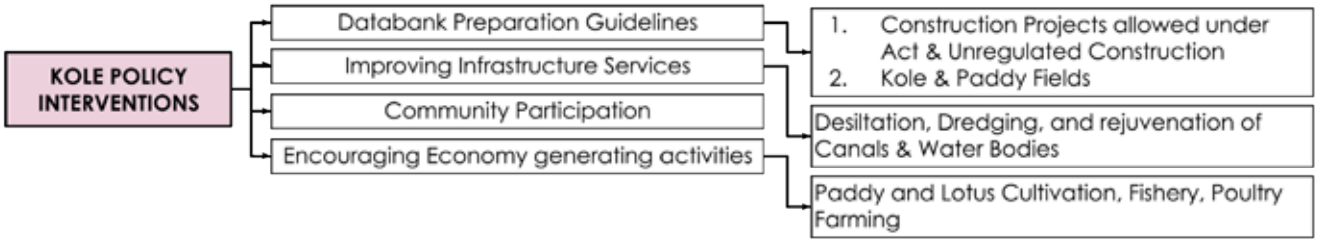
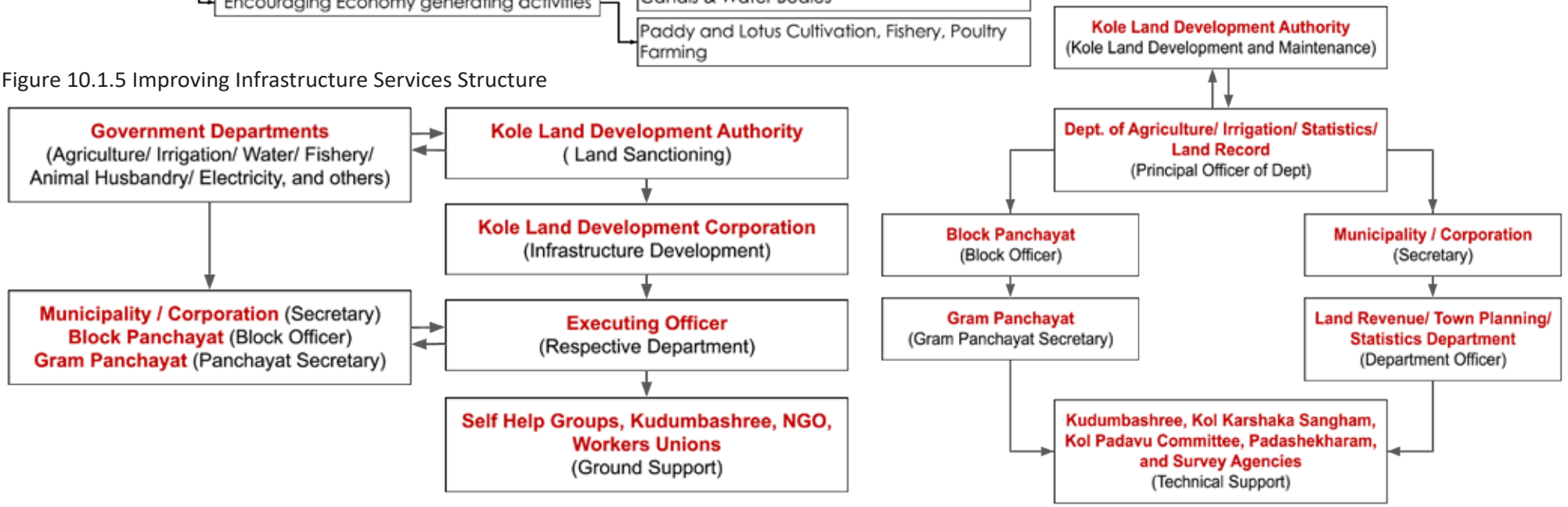


Figure 10.1.5 Improving Infrastructure Services Structure



posals but lotus farming is the sector that can be promoted more in the canals by regulating the flow of water. The canals also incorporate discharged treated wastewater from STPs which makes them more suitable for lotus farming, and also the lotus farms help to boost the tourism activities in the area. The financial support for the encouraging these activities is provided from the funds allocated for the Kole area under the RAMSAR funds, Agriculture Promotion Fund under the wetland act, and Central and State Schemes. Development Fund of respective departments, and Gram & Block Panchayat Development Fund.

Proposal of Rejuvenating Canal

The interspersed canals of Kole lands are facing the problems of siltation and encroachments which is also resulting in an increase in

the adverse effects of flood. For dealing with these issues, some canals are identified as shown in figure 10.1.3 for rejuvenation by desiltation, dredging, and increasing their width and depths. The soil extracted from this process is very rich in terms of minerals and can be utilized in the fallow paddy fields for better productivity. The total length of canals identified for rejuvenation is 196.86 Km which is divided majorly into three categories, Tourism transport canals, Irrigation canals, and Canals for lotus farming. The proposed length for the tourism transport canal is 136.0 Km, the irrigation canal is 41.28 Km, and the lotus farming Canal is 19.58 Km in total with a width of 9m for the tourism transport canal, and 6m for irrigation and lotus farming canal. These canals can store about 2972.9 MLD of water in total which will consist of flood water, rainwater, and discharge-treated water from STPs. The project and its financial aspects will be covered under the improvement of infrastructure services and encouraging economy-generating activities.

Canals for Lotus Farming

The canals identified for lotus farming are 19.58 Km long covering a total area of 11.75 Ha which is used for generating economy, tourism, and irrigation. Lotus flower holds the cultural and religious importance in Thrissur, used for worship, cultural functions, decorations, and other activities in a huge amount, as well as lotus farms are one of the major tourist attractions of plant lovers. The cost of lotus cultivation is Rs.87,500 per hectare yielding approximately 102,500 lotus flowers per hectare per year. The market price for Lotus is Rs. 3.0 resulting in total revenue generated from lotus cultivation of Rs. 307,500 per hectare per year and a net return of Rs. 220,000 per hectare per year from the lotus cultivation.

As per the net revenue generation of lotus cultivation, a total of 11.75 Ha of the area will yield a net return of Rs. 2,585,000 per year which will help in generating economy from the canals, including the cultural conscience of people, storing water for more time by reducing evaporation, and developing the attraction zone for tourist. The already-developed zone can also be developed further including temporary recreational facilities, and tourism activities like boating in lotus farms, site seeing, and other commercial activity centers for transporting lotus to different locations which will help in achieving the vision of developing Thrissur into a hub of Symbolic Economy.

10.1.5 Ground water quality

Proposal for improving Developing a sustainable ground water and surface water management plan for Thrissur district.

A healthy, sustainable and clean environment is now a basic necessity for people along with other essential needs. A healthy environment is equally important to human well-being as income and fundamental requirements. One of the biggest problems in metropolitan areas is the inadequate handling of wastewater. Ground water and other sources of fresh water are contaminated as a direct result of the build-up of human waste and mismanaged wastewater. Additionally, the cumulative consequences of improper wastewater management can have significant negative effects on ecosystem and public health. Therefore, for a sustainable, healthy ecosystem, there is a great need for an efficient ground water recharge in addition to liquid waste treatment.

Sanitation is a major issue in areas where residents are frequently exposed to contaminated air and water. These towns' expansion and usage of unhygienic waste disposal practises pose a risk to both their residents' health and the environment as a whole. Therefore, it is essential that liquid wastes are properly collected, transported, treated, and disposed of in order to safeguard public health and enhance the environment.

Development of lakes and rejuvenation of water bodies is a step towards paving the way for water resilience in the district, while developing ground water recharge models. The rejuvenation and development of lakes will encourage creations of landscaped tourist spot generating economy and land value.

Existing scenario for ground water quality

On the basis of analysis of ground water quality of 72 wells spread all across district, it was found that 4 blocks in Thrissur district that are Mathilakam, Ollukara, Pazhyannur and Chavakkad are facing ground water quality depletion and high level of contamination in terms of iron content and alkanity of water and therefore these four blocks are coming under critical category. Out of the 72 wells identified and analyzed in the district, 42 wells have been found out to be polluted which includes 16 wells in the blocks listed above.

Stakeholders and Beneficiaries

In India, lakes/wetlands are protected by various acts and rules which includes: The Indian Forest Act 1927, The Indian Fisheries Act 1897, Water (Prevention and Control of Pollution) Cess Act 1977 , Wildlife (Protection) Act 1972, Water (Prevention and Control of Pollution) Act 1974, Water (Prevention and Control of Pollution) Cess Act 1977, Forest (Conservation) Act 1980, The Environment (Protection) Act 1986, Wildlife (Protection) Amendment Act 1991, National Conservation Strategy and Policy Statement on Environment and Development 1992 The Biological Diversity Act 2002, National Water Policy 2002, National Environment Policy 2006, Environment Impact Assessment Notification 2006, Wetlands (Conservation and Management) Rules 2010, Government of India, National Water Policy 2012 etc.

Beneficiaries and participants, such as Kerala Water Authority, will be involved in the project. The primary objectives are to prevent and remove lake encroachment, conduct Environmental Impact Assessment (EIA) studies for lakes, environmental planning and mapping of lakes with the aid of Geographical Information System (GIS), create a database and atlas of lakes along with their catchments, develop an integrated development strategy for lakes, and improve habitat quality.

Based on the levels of emissions (air pollutants), effluent discharge (water pollutants), generation of hazardous wastes, and resource consumption, the Ministry of Environment, Forest and Climate Change (MOEFCC), India, has divided industrial sectors into Red, Orange, Green, and White. It should be highlighted that no industry included in the Red category may be located within a protected or ecologically vulnerable area. For the protection and conservation of lakes or wetlands, certain laws must be upheld. The Kerala Water Authority is able to influence zoning, land use, taxation, and incentives. Private parties may participate in the Design Built Operate model and lake upkeep.

Project Details

All the lakes are located close to existing or proposed waste water treatment plant and will have recharge pits equal to 50%of STP capacity. All the water bodies to have three phases of development. Phase I includes garbage removal, fencing and excavation. Phase II involves arranging water source for rejuvenation from nearest STP or constructing and decentralized STP. And phase III includes landscaping for creating public spaces. A secondary STP (sewage treatment plant), and a constructed wetland including a n algae pond and aquatic plants will be integrated with the lake. Treated effluent for STP will be released into wetland an then into the lake.

In Mathilakam block, 20 Ha area is proposed for lake development and waste water treatment plant of 0.5 MLD. For Ollukara block, 15 Ha area is provided for lake development. The lake is proposed near already completed FSTP (Faecal Sludge Treatment Process) project. The FSTP is scheduled to start in 2023. For Chalakudy block, a 3MLD STP plant is already functioning. An area of 30 Ha around the STP has been proposed as lake rejuvenation project. For Pazhayanur block, 30 Ha of area is proposed for 1 MLD STP, lake and infrastructure development.

Expected outcome

The project will demonstrate innovation in water treatment and groundwater recharge technologies. Its landscape will benefit the public by featuring attractions and amenities. Clean waterways and restored ecologies and landscapes provide the basis for creating public assets in the city in the form of public spaces, recreational amenities and enhanced biodiversity. These assets will be incorporated in all restoration initiatives to enable the creation of water oriented corridors of amenity that are robust in the long term, giving rise to new zones of growth and opportunities of land value capture.

The project will not only recharge ground water levels but improve air quality and create a healthy environment. The water bodies can be used to store excess water during rainfall and floods. It will redirect city's liquid waste towards better management. It will help in reducing urban heat island effect. Various Lake Rejuvenation projects in states across India has proved to be a very effective project for ground water recharge.

The project will help in achieving various SDG goals like SDG 3, good health and well being, SDG 6, clean water and sanitation, SDG 11, sustainable cities and communities and SDG 13, climate action.

10.1.6 Carbon Mitigation & Reviving Water Transportation

To reduce carbon via. road transportation, an extenstion to NW3 is proposed which passes by thrissur and includes - kodungallor backwaters, karuvannur river, and canolly canal, a total of 68km stretch from kottapuram to Thrissur end

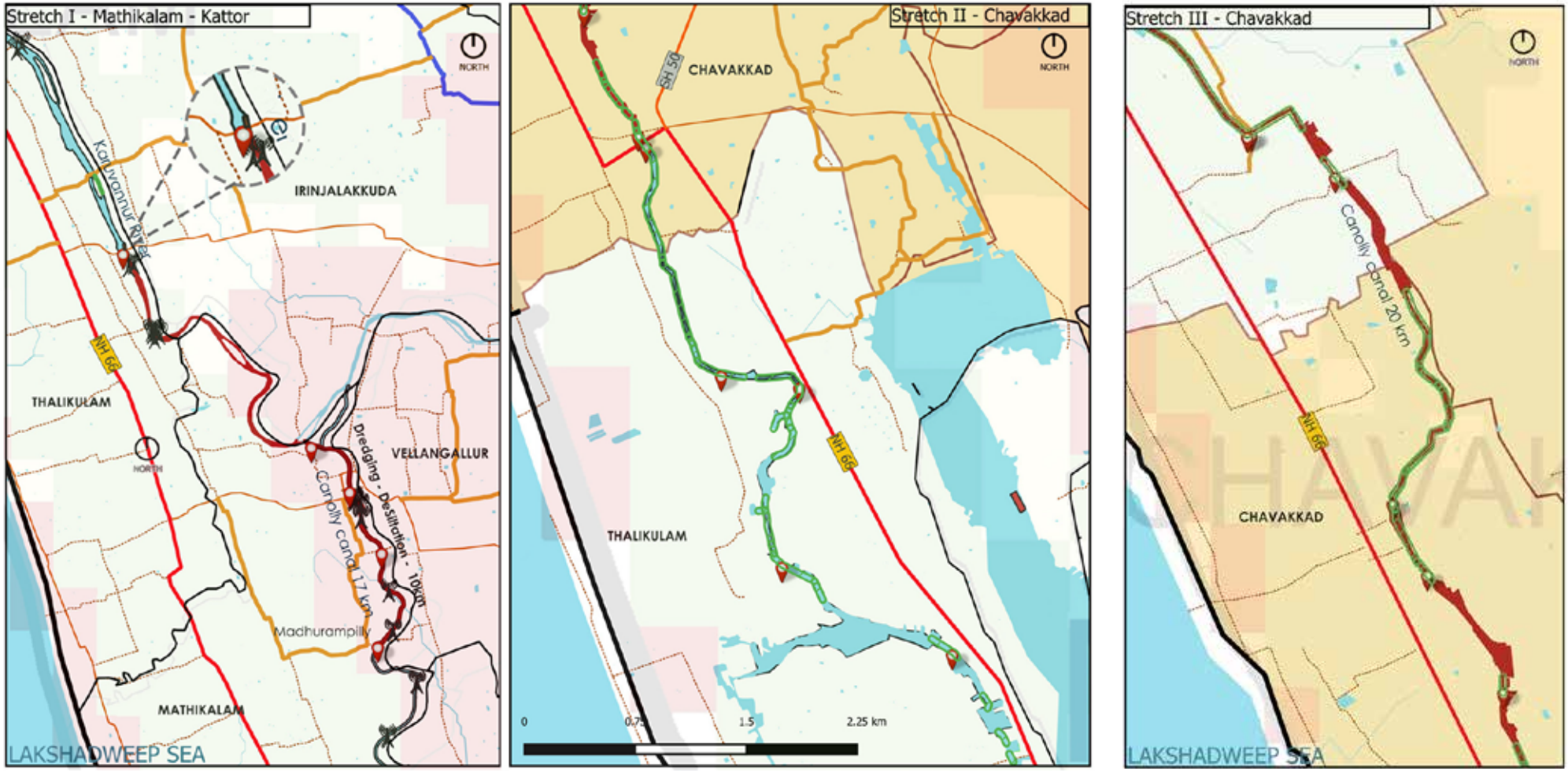
in north.

To Revive water transportation dredging depth of 2.2m is proposed in two blocks chavakkad and maithilikalam to desilt 14 km and 10 km stretches respectively as per IWAI Standards developed for Class III waterway standards considering Vessel dmension 50m x 9m x 1.5m and Tug & Barrages 141m x 9m x 1.5m. Dreging will also help in flood mitigation to some extent. Since dredging has bad impacts on environment as well, here maintenance dredging is done which will reduce vertical shrinkage, improve biodiversity and clear route for transportation.

Dredging calculated for chavakkad stretch is 75,931cum and for maithalikalam stretch 55,665 cum requiring a total cost of 1,62,49,234 Rs and 1,19,12,310 respectively (214Rs/cum). Dredging is untertaken by Irrigation Dept., WRD, SDMA, DDMA,Panchayats.

Fairway Navigation is proposed with flood resilience buoys for transportation accessibility and environment concerns for identified route of 68kms, considering Polythylene Solar floating Buoys as per IALA Standards at 750m zig zag placement in wider stretch and 500m placement in narrow stretch (112 no.s)

Figure 10.1.6 IWT Mobility Revival Stretches in Thrissur,Kerala



Canal Widening is proposed in canolly canal for a total length of 25km, as per IWAI Standards canal width is to be 40m minimum for mobility. Quantity worked out for land acquisition is 55 hectares.

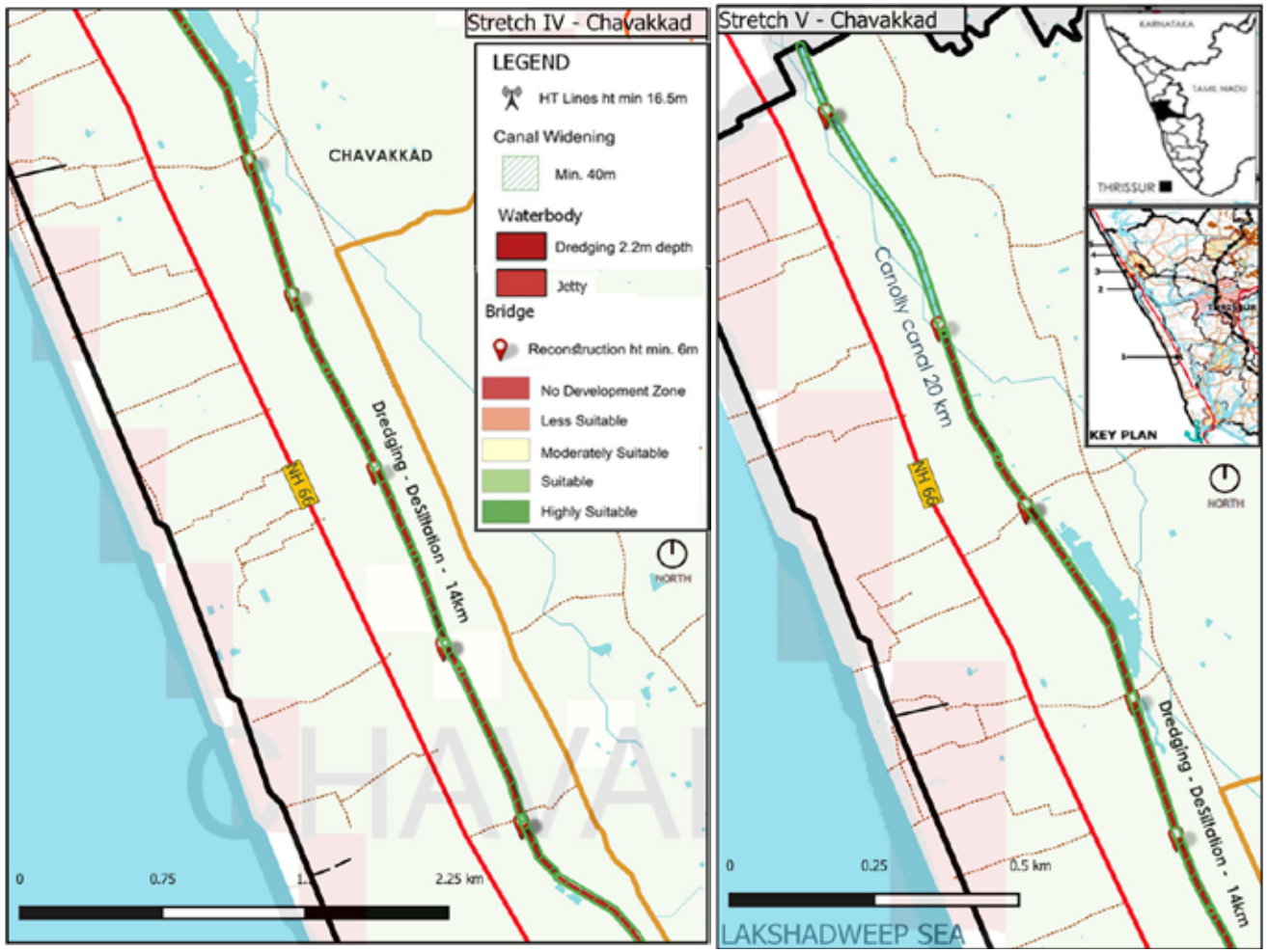
Vertical clearance is required for mobility for which reconstruction of 20 bridges is proposed in chavakkad's canolly canal and 12 bridges in maithalikalam's canolly canal at a minimum clearance of 6m as per IWAI Standards.Karuvannur river and canolly canal in maithalikalam block has 46 LT lines and 3 HT lines which needs to be raised at an clear height of 16.5m and 19m respectively.Jetty location provided at two locations chettuva lake and Tripyar for multimodal connectivity to roads as well. Revival of IWT mobility is cost effective and environment friendly as shown in chapter 3 analysis. IWT mobility will ease fishermens life and will boost fishery transportation as well as water tourism along banks of identified NW3 canal.

Certain Policy are proposed for shift of cargo mobility to IWT. Minimum 50% rebate on vessel-related charges. 10% Incentive above the road transportation cost. Licensing relaxation to foreign flag vessels for carrying transshipment containers. GST reduction on bunker fuel from 18% to 5%.

To achieve Sustainable green transportation and to mitigate carbon emission certain policies are proposed to comply with SDG 13.

To achieve Net carbon neutral by 2050 as per targeted by Kerala maritime Vision certain polices are proposed for carbon mitigation in Water route. MARPOL Regulation to be followed which states - Use of treated & clean fuel for

Figure 10.1.7 IWT Mobility Revival Stretches in Thrissur,Kerala



Vessels. Installation of Oil discharge monitoring & control system. Installation of emulsion breaking filters. Shipboard incineration to be made mandate for vessels.

Oil Discharge by vessels to be less than 15ppm (Oil Water Separator). To establish Green Mobility - use of Solar/Electric/H_2 powered vessels will have positive impact in reducing carbon emission and hence efforts to convert old fuel driven boats into Solar/Electric/CNG vessels needs to be focussed (KSWTD). Fuel fishing boats to LPG driven vessels may reduce 50-55% fuel cost. (KSCADC & CIFT)

Stakeholders for following proposals are IWAI, DDMA, Irrigation Dpt., CSIND, KSCADC, KSWTD, Kerala Shipping & Inland, Navigation Corporation Ltd, Ministry of Ports, Shipping and Waterways.

10.1.7 Flood resilient connectivity routes

Successful interventions across the globe have been implemented to make connectivity routes more flood-resilient. In Bangkok, Thailand, elevated roads have been built above flood levels to prevent flooding. In the Netherlands, a comprehensive drainage system consisting of canals, dikes, and pumps effectively prevents flooding. Permeable pavers have been used in Iowa, USA to reduce flooding on roads in flood-prone areas. New York City restricted development in flood-prone areas and created green spaces to absorb excess water. The UK's Environment Agency uses sensors and alerts to warn road users of potential flooding. Japan's Kobe has a robust emergency preparedness plan for road closures, evacuation routes, and shelters. These interventions have served as successful examples of flood-resilient connectivity routes and inspired the proposed Thrissur flood-resilient connectivity model.

The proposal for flood resilient connectivity routes as shown in figure 10.1.8 includes several key components. Firstly, elevated design is essential for ensuring that roads remain above flood levels. This can be achieved by constructing raised embankments or by using elevated bridges or causeways. Additionally, efficient drainage systems are necessary to channel water away from the road surface and prevent flooding. This includes the use of gutters, ditches, culverts, and stormwater management systems. The use of resilient materials such as asphalt, concrete, and other durable materials is also important to minimize damage to the road surface during flooding. Furthermore, roadside barriers such as guardrails and crash barriers can provide additional protection to the road surface and prevent debris from damaging the road during floods. The table 10.1.5 shows the proposed length of connectivity routes blockwise. Finally, as shown in figure 10.1.8, strategic phasing of road redesign and improvement should be implemented to minimize disruptions to traffic flow. This may involve redesigning one section of the road at a time or working on the road during off-peak hours. Overall, implementing these strategies will ensure that connectivity routes remain resilient to flooding, minimizing the impact on transportation infrastructure during extreme weather events.

There are several stakeholders involved in the establishment and maintenance of flood resilient connectivity routes in Thrissur. Local and state government bodies are responsible for funding and overseeing the construction and

Figure. 10.1.8 Proposed District Resilience Plan: Connectivity

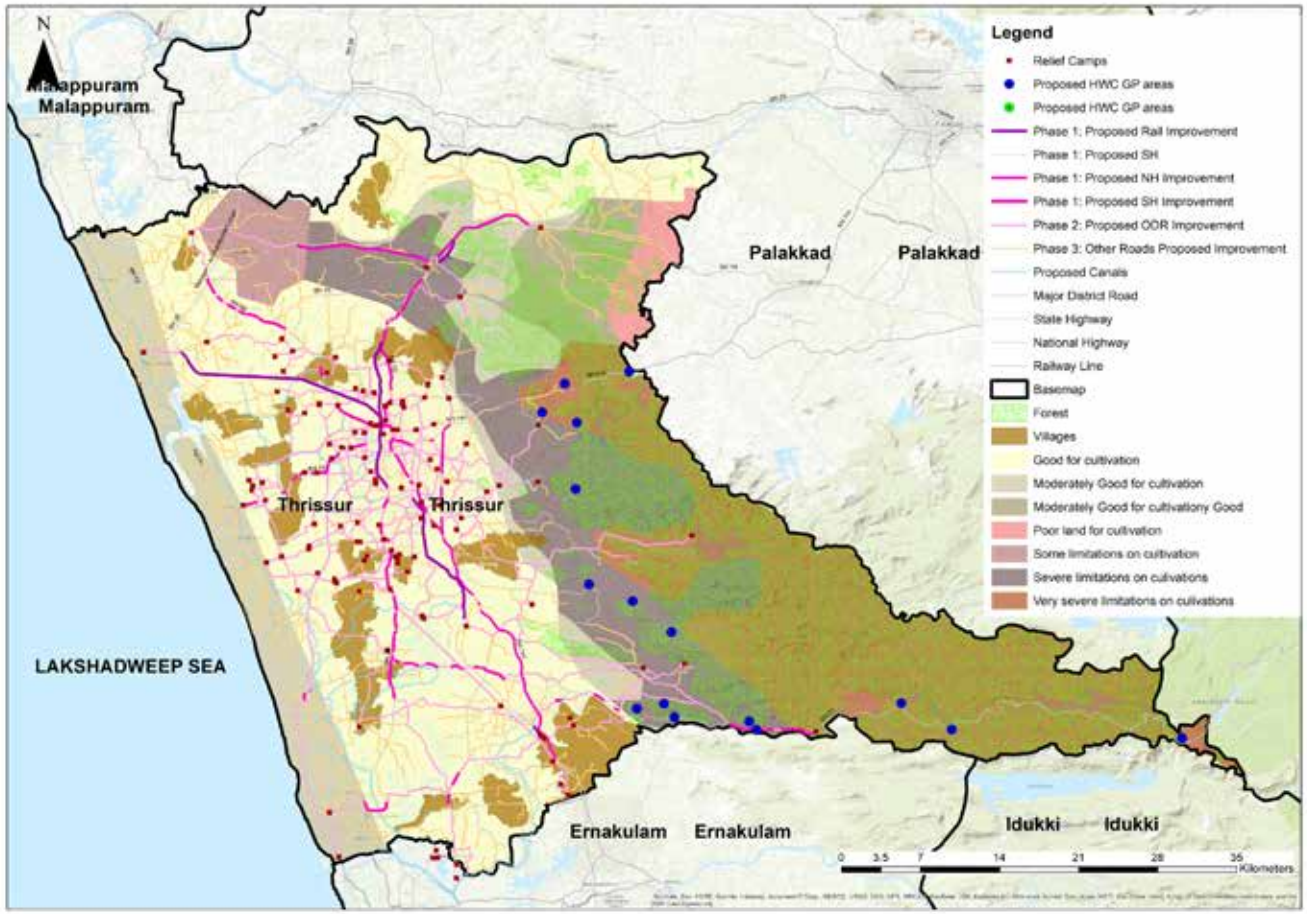


Table 10.1.5 Proposed length of connectivity routes

Block →			Kodakara	Wadakkanch...	Irinjalakuda	Mala	Mathikalam	Chowannur	Thrissur	Cherpu	Puzhakal	Chavakkad	Pazhayannur	Thalikulam	Oliukara	Anthikkad	Mullassery	Challakudy
Parameter ↓																		
Connectivity Length Proposed	Rail Line Affected	Km	4	0	2	0	0	0	8	0	13	0	0	0	0	0	6	0
	NH Affected	Km	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	SH Affected	Km	0	15	1	0	0	4	0	0	2	0	2	0	0	57	0	1
	Other Roads Affected	Km	19	11	18	9	11	15	78	54	40	2	0	0	29	0	2	1
	Total	Km	26	26	21	9	11	19	86	54	55	2	2	0	29	57	8	3

maintenance of these routes. The Department of Public Works and the National Highways Authority of India are also involved in the design and implementation of these routes. Local residents and businesses are important stakeholders as they rely on safe and accessible connectivity routes for their daily activities. Non-governmental organizations (NGOs) and community-based organizations (CBOs) may also be involved in advocating for the needs of local communities and ensuring that their voices are heard in the planning and decision-making processes. Finally, engineers, architects, and construction companies are also critical stakeholders who provide technical expertise and support in the design and construction of flood-resilient connectivity routes in Thrissur. Effective stakeholder engagement and collaboration will be essential for the successful implementation of these projects, ensuring that the needs of all stakeholders are met and the connectivity routes remain resilient in the face of extreme weather events.

There are various sources of funding available for such projects. Government grants are one source of funding, with central and state governments in India providing grants and funds for projects related to disaster management and mitigation. International aid is also available for disaster risk reduction and management projects in developing countries, with organizations such as the United Nations Development Programme (UNDP) and the World Bank providing funding. Corporate social responsibility (CSR) funds are another potential funding source, with companies allocating funds for social and environmental projects. Finally, public-private partnerships (PPP) can be established, with partnerships between local government bodies or private organizations helping to share the costs and resources required for the analysis. A combination of these funding sources can help to ensure that flood-resilient connectivity routes are established and maintained to protect against extreme weather events.

10.1.8 Smart Agri Villages – to promote Smart Agriculture

Smart Agri Villages (SAV) are models that demonstrate sustainable and self-sufficient farming systems that encompass all integrated approaches for ventilating a plethora of concepts such as poverty reduction, food and nutritional security, natural resource conservation, livelihood diversification through agri-preneurships, and so on. The larger perspective opens up a world of possibilities, from creative businesses to geographical product indexing, not to mention farm tourism. This argument objectively offers a greater dream, buoyed by examples of successful preceding attempts. Adoption of efficient cropping systems – inter cropping, mixed cropping, Organic farming, fish farming with other integrated cropping systems like strip cropping, Bio-pharmacies and nurseries, Agro clinics for better yield and better crop protection, Farmer field education systems, Common facility centres, Formation of farmer collectives, Creation of labour banks, Value addition units/ Agri business ventures, Branding and Marketing outlets with cold storages are some of the main components of this integrated system. Crops/ practices that are unique for geographical indexing, livestock for additional revenue, nutrient recycling Biogas units for energy generation, machines/technologies for next-level economic ease, and farm tourism/stay.

The process of selection

The ULBs begin by shortlisting possible agri villages based on soil quality, fertility, carrying capacity, agricultural land value, soil erosion, vulnerability to catastrophes, and other characteristics, as well as the total number allotted to it. These communities are depicted geographically on Map 1. In what is known as a 'AV Challenge,' each aspiring community competes for selection

Table 10.1.6 Implementation strategies in proposed agri villages

Strategies	Requirement	Detail
Organic Farming	Minimum 10 Ha of land in each village to be converted into organic farms	Cluster-level cordinators are selected from the experienced farmers members who are capable of doing the documentation works. This can help produce unique products to earn GI tag.
Plant nurseries	10 plant nurseries to be set-up in each cluster in phase I	Will reduce pressure on Vegetable and Fruit Promotion Council Kerala (VFPCK) and Krishi Vigyan Kendra (KVK) for meeting the seedling requirements.
Integrated farming	Mixed cropping for 10 months of the year	Inter – cropping, mixed cropping and strip cropping will help enhance yield.
Value addition units	10 different Agro based industries to be setup in each cluster	ensuring better income generation for the farmers through systematic interventions in collectivization, procurement, processing and marketing of the agricultural products.
Fallow Land conversion	Dry and wet fallow lands to be mapped and cultivated	Paddy, lotus, passion fruit, banana, coconut and flowers production would be given thrust under this programme.

as a smart agri village. The villages are expected to register for the selection by accepting an undertaking of agreement to the parameters stated, as well as submitting approval from at least 60% of the landholders and village inhabitants within the time frame indicated. This information in the forms will have to be evaluated by the AV Mission Director and the evaluation has to be presented to the Agiculture Village Committee (AVC) for approval. The final list of the selected villages would then be issued online.

Proposal Initiatives

Climate-smart Agriculture (CSA), which can help transform agri-food systems in a responsive manner and mitigate the devastating effects of climate change while producing food and energy in a sustainable manner, is one of the strategic components of land-based development in the Agri Villages Mission. Because of Covid, when all businesses were declared to cease or pause for a brief period, farmers and landlords were still working in their farms, and it has emerged as one of the most trustworthy sectors in business industries. Because of the abundance of money-making Agriculture Business Ideas, this industry has grown significantly and continues to grow. Farmers may be reached and assisted by agro-based start-ups. Initiatives that will be undertaken as part of this initiative

One of the key components of land-based development in the Agri Villages Mission is climate-smart agriculture (CSA), which may help transform agri-food systems in a responsive manner and alleviate the severe consequences of climate change while generating food and energy in a sustainable manner. Farmers and landlords were continuing working in their farms because of Covid, even when all companies were proclaimed to quit or pause for a brief while, and it has emerged as one of the most trustworthy sectors in business industries. This sector has developed tremendously and continues to grow as a result of the quantity of profitable Agriculture Business Ideas. Agro-based start-ups may reach out to farmers and support them with such feasible and cost-effective alternatives. The third part is fallow lss village development to create a robust and responsible tourist segment by generating engaging rural experiences, so boosting indigenous jobs and protecting local culture and tradition. Table 1 outlines these components in further depth.

Beneficiaries and Stakeholders

In phase I of the system, the system's targeted beneficiaries are mostly the poor and women in the farming community. Beneficiaries with land holdings are classified into four groups. Stratum I includes holdings of less than one acre, Stratum II includes holdings of one acre or more but less than three acres, Stratum III includes holdings of three acres or more but less than five acres, and Stratum IV includes holdings of five acres or more. The beneficiary pool would be made up of people from all walks of life who are engaged in rural livelihood activities and can help create the system and cycle it. Untapped abilities or talents, those with simple access to scarce or plentiful resources, socially and economically upgradable in the sense that attitude or behaviour may be improved.

KrushiMandals are the farmers committees or associations in each village that work with institutions to help the farm livelihood sector in a variety of ways. of extending technical, financial, social and advisory services. Some of these institutions are Soil Survey and Soil Conservation department, Commodity Boards under the Ministry of Commerce, Kerala Infrastructure Investment Fund Board, Kerala bank, labour department, Local Self Governments and the THINK cluster startups.

Agriculture allocations from Plan programmes, including State and Central sector schemes, the Rural Infrastructure Development Fund (RIDF), the Rebuild Kerala Initiative (RKI), and the Kerala Infrastructure Investment Fund Board (KIIFB; outside the plan).

Expected outcomes & indicators

Economic empowerment, which would be a dynamic system in which farmers' incomes would be raised through diverse agricultural activities and firms that are independent or interconnected, and also by lowering or eliminating all conceivable limiting constraints of economic growth, are anticipated successors. Individual and collective social empowerment through institution and capacity building for sustainable development and ecological empowerment into community led indigenous and participatory social systems for eco-preservation, preserving the notion of ecofeminism. The indicators of agricultural and sustainable development can be divided into economic indicators, ecological indicators and social indicators which could further be detailed into increase in cropping area and crop intensity, enhanced production and productivity, increase in income of farmers and enterpreneurs, banking linkages, soil and waste conservation strategies, reduced pollution hazards, water availability and use efficiency, waste management systems,increase in assets, living conditions and opportunities, reduction in poverty, increase in farm based individual and group ventures, food self-sufficiency, equality in food and income distribution among farmers and access to resources and support services.

10.2 Transport and Connectivity

Transport and connectivity is critical components of any regional plan, as it promotes economic growth, and improve access to important services. The proposals aim to create a seamless and efficient network of transportation systems, including Railways, Highways, Public Transport, and Waterways which enhances overall quality of life. The issues identified which is to be solved are congestion, delay and inconsistency in commuting. The proposals range from the development of new transport infrastructure to the implementation of innovative technology which enhances safety and comfortable transportation. These have to be taken into account to the current and future needs of the region and its residents.

We have developed a proposal by considering several strategies and analyzing the situations. We have tried to connect all modes of transportation by multimodal hubs to provide passengers with more options. We have also provided connections between different modes of transportation for seamless and last-mile connectivity. While developing our proposal We have taken environmental impact, road safety, congestion, and disaster into account.

10.2.1 Upgradation of road geometry

During the survey in Thrissur, it was observed that traffic from all directions is merging into the city due to the radial road pattern. This has resulted in heavy congestion during peak hours. The traffic volume count data at three locations corroborate this observation. It is found that the average traffic movement towards the city centre is 4,628 vehicles per hour, while the movement away from the centre is 5,057 vehicles per hour. Additionally, accident reports from the past five years were analysed and found that the maximum number of accidents occurred in the Thrissur M.Corp. This highlights the need for improved traffic management and safety measures in the area.

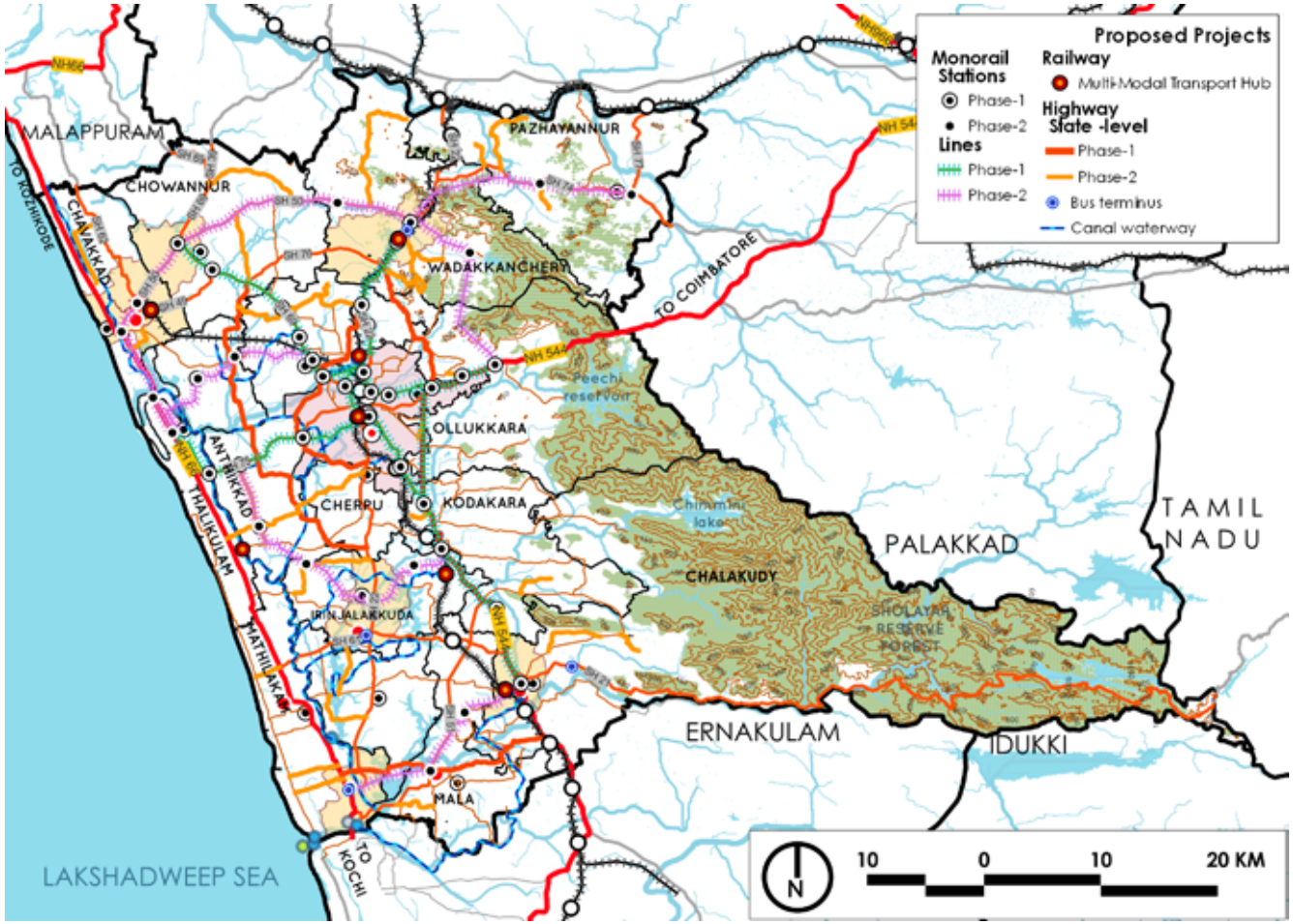
Based on the analysis, it is proposed as a two-phase road upgrade plan for Thrissur, as shown in Figure 10.2.2. In phase 1, it is recommend for the construction of a ring road to reduce congestion and accidents in the city centre by diverting through traffic. The plan involves widening existing roads that connect different state and national highways to create a ring road around the city, with a new upgraded road width of 14 meters. The proposed road upgrade project will cover a total length of 93 km, out of which 88.86 km will be for road upgradation and 4.13 km will be for new road construction.

The existing roads that has identified for widening are currently 3 to 7 meters wide and fall under the MDR, ODR, and village road categories. The total area required for the phase 1 project is 129.65 hectares, out of which 50.74 hectares are existing roads. Therefore, it is estimate that 79 hectares of land will need to be acquired for the project. To help with the planning and implementation of the project, block-wise road length and land acquisition details is provided in Table 10.2.1.

In phase 2 of the proposed road upgrade plan, roads are identified for upgradation based on proposed bus routes connecting all Central Villages, Service Centres, Growth Points, and Growth Centres. The identified existing roads fall under the ODR and village road categories and are currently 3 to 4 meters wide. Our plan involves upgrading these roads to a width of 9 meters, which is of MDR standard.

The total length of road identified for upgradation in this phase is 302 km. It is estimate that the area needed for the phase 2 project is approximately 272 hectares, out of which 121 hectares are already existing roads. Therefore, total 151 hectares of land will be needed to acquire for the project. To facilitate the planning and implementation of the project, block-wise road length and land acquisition details is provided in Table 10.2.1. It can be assumed that the proposed road upgrade plan will significantly improve traffic flow, connectivity and safety in Thrissur and benefit the local community.

Figure 10.2.1 Proposal for transport & connectivity



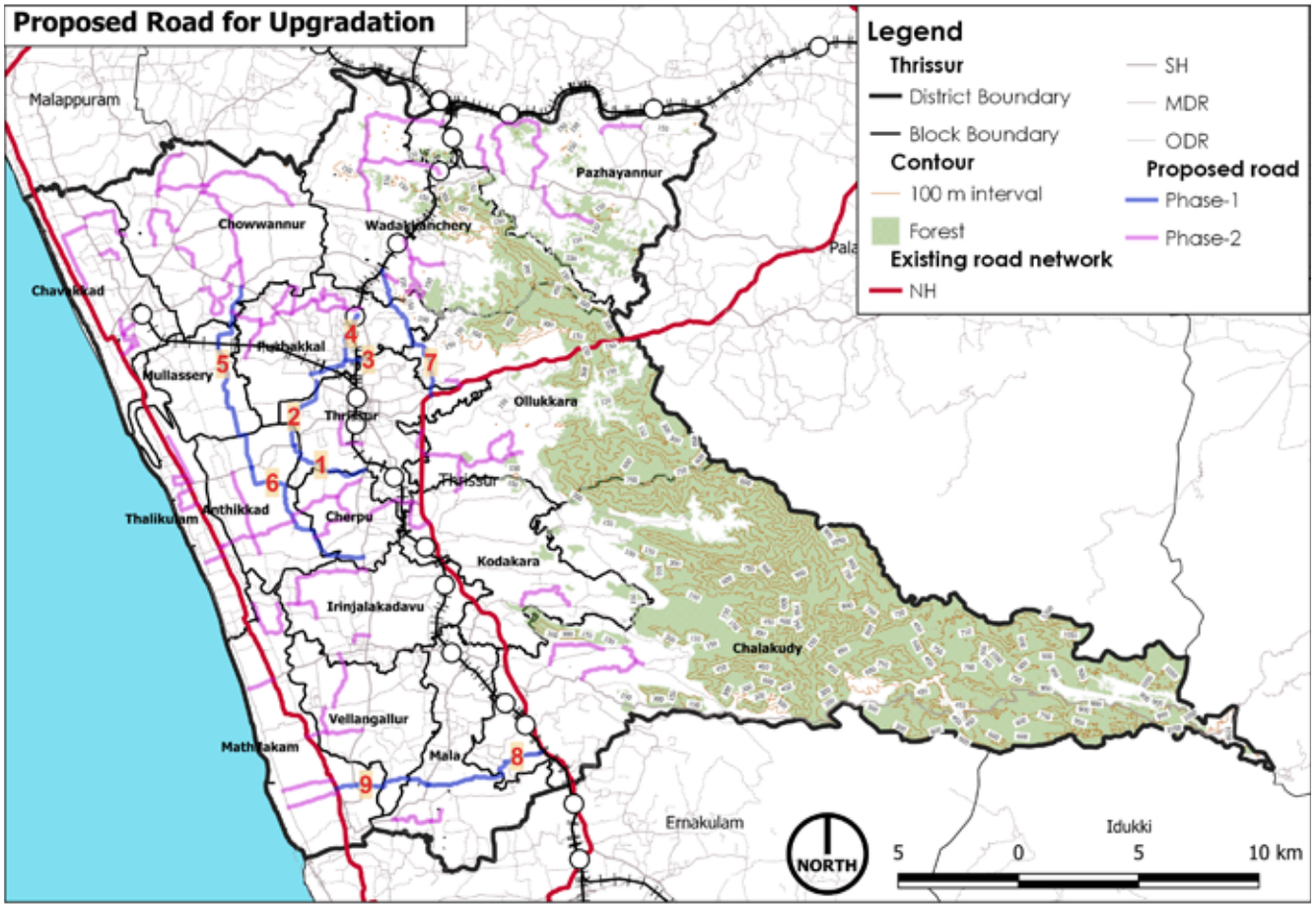
The concerned authorities for the construction and maintenance of the proposed road upgrades in Thrissur are the Public Works Department (PWD), Local Self Government Thrissur, and the Land Revenue Department for land acquisition.

To fund the project, it is recommend to use a combination of Public-Private Partnership (PPP) and Build-Operate-Transfer (BOT) models. Under PPP, the government can partner with private sector entities to share the costs of the project and allocate risks and responsibilities.

The BOT model involves a private entity financing, designing, constructing, and operating the project for a specified period, after which ownership and control are transferred back to the government. It can be assumed that the PPP and BOT models can provide an efficient and effective way to finance the proposed road upgrade plan for Thrissur, while also encouraging private sector involvement and expertise in the project.

Pedestrianization- There are average 771 padestian accident recorded every year in Thrissur District only(Accident data- City & Rural Police Department). Main reason of accident is improper signalization, inavability of zebra-crossing, uncontroled speed, inadequate enforcement of law, etc. Pedestrianization is an important tool to reduce pedistrian accident in car oriented cities. . Many Cities around the world started to shift their mobility from car-oriented toward pedestrian friendly access, such as Hamburg, Madrid, Copenhagen, Milan, Paris, etc. The approach consists pedestrian only routes, mobility on demand service, car restricted zones, paid car entry in certain areas, etc. (Yassin, 2019). however to implement the concept of pedestrianization need proper CTTS study and accident data analysis. Government need to implement it strategically because certain group of citizen may oppose the sifted mobility from car oriented to pedestrian priority, so the public participation is very important to make it successfull.

Figure 10.2.2 Proposed road for upgradation



10.2.2 Sustainable Bus Transport Improvement Plan

From the issues identified by the analysis as mentioned in Table 10.2.2, an understanding of the various need of interventions were identified which in turn provided the basis for the proposal of a 'Sustainable Bus Transport Improvement Plan'.

A Sustainable Bus Transport Improvement Plan is a strategic approach that focuses on enhancing the quality and efficiency of bus transport systems. Such plans aim to develop an integrated and sustainable public transportation network that meets the needs of commuters and reduces the negative impact of private vehicles on the environment. One of the key objectives of a Bus Transport Improvement Plan is to increase the frequency and reliability of bus services. This can be achieved through various measures, such as optimizing bus routes and schedules, improving infrastructure such as bus stops and terminals.

It can also enhance the safety and security of passengers. This can be achieved by introducing measures such as installing CCTV cameras on buses and at bus stops, deploying more transit police personnel, and introducing smart

ticketing and fare collection systems to reduce cash handling and associated security risks. It also seeks to enhance the accessibility of public transport, particularly for vulnerable groups such as the elderly and people with disabilities. This can be achieved by introducing low-floor buses, installing ramps and lifts at bus stops, and providing audio and visual announcements to assist visually impaired passengers.

Furthermore, it also focuses on promoting sustainable and environmentally-friendly modes of transport. This can be achieved through the introduction of hybrid or electric buses, the use of alternative fuels such as biodiesel or compressed natural gas, and promoting the use of bicycles and walking as alternative modes of transport for short journeys. By increasing the frequency and reliability of bus services, enhancing passenger safety and accessibility, and promoting sustainable modes of transport, such plans can contribute to improving the overall quality of life in urban areas.

Proposals: Introducing Intelligent Transportation systems (ITS), improvement of bus depots capacity and parking spaces, expanding the fleet of 'low-floor buses, introducing real-time information systems, increasing bus frequency, increasing bus frequency, provision of electric buses and EV charging stations and introduce online bus ticketing and payment systems.

As per the projected population of 2047, to maintain a factor of 1 for buses per thousand population, for the population of 4.6 crores, there would a requirement of 4632 buses. All the proposals are based on the projected number of buses required as mentioned in Figure 10.2.3.

Table 10.2.1 Block wise proposed road length and area

Block wise proposed road length					
		Length of proposed road (km) and area (Hectare)			
S.N.	Block name	Phase-1 (Width-14m)	Land for Acquisition	Phase-2 (Width-9m)	Land for Acquisition
1	Anthikkad	18.42	17.31	14.18	7.09
2	Chalakudy	5.02	4.72	14.42	7.21
3	Chavakkad	NA	0.00	21.16	10.58
4	Cherpu	4.54	4.27	15.57	7.785
5	Chowwannur	3.86	3.63	50.09	25.045
6	Irinjalakadavu	NA	0.00	14.53	7.265
7	Kodakara	NA	0.00	11.58	5.79
8	Mala	8.88	8.35	5.56	2.78
9	Mathilakam	4.18	3.93	18.84	9.42
10	Mullassery	12.02	11.30	NA	NA
11	Ollukkara	5.05	4.75	18.9	9.45
12	Pazhayannur	NA	0.00	29.06	14.53
13	Puzhakkal	14.68	13.80	26.94	13.47
14	Thalikulam	NA	0.00	13.82	6.91
15	Thrissur M.C.	10.1	9.49	7.88	3.94
16	Vellangallur	2.91	2.74	10.24	5.12
17	Wadakkanchery	3.33	3.13	33.38	16.69
	TOTAL	92.99	87.41	306.15	153.075

10.2.3 Identification of new bus routes:

Depending on the growth trends of identified Central Villages new bus routes were identified connecting all the 16 blocks. A number of 18 new bus routes were identified which would be situated along the 2 National Highways NH66 and NH544, the different State Highways and the Major District Roads. Furthermore 27 sub-routes for buses were identified along the Other District Roads. The total route length of the identified routes amounted to 1342 kms of road length as mentioned in Figure 10.2.3.

The project would be carried out in three phases. In phase 1, 11 major bus routes were identified along the 2 National Highways NH66 and NH544, the different State Highways. In Phase 2, further 7 major bus routes were identified along the Major District Roads which would be integrated with proposed new roads. In Phase 3 further 27 sub-routes for buses were identified along the Other District Roads. A funding of approximately 12 crores might be required for the completion of the projected and would be facilitated by the agencies such as the Ministry of Road Transport Highways (MRTH), Public Works

Department (PWD) and Kerala State Road Transport Corporation (KSRTC).

10.2.4 Creation of new bus depots:

From the analysis it was identified that the number of bus depot is already insufficient for the current population in 2023. For the projected population of 2047, a number of 4632 buses have been proposed. Hence to calculate the required number of buses was found using Bus Capacity Formula (Kadiyali, 2017)

Bus Capacity formula= Total Number of Buses/(Avg Capacity of each bus*Maximum Utilisation rate of each depot)

Maximum Utilisation rate= (Total Number of Buses/Total Number of parking spaces)*100

From the calculation, it was found that existing conditions (2023)

Assuming Maximum Utilisation rate: 90percent

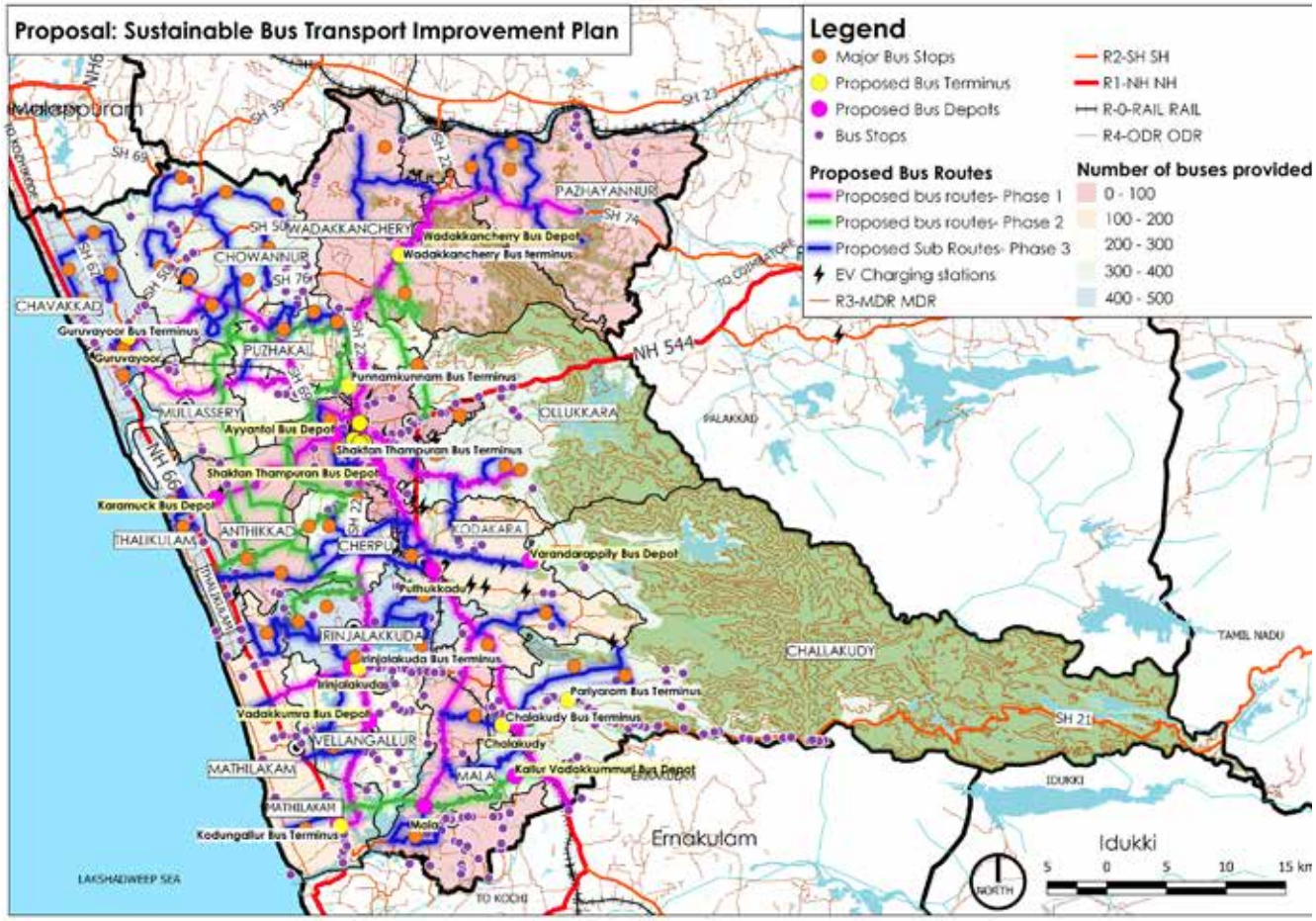
Assuming parking capacity: 200

Bus Depot number required: (4632/(40 × 0.90)/7)=18.78

Hence, it was found that for the year 2047, with a bus fleet of 4632 buses there is a requirement of approximately 19 bus depots

The project would be carried out in three phases. In phase 1, 12 bus depots were identified out of the 7 existing bus depots would undergo ugradation. In Phase 2, further 3 bus depots were identified And in Phase 3, a further addition of 4 bus depots were proposed as mentioned in Figure 10.2.3. An area of 18.05 acres would be required. A funding of approximately 210 crores to 450 crores might be required (excluding land cost) for the completion of the projected and would be facilitated by the agencies such as the Ministry of Housing and Urban Affairs (MoHUA), Public Works Department (PWD) and Kerala State Road Transport Corporation (KSRTC).

Figure 10.2.3 Map showing proposals of bus services in Thrisssur



10.2.5 Creation of new bus terminus:

As per Urban Bus Specifications Guidelines 2013 (Ministry of Urban Development): From the analysis it was identified that the number of bus terminus is already insufficient for the current population in 2023. For the projected population of 2047, a number of 4632 buses have been proposed. Hence to calculate the required number of bus terminus was found. (Kadiyali, 2017)

Calculating the number of Bus Terminus (Kadiyali)

$N = [(1 + P) \times (L / C)]/100$

where: N = Number of bus termini

P = Percentage of buses that terminate at each terminus

L = Total number of bus trips per day

C = Capacity of each bus

Assuming a capacity of 44 passengers per bus, assuming each bus making average trips of 10 trips/day and assuming percentage of buses that terminate at each terminus as 50 percent, number of terminus required for 4632 buses, using the formula

So, L = 4632 × 10 = 46320

Substituting this value into the equation, we get:

N = [(1 + 0.50) × (46320 / 44)]/200 = 7.89

Hence, it was found that for the year 2047, with a bus fleet of 4632 buses there is a requirement of approximately 8 bus terminus.

The project would be carried out in three phases. In phase 1, existing 3 bus terminus would undergo ugradation. In Phase 2, further 7 bus terminus were identified. And in Phase 3, an integration of proposed terminus with multi-modal hubs were proposed as mentioned in Figure 9.2.3. An area of 8.05 acres would be required. A funding of approximately 21.07 crores might be required (excluding land cost) for the completion of the projected and would be facilitated by the agencies such as the Ministry of Housing and Urban Affairs (MoHUA), Public Works Department (PWD) and Kerala State Road Transport Corporation (KSRTC) and Kerala Infrastructure Investment Fund Board (KIIFB)

10.2.6 Electrification of bus:

The project would be carried out in three phases. In phase 1, addition of 1500 electric buses, EV stations at all bus depots and terminus facilitated by proposed solar park. In Phase 2, a further addition of 2000 electric buses, and the conversion of existing buses. And in Phase 3, an addition of 500 electric buses, net zero carbon footprint to achieve 100 percent sustainability as mentioned in Figure 10.2.3. A funding of approximately 15,060 crores might be required (excluding land cost) for the completion of the projected and would be facilitated by the agencies such as the Ministry of Housing and Urban Affairs (MoHUA), Public Works Department (PWD) and Kerala State Road Transport Corporation (KSRTC).

Calculation for number of EV charging stations for 3000 electric buses:

Assuming:

Avg. daily distance: 100kms/bus

Battery capacity: 300 kWh

Assuming avg. charging efficiency: 90percent

Assuming charging rate 50 kW

Hence,

Total energy required:
3000*300*100=900000kWh

Total energy of E-station:
900000/0.09=100000kWh

Number of EV stations: 100000/50: 2000

Hence, it was found that for the year 2047, with a bus fleet of 4632 buses there is a requirement of approximately 2000 EV charging stations.

All of the abovementioned proposals would be combined to form the 'Sustainable Bus Transport Improvement Plan'

Way forward:

To have an understanding of the existing conditions to enable proposals of interventions a study was conducted on the district profile, characteristics of travel modes and daily traffic, existing public transport systems such as the available modes, route details, bus typology, physical & economic conditions, available infrastructure etc.

From the assessment generated through on-site surveys, collected data and available secondary information, an analysis was done to identify the issue which further provided the proposals. The proposals amounted to a proposal for a 'Sustainable Bus Transport Improvement Plan' can be proposed. The proposal will include the planning of new bus routes and route rationalization of existing bus routes. Providing or improving infrastructure such as bus stations/ terminals/depots. Creating Intelligent Transportation Systems (ITS) consisting of control centers, workshops/training centers, resting lodges, adjacent shopping complexes etc. It could also include planning for Multi-Modal Integration and reforms at an institutional level which would contribute to an Integrated Public Transport System.

10.2.7 Modernizing Intermediate Public Transport (IPT) Services

Data analysis for 2047

Thrissur, a district in Kerala, India, is looking to improve and upgrade its intermedia public transport (IPT) services till 2047. To achieve this goal, it is important to analyze the current situa-

tion and projected demand. Based on the mode of transport share, it can be observed that IPT currently has a 32.2 Percent share, which highlights the need for further improvement and expansion of IPT services.

Mode of transport share of IPT = (Number of passengers using a specific mode of transport / Total number of passengers) x 100 Percent

Mode of transport share = (1838565/ 5337860) x 100Percent=32.2

To determine the number of IPT vehicles required for Thrissur, the travel demand must be calculated. This is based on the population, trip rate, and modal share. With a population of 18.5 lakhs and assuming a trip rate of 2 trips per person per day, the total travel demand for Thrissur is calculated to be 12.13 lakhs trips per day. Assuming an IPT modal share of 7Percent, this translates to a daily demand for 4.4 thousand IPT trips. Based on an average daily distance covered by each e-rickshaw of 95, the number of IPT vehicles required for Thrissur is calculated to be 4,737.

Number of IPT = (Travel demand x Utilization rate) / Average daily distance covered by each IPT. Travel demand = Population x Trip rate x Modal Share

Traveldemand=1838565.1x2x.32.2=1213452.96 trips per day

Average daily distance covered by each IPT= 95 Km

To support the increased number of IPT vehicles in Thrissur, it is necessary to establish a sufficient number of charging stations. The total battery capacity of all IPT vehicles in Thrissur is estimated to be 316,800 kWh, based on an assumption of 67 kWh per vehicle. Assuming a charging rate of 50 kW and a charging time of 2 hours, the number of charging stations required for Thrissur is calculated to be 694.

To achieve a more sustainable and accessible transportation system in Thrissur, it is important to continue improving and upgrading IPT vehicles and services. This can include the use of cleaner and more efficient vehicles such as electric rickshaws and buses, as well as the integration of technology such as real-time tracking, mobile payments, and route optimization software.

Number of IPT required = (3994617.76x .33) / 95=13876

Number of Charging Stations = (Total Battery Capacity of all IPT) / (Charging Rate of Charging Station x Charging Time)

Number of Charging Stations = (13876x5) / (50 x 2) =694.

To improve and upgrade IPT services in Thrissur, Kerala, it is important to analyze the current situation and projected demand. Based on the mode of transport share, it can be observed that IPT currently has a 32.2 Percent share, which highlights the need for further improvement and expansion of IPT services.

To determine the number of IPT vehicles required for Thrissur, travel demand must be calculated. This is based on the population, trip rate, and modal share. With a population of 18.5thousand and assuming a trip rate of 2 trips per person per day, the total travel demand for Thrissur is calculated to be 6.4 lakhs trips per day. Assuming an IPT modal share of 7Percent, this translates to a daily demand for 4.4 thousand IPT trips. Based on an average daily distance covered by each e-rickshaw of 95, the number of IPT vehicles required for Thrissur is calculated to be 4,737.

In order to support the increased number of IPT vehicles in Thrissur, it is necessary to establish a sufficient number of charging stations. The total battery capacity of all IPT vehicles in Thrissur is estimated to be 3.1 lakhs kWh, based on an assumption of 67 kWh per vehicle. Assuming a charging rate of 50 kW and a charging time of 2 hours, the number of charging stations required for Thrissur is calculated to be 694.

Proposal for an intermediate public transport system

The proposal for an intermediate public transport system in Thrissur district, Kerala, aims to provide a sustainable and efficient transportation system to cater to the growing demand for public transportation. The proposed plan involves three phases to upgrade and improve IPT services.

In Phase 1, the proposal includes providing formal IPT stands on existing routes, formal parking spaces for IPT, and promoting the use of IPT as shared services. The objective is to provide easy access to IPT services and make it a convenient mode of transport for the general public. The agencies responsible for implementing this phase are the Thrissur Municipal Corporation and the Kerala State Road Transport Corporation.

Phase 2 involves rationalizing the existing public transportation routes and restricting the

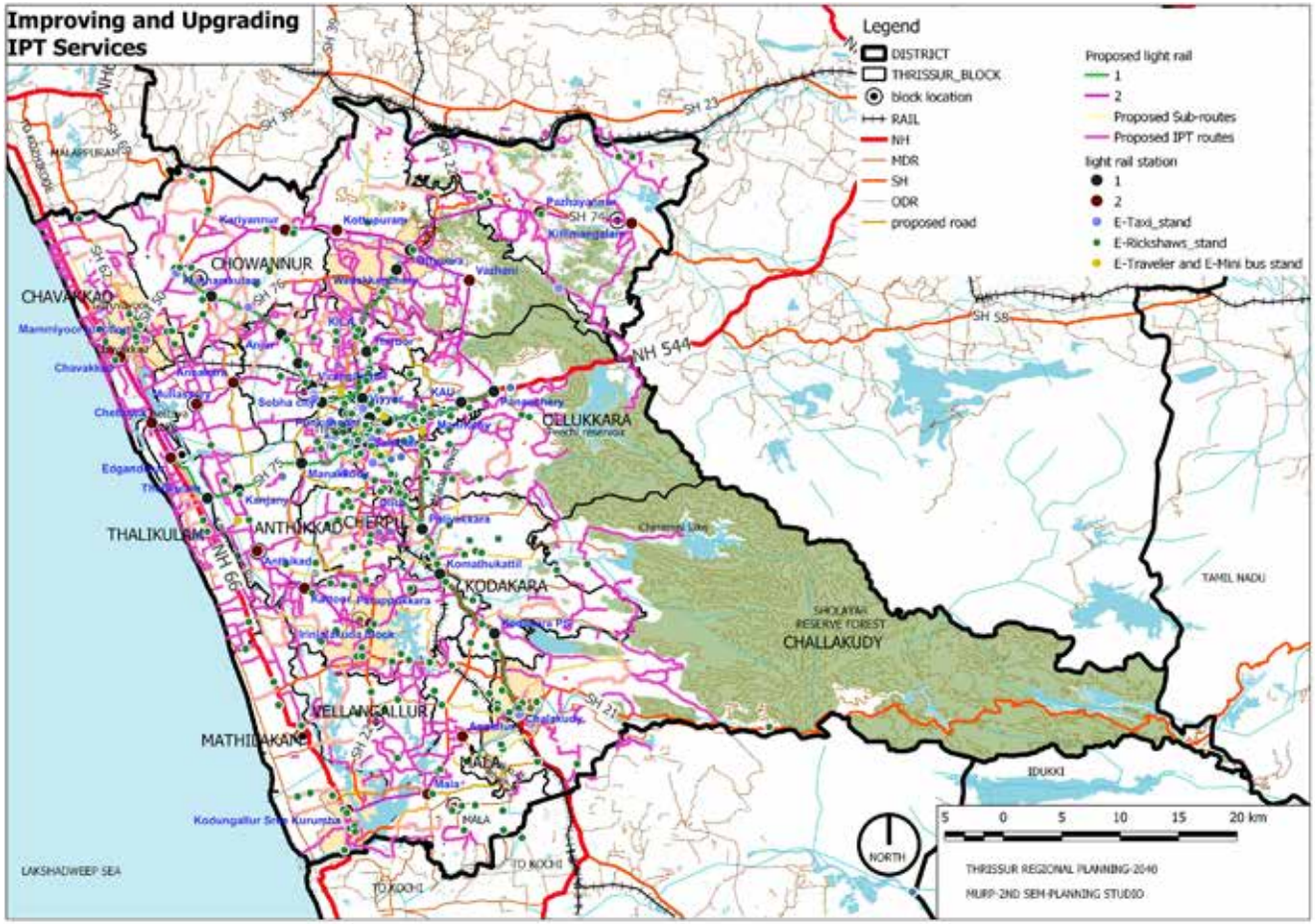
use of IPT only in the inner areas of the city. The policy intervention for the use of E-autos and E-rickshaws will also be introduced in this phase. The Thrissur Regional Transport Office and the Kerala Motor Vehicle Department will play a crucial role in implementing this phase.

In Phase 3, the focus will be on sustainability by introducing electric vehicles in the district. The proposal suggests prioritizing electric auto permits over conventional vehicles. The agencies responsible for implementing this phase are the Kerala State Electricity Board and the Kerala State Pollution Control Board.

To ensure the success of this proposal, a collaborative effort is required from various agencies. The Thrissur Development Authority, Thrissur Smart City Limited, and Thrissur District Administration will work together to provide the necessary infrastructure and technology to support the IPT system. The Kerala State Transport Project, Kerala Urban Road Transport Corporation, and Indian Institute of Technology Madras will provide technical support and guidance in implementing the proposed plan.

The proposed IPT system in Thrissur district is a step towards creating a sustainable and efficient transportation system. The plan's phased approach ensures that each aspect of the IPT system is given the necessary attention, resulting in a comprehensive and effective transportation solution. The involvement of various agencies will help ensure the plan's successful implementation, and the move towards sustainability is a positive step towards reducing the district's carbon footprint.

Figure 10.2.4 Improving and upgrading IPT Services



10.2.8 Monorail Transit

According to a study by Truong & Currie (2019) published in the Journal of Accident Analysis and Prevention, mode shift from private to public transport can result in a reduction in total crashes and severe crashes. The study, which was conducted as a case study of Melbourne, Australia, found that a percentage point increase in the proportion of commuters to a zone by bus would reduce total crashes by 9.9 and severe crashes by 4.8. Similarly, a percentage point increase in the proportion of commuters to a zone by train would reduce total crashes by 2.2 and severe crashes by 0.75 (Truong & Currie, 2019).

To reduce traffic on the roads and encourage mode shift from private to public transport, a monorail transit system need to be proposed for regional connectivity in Thrissur. The project will be completed in two phases as shown in Figure 10.2.5).

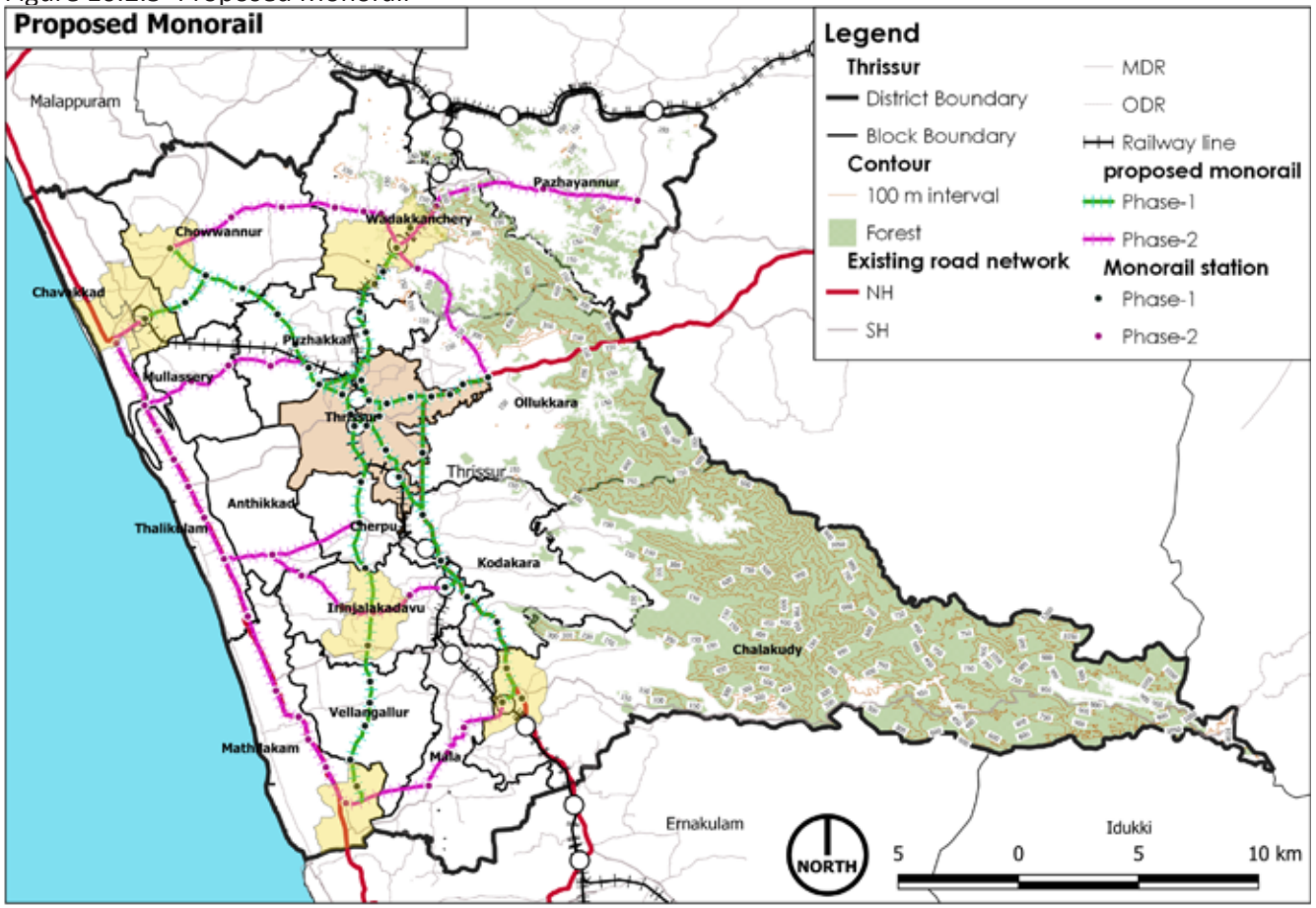
In phase 1, the monorail transit system

will connect Thrissur M.Corp. to all Municipalities i.e., Chowwannur, Chavakkad, Guruvayoor, Wadakanchery, Challakudy, Kodangaloor and Irinjalakuda, with a total length of 139 km. In phase 2, the monorail transit system will connect between all blocks such as Chowwannur-Wadankanchery, Chowwannur-Chavakkad, Chalalakudy-Mala-Mathilakam, etc. The total length of the Phase 2 line will be 170 km.

It can be assumed that the proposed monorail transit system will provide an efficient and sustainable mode of public transportation, which will help to reduce traffic congestion and promote mode shift from private to public transport. This will not only reduce the number of accidents but also improve overall safety for commuters in Thrissur.

Monorail is a sleek, elevated mass rapid transit system which operates on a single beam (normally concrete) guide way and with rubber tiered wheels. Because of its less turning radius (50 – 70) and single-track system, it can be built to efficiently serve areas dominated by high-rises and sharp turns and where metro rail cannot penetrate (Parekh et al., 2021). Proposed monorail will contain 3 cars with expected capacity of 500-675 peoples. With the headway of 15 minutes, it can carry 2700 people per hour and with 5 minutes headway can carry 8100 peoples per hour. According to Institute of Urban Transport (India) report, it can carry up to 15000 PHPDT (Pick Hour Pick Direction Traffic). According to our Traffic survey we have calculated PHPDT of 9685. Estimated cost of construction is around 85 crores per km which is economical than other light rail transit construction. It has also environmental advantages because it creates very less noise because of its rubber tire and it is fully electric driven and does not use pantograph, saves 200 Tons of Co2/day (Institute of urban transport (India), 2012).

Figure 10.2.5 Proposed Monorail



the construction and maintenance of the proposed monorail will be carried out by creating a Special Purpose Vehicle (SPV) consisting of the Public Work Department (PWD), Municipal Corporation, Local Body, and Central Government. Based on the proposed monorail projects in Kozhikode and Thiruvanantpuram, it had been observed that the Internal Rate of Return (IRR) for this type of project is very low, making it unattractive for private parties to invest in (Sharma, 2013). Therefore, it cannot be recommend using Public-Private Partnership (PPP) or Build-Operate-Transfer (BOT) models to fund this project. Instead, it is suggested that the funding for the construction and maintenance should be fully provided by the state and central government.

10.2.9 Multi-Modal Transport Hub

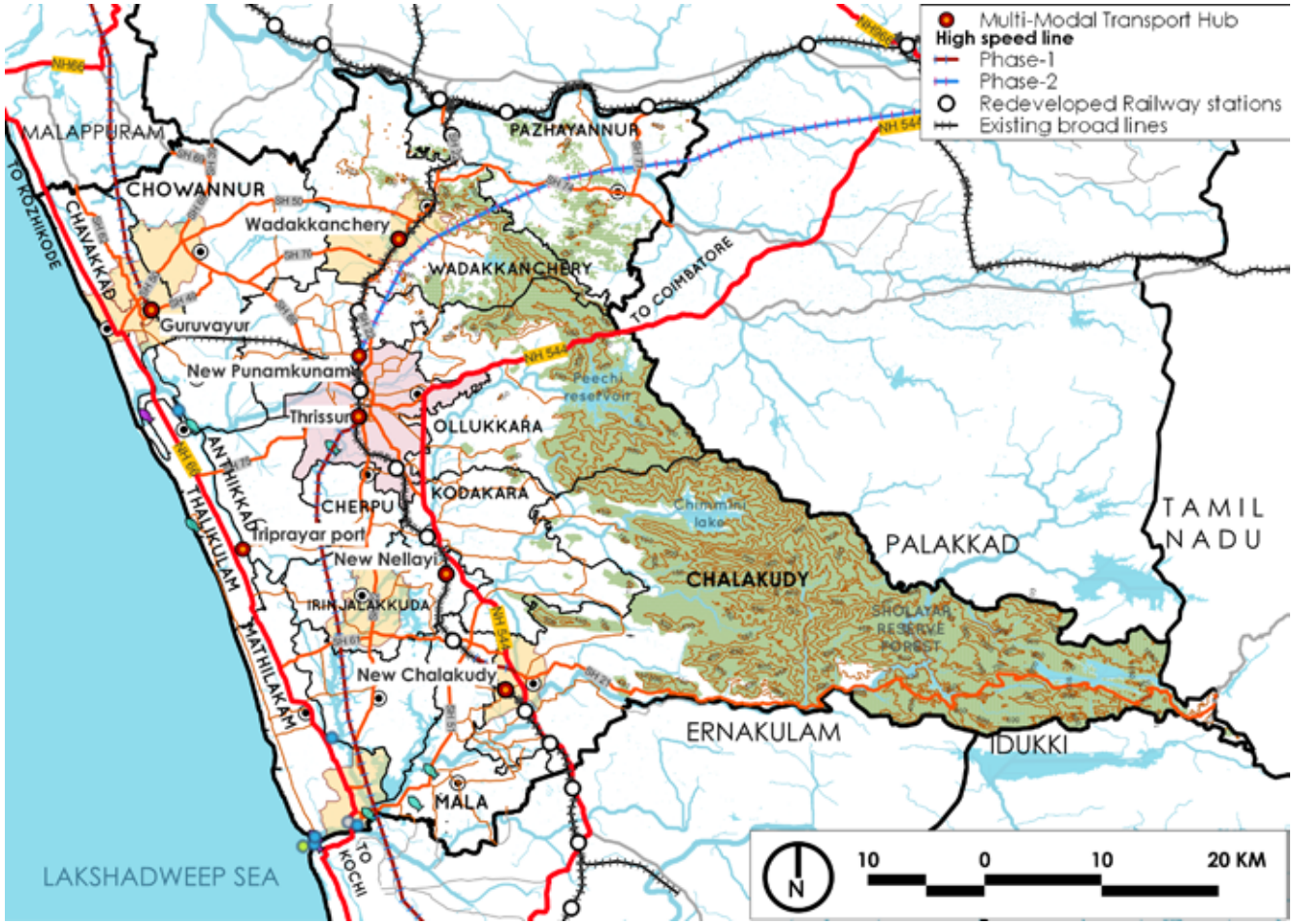
The proposed initiative is to develop a

Multi-Modal Transport Hub (MMTH) in the district, Refer for locations in figure 10.2.6. which aims to improve connectivity and accessibility for commuters. The existing railway station needs to be redeveloped to integrate various modes of transportation such as trains, buses, auto/taxis, and waterways. Currently, few blocks have railway but mostly have bus connectivity, and the lack of seamless and end-to-end connectivity is a primary issue faced by commuters. During peak hours, commuters face difficulties traveling, and immediate bus availability cannot be expected. Auto/taxis available on station premises can charge a hefty amount.

During study visit to the district, it was observed that while all blocks are connected to each other, only 7 out of 16 blocks have both railways. While there are express and passenger trains running along the Coimbatore to Ernakulam line with unreserved coaches, regions without railway stations have to rely on roadways for transportation, which can be challenging due to the unavailability of immediate buses. Furthermore, auto/taxi charges at the station premises can be expensive.

To address these issues, a proposal is put forth for the development of a Multi-Modal Transport Hub (MMTH) that integrates train, auto/taxi, bus service, and waterway for seamless and end-to-end connectivity. The development of a multi-modal railway station that houses KSRTC, Private Buses, and Auto/Taxis on the same platform, along with the creation of new entries on the West and East sides of the railway station, is suggested. The regulated charges for auto/taxi services can be helpful for users, while

Figure 10.2.6 Proposed locations of Multi Modal transportation hub



the improvement of current railway stations and bus terminals is required to enhance user experience and accessibility.

The proposed development also includes the creation of a roof plaza for train passengers with segregated entry/exit, commercial development near the railway station and adjoining land parcels. Under the Amrit Bharat Station scheme, four stations have been selected for upgradation, taking the model of Rani Kamlapati Station in Bhopal. Surat is also being developed as an MMTH, and this project is planned to be taken up through a Special Purpose Vehicle (SPV) Surat Integrated Transportation Development Corporation (SITCO), with MoR's share of 63Percent through IRSDC, GSRTC's share of 34Percent, and SMC's share of 3Percent. Budget for 8 acre built area is rupess 1450 crores. Similar approach can be taken to integrate agencies Indian Railway Station Development Corporation (IRSDC),

KSRTC, local bodies, Kerala Public Works department, Kerala State Transport Project, State Water Transport Department, Inland Waterways Authority of India. The existing area of railway stations is 0.1 sqkm /25 acres, while the required built-up area is 0.75 sqkm /185 acres.

In addition, the proposed railway line can be through Coimbatore and Ernakulum, which can cater to people involved in daily commuting to major cities. There is also a requirement for a train with more stoppages and runs in shorter distances to make daily commuting easier. As the future of transportation is high-speed railway infrastructure, the proposed Guruvayur line can be extended to Tirunavya (Malappuram), another town with similar cultural importance, which will improve cultural relation and preserve the town's heritage even after modern interventions. The proposed MMTH aims to create a sustainable, holistic, and efficient transport system for the district.

10.2.10 Logistics Park

As per the National Industrial Corridor Development Programme, which includes the extension of the Chennai-Bengaluru Induastrial Corridor (CBIC) to Kochi via Coimbatore, the Thrissur District NH544 Industrial Corridor is included (NICDC, 2023). In addition, Kodakara block has been chosen as the location for the logistic park due to its proximity to the thriving industrial hub of Thrissur block. This strategic decision offers the advantage of reduced transportation costs and logistical complexities, as well as easy accessibility to the existing industrial units in the area. the city has a diversified economy with several industries such as textiles, handlooms, coir, timber, and others. Due to the presence of a wide variety of industries, Thrissur has significant market potential. This market potential attracts many entrepreneurs and businesses to invest in the city. With a large consumer base and a thriving economy, there is good scope for the growth and expansion of businesses in Thrissur. Besides this, the city's strategic location and well-developed infrastructure also contribute to its market potential. Thrissur is well connected to other parts of Kerala and major cities in South India through a road and rail network. Additionally, the city has a well-established port, which provides easy access to international markets. Such as Thrissur's market potential, transport infrastructure, and environmental impact. It is also necessary to conduct a feasibility study and obtain the necessary approvals from local and state authorities (Devika et al., 2016).

The agency responsible for this project is the Ministry of Road Transport and Highways (MoRTH), in partnership with the National Highways Authority of India (NHAI) and private en-

Figure 10.2.7 Proposed Multi-Modal Transport Hub - integrating zonning of transport modes

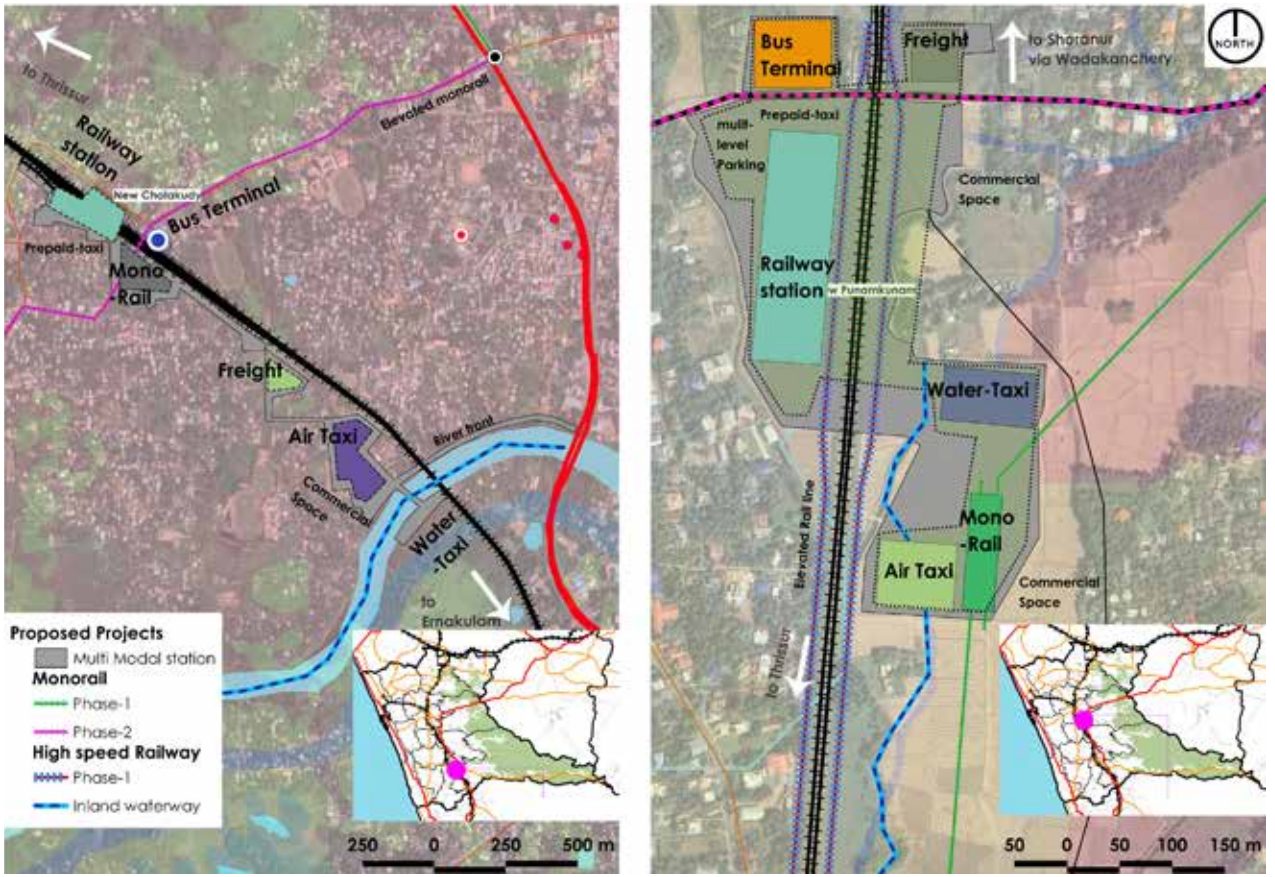
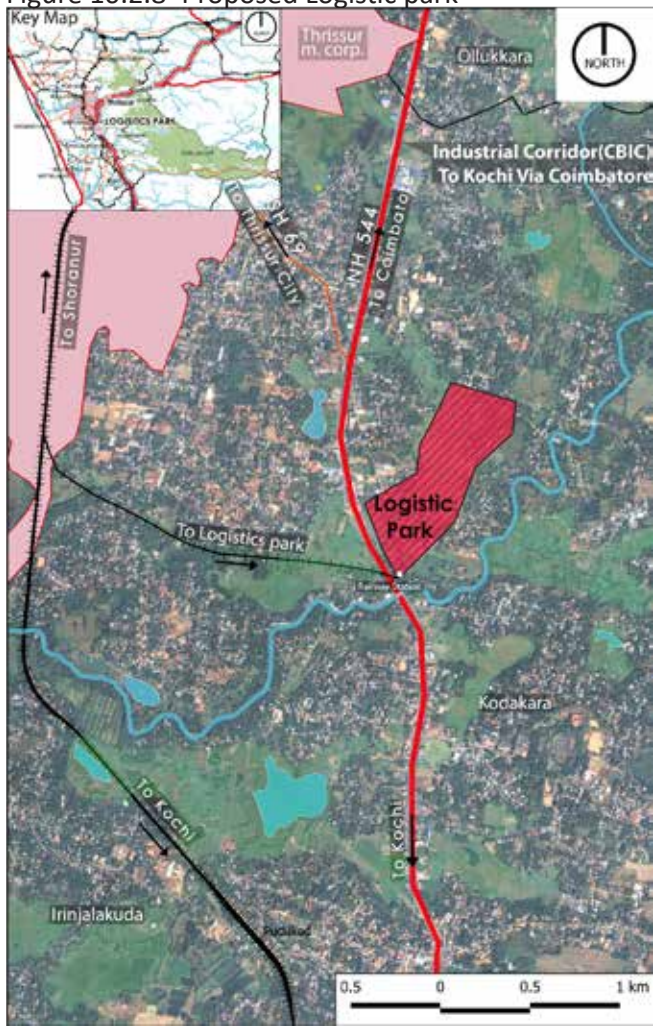
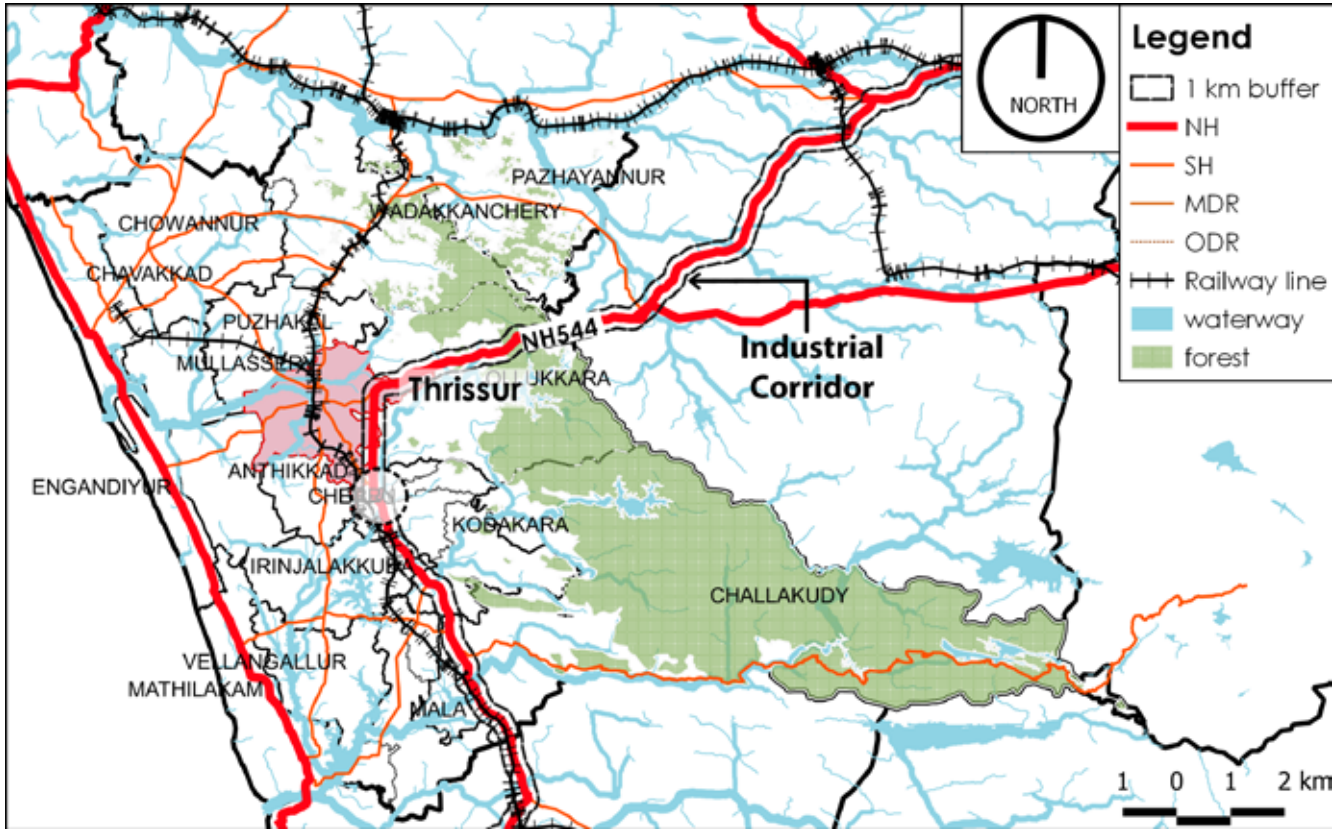


Figure 10.2.8 Proposed Logistic park





tities. In the first phase, we will build a logistics park and plan to develop a total of 90 acres of land, which will include a warehouse with a capacity of 7 Lakhs cubic feet, a cold storage facility spanning 30 Thousands square feet, and a container freight station capable of handling 50 containers per day. The cost of the project can be estimated at Rs. 1500 Crores. I have referred to the costs of the logistics hubs that have been established in India and those that are proposed.

10.2.11 Air Taxi

The Indian Institute of Technology-Madras has developed an electric flying taxi that it claims will ferry passengers faster than a helicopter. A flying taxi was displayed at the Aero India show in Bangalore. Gu E-Plane Co. “Designed for 10 times faster intra-city transport, they aim to reduce road traffic congestion in cities through their flagship product, the e-plane e200,” he added.

In the first phase of our project as shown in Figure 10.2.1, It is recommended to introduce air taxis in Thrissur as part of a multi-modal transport system that we are developing. These air taxis will connect areas like Waddankanchery, Chalakudy, Chavakkad, Thalikulam, and New Nellayi, Cochin and Coimbatore where we have proposed a multi-modal hub. The transport system will be integrated in these areas and will also provide inter-state connectivity connecting Thrissur city to Cochin International Airport and Coimbatore Airport.

One of the major advantages of this system is its ability to significantly reduce travel time. For example, if a car takes 60 minutes to reach a destination, an air taxi can cover the same distance in only 27 minutes. This can prove invaluable in times of disaster or emergency.

Also, the cost of using an air taxi, at around Rs 150, is slightly higher than that of a car, which charges around Rs 100. This makes air taxis an affordable and cost-effective option for transportation. Another advantage of the air taxi is its affordability. The taxi can carry only two people at a time, but it can cover a range of 150–200 km/h. This makes it a suitable means of transport for short distances. Several agencies are involved in the project, including the Ministry of Civil Aviation and air taxi maker E-Plane. Excluding land and e-plane keeping, the cost of the project can be up to 15 crores; this budget only includes the landing area and amenities. This collaboration will ensure that the project is implemented successfully and will bring about a paradigm shift in the transport system in Thrissur and its inter-state connectivity (Chennai News - Times of India, 2021).

10.2.12 Water taxi in Canals

The water canals in the district are well connecting to every blocks from the Thrissur Municipal Corporation. These are connecting prominent places like Chettuva Backwaters (Mullassery), Chalakudy river, Kodungallur in Vellangallur block. Although the purpose of irrigation is happening only in few parts and rest is remaining facing scarcity. There is scope of its revival in context of environment but for transportation too. It will be a boost to tourism too although its famous for its kole wetland and backwaters but reaching through water way will have a different experience which anyone would like to have.

In intial phase 145 km of water canal has been identified which are originating from the the proposed Multi Modal transport hub. The water taxi with capacity of 7 can is appropriate for running along these canals; the depth of canal is varying from 2 to 3 metres and the requried boat draft is 0.3metres to 1.2metres. The water taxis route is also connecting others all canals as well as rivers like Chalakudy and Karavannur (parallel to NH66).

There are places along these rivers and canal banks, and therefore one can opt for these routes apart from the traditional route of buses or taxi to reach. There are temples and farms along rivers like Triprayar temple, Thiruvanchikulam temple and Shrimps farms in south Vellangallur. Waterways and Infrastructures Ltd. , Irrigation department and IRSDC can collaborate and development infrastructure required to attain the seamless connectivity meanwhile local bodies can work on maintenance at major stoppages. The integration of all the proposed transportations system to ensure end-to-end connectivity can be unique model for the state and improve travelling experience.

10.2.13 Conclusion

In conclusion, the proposal for transport and connectivity in Thrissur District encompasses a comprehensive approach aimed at enhancing the transportation infrastructure and improving mobility options for residents and visitors. The proposed measures, including the upgradation of road geometry, introduction of e-buses, e-IPT (electric-powered intermediate public transport), monorail, air taxi, water taxi, multimodal transport hub, and logistic park, are designed to address various transportation needs and promote sustainable and efficient modes of travel.

By upgrading the road geometry, we aim to enhance the safety and efficiency of road networks, reducing congestion and travel times. The introduction of e-buses and e-IPT systems will not only reduce carbon emissions but also provide a convenient and affordable public transportation option for commuters. The implementation of a monorail system will further enhance the mass transit capacity and connectivity within the district.

The integration of air taxi and water taxi services will provide alternative transportation modes but also enhance connectivity to nearby regions and tourist destinations. This will contribute to the development of a robust and interconnected transport network as well as provide a great help during disaster.

The proposed multimodal transport hub will serve as a central hub for various transportation modes, facilitating seamless transfers and enhancing the overall travel experience. Additionally, the logistic park will cater to the growing demand for efficient cargo and freight management, promoting economic growth and trade in the region.

Overall, the proposal for transport and connectivity in Thrissur District presents a forward-looking vision that emphasizes sustainability, efficiency, and improved accessibility. By implementing these measures, we can foster economic development, reduce traffic congestion, and enhance the overall quality of life for the residents of Thrissur District.

10.3 Economy

Thrissur as a "Competitive District"

In order to address Thrissur's unemployment, the district is proposed to become a "Competitive district". The district has a tier two Thrissur city in it's administrative boundary which has a neighboring competitive city Coimbatore. The economy of Coimbatore is taken as an example and projected to Thrissur keeping the relevant cultural values in mind for it's symbolic economic development.

A competitive district is one that successfully supports its businesses and industries in its efforts to grow over time, boost production, and raise the living standards of its residents (World Bank, 2015). Competitive districts are more than just the locations where competitive businesses and industries develop. They are settings that support businesses in operating efficiently by offering things and conditions including laws, infrastructure, services, good quality of life, talent, and effective governance. Therefore, making districts with tier-two cities into thriving urban centers that successfully allow business and industry expansion to create employment, raise productivity, and increase incomes is one strategy to successfully resolve its issues. To achieve the said goals, the Thrissur district needs to make interventions in these four categories-

I. Institutions and Regulations

II. Infrastructure and Land

III. Skills and Innovations

IV. Enterprise Support and Finance

Table 10.3.1 Statistically significant correlation

Category	Metric	Creative and Financial Centers		
		Disp. Income	Labor Produce	Emp growth
Institutions & Regulations	Ease of Doing Business Index (DB)			+
Infrastructure & Land	Physical Infra-structure	+	+	
	Social Infrastruc-ture	+	+	
Skills and Innova-tion	Human capital	+	+	+
	Innovation		+	
Enterprise sup-port and Finance	Financial Infra-structure			+

(Source: Fikri and Zhu, 2015)

According to World Bank in its report on Competitive Cities in 2015, there are three categories cities can be put in based on their economic performances. These categories are market towns, production centers, and creative and financial services. Thrissur district has GDVA distribution similar to the creative and financial services defined after studying 750 cities and their GDPs and GDVAs (Fikri and Zhu, 2015). Creative and Financial services have a lesser contribution from the primary sector and more in the tertiary sector. This creates more job opportunities in the IT sector and several other improvements in the district as mentioned in Table 10.3.1.

Under the interventions categories Institutions and Regulations and Enterprise Support and Finance, a Private Economic Zone (PEZ) is proposed in the Wadakkanchery village in the Wadakkanchery block. Thrissur has an increasing IT sector but the rate of growth can be increased by interventions in the right direction. The private sector can bridge the gap in the works of regional investment promotion to help support the interests of the city similar to the case of Coimbatore, where private companies stepped up for the Economic Zone improvement and created 20,000 jobs (World Bank, 2015). In Coimbatore, private IT companies leased out a space of 61.59 acres and developed a Special Economic Zone with an IT park, enterprise solutions, and various other services. As analyzed earlier, the IT park which is in Thrissur Municipal Corporation has a few co-working spaces and no other facilities available. The unsuccessful IT park will be instead shifted to the PEZ in Wadakkanchery village.

10.3.1 Private Economic Zone(PEZ)

The PEZ will contain majorly four

structures, an IT park, enterprise solution services, real estate, and higher education structures. The IT park will bring in IT companies to invest in the village creating job opportunities and will help the real estate develop there simultaneously. The economic zone's backward linkages would include the infrastructure in that village which is identified as one of the growth centers in the district. While the forward linkages would have the real estate market and the higher education which will work as the infrastructure for the families that will be residing because of the job opportunities in the PEZ. The total area taken up by the PEZ is 45 Acres in the village's western part as shown in Figure 10.3.1. To get MNCs to invest, Thrissur can be pitched as a better alternative to labor as it produces skilled labor every year who migrate. This migration will be mitigated through the jobs created. It is estimated to create 15,000 jobs in the IT sector within the Thrissur district with the help of private investors and companies.

The total area of 45 acres in the PEZ is distributed among the four categories of structures erected in it. The area distribution is as follows- 12% (5.4 acres) in enterprise solution services, 23% (10.35 acres) in higher education, 30% (13.5 acres) in real estate, and finally, the remaining 35% (15.75 acres) for the IT park. The total funding required is estimated to be around 150 crores. The benefits of the PEZ include an Increase in private sector Investments, more jobs created, and various SDGs achieved including SDG 8 and SDG 11, and finally, infrastructure is developed in and around the PEZ which will invite even more investments in the village and the district.

10.3.2 THINK (Thrissur Innovation and Knowledge) Cluster- A consortium for collaborations

A 2018 report on the future of education and skills 2030 by the Organization for Economic Cooperation and Development (OECD), visualized collaboration as the future of scientific knowledge: "Innovation springs not from individuals thinking and working alone, but through cooperation and collaboration with others to draw on existing knowledge to create new knowledge". Science and technology constitute the key forces behind innovation and have the potential to completely transform any region. By 2047, Thrissur would be well-positioned to benefit from advancements in science and technological innovation owing to a large pool of skilled and competent human capital, a strong scientific infrastructure, a varied and sophisticated industrial sector, and a booming entrepreneurial culture. To create a platform for the collaboration of Science, Technological innovation, and entrepreneurship, THINK Cluster is proposed at Wadakencherry Village, which is identified as a growth point in the Wadakencherry Block in the district (Figure 10.3.1). The cluster proposed would require an area of 6 acres (24280 sq.m.) and spaces like super fab labs, convention center, workshop areas, exhibition space, training classrooms, offices, etc. and would employ approximately 10,000 people. The thematic areas of the proposed cluster include futuristic marketing technology & solutions, wetland management, disaster management, green mobility, and waste to wealth. The cluster would connect academic, industrial, corporate, and start-up ecosystems to create a hub actively facilitating innovation, knowledge creation, and implementation of technologies for socio-economic benefits. The funds for start-up can be obtained from Meity Samridh scheme, Pradhan Mantri Mudra Yojana (PMMY) Scheme, Start-up India Seed Fund Scheme (SISFS), Atal Incubation Center Grant, Aspire Scheme, and Office of the PSA for operational expenses. Thus the backward linkages are directed towards the different R&D institutions, start-up communities, industry partners, entrepreneurs, and the local administration, and the forward linkages are directed towards the science and technological innovation, social and economic development of the region, growth in employment opportunities and hence inhibit out-migration.

With a similar mechanism, the Science & Technology (S&T) Clusters are being built to serve as umbrella structures for S&T organizations in various parts of India in order to increase synergy while maintaining autonomy. These clusters are supported by The Prime Minister's Science, Technology, and Innovation Advisory Council (PM-STIAC) and are backed by the Office of Principal Scientific Advisor. These clusters would establish solid connections between current academic institutions, federal and state research facilities, and other parties like relevant ministries, business partners, start-ups, MSMEs, state governments, charitable foundations, and international organizations. The Science and Technology Cluster Apex Committee, chaired by the Vice Chairman of NITI Aayog, would be the governing body for Science and Technology Clusters. Six such prototype cluster frameworks have been launched: PKC

(Pune Knowledge Cluster), RICH (Research and Innovation Circle of Hyderabad), DRIIV (Delhi Research Implementation and Innovation), BeST (Bengaluru Science and Technology Cluster), JCKIC (Jodhpur city knowledge and innovation cluster), BCKIC (Bhubaneswar City Knowledge Innovation Cluster). These institutions bring together academics, research institutions, representatives of the industry, MSMEs, the start-up community, charitable institutions, and local government (O/o PSA, 2022).

The Clusters are working on three stages in order associated with applied R&D for solutions with defined end-users: Firstly, establishing a shared ecosystem, secondly, developing a regional solution provider, and lastly, emerging nationally and globally competitive. Establishing a Shared S&T Ecosystem- Clusters allow for the formation of an interconnected ecosystem, i.e., a collection of 15-20 institutions that work as one large institution under a formal umbrella structure. The umbrella structure would encourage better collaboration among diverse entities while maintaining their internal autonomy. A shared ecosystem includes the sharing of high-end labs and equipment through the Indian Science, Technology, and Engineering Facilities Map (I-STEM), joint multi-institutional programs, facilitating researcher mobility through the sharing of credit courses for students across various institutions, as well as facilitating researcher exchange between industry and public R&D labs, and delivering high-quality research. The cluster as a regional solution provider- by doing so, the clusters become solution providers to local authorities, state governments, and industry, as well as increase regional impact by working alongside local incubators, science and technology councils, and innovation groups to solve local challenges. This can be accomplished through collaboration between the government, industry, start-ups, and incubators. The cluster may include a local incubator as a 'partner institution,' using its current strengths in industrial relationships, technological development, and innovation. This will have an impact on the regional network. Devising connections with the State S&T Council and the 'State Innovation Council/Society,' both of which are based in state machinery and will help to address regional challenges through S&T, can aid in obtaining government engagement. The cluster may organize inter-institutional research teams to carry out R&D activities with innovative technology and science to address regional challenges. The cluster could consult with local governments to identify regional issues that can be addressed with advanced S&T solutions. The cluster in emerging the district as nationally and globally competitive- The clusters focus on 1-2 crucial domains and are establishing robust capacities to develop into national and international leaders. In order to become internationally competitive, they contribute to the Government of India's national missions and participate in transnational mega-science programs (NITI Aayog, 2020).

THINK Cluster Stakeholder Value Proposition- Academic institutions and research and development organizations will benefit from cluster participation by gaining more resources such as facilities, manpower, funding opportunities, industry knowledge, potential student placement opportunities, and so on at the regional, national, and global levels. By interacting with a single organization, the industry will be able to outsource R&D and have access to the most recent advances in its field. Through the cluster, start-ups and MSMEs will get the benefit of both human and physical resources for developing products and process optimization. The cluster will facilitate local governments, state governments, and respective ministries to identify technology solutions to significant local and regional challenges (for example, green mobility, wastewater management, etc.).

Role of the THINK Cluster (Process) - Through outreach programmes, roundtable talks, seminars, citizen science initiatives, and its own social media channels, the cluster may raise public awareness about the relationship between science and technology and entrepreneurship in collaboration with industry. They foster cross-institutional mobility of researchers, technical workers, and faculty from member institutes by offering measures like providing open access to common facilities like libraries, laboratories, and other similar spaces. A network of research centres, cross-institutional credit courses for students, faculty, staff, and student mobility between academia and industries can be developed, and the cluster can ensure that all public academic institutions in its network use the I-STEM site. The cluster may develop and implement advance academic and HR development programs with help from the industry and incubator. These can include opportunities for faculty intra-mobility among cluster members through inter-institutional fellowships, for students to collaborate with cross-institutional research supervisors, etc.

With industry and incubator assistance, the cluster can create and implement high-quality HR development and academic programs. They can develop public spaces such as scientific museums, technical validation centers, and so on. They may also organize short-term exchange schemes between industry and academia, in which experienced industry professionals can come to teach while scientists can work in the industry for one to two years. The cluster is working towards SDGs- 8, 10, 11, and 16, which speak about decent work and economic growth, industry, innovation, and infrastructure, decreased disparities, sustainable cities and communities, peace, justice, and strong institutions, respectively. Thus, the THINK cluster will work to foster this collaborative spirit among stakeholders, across institutes, and between institutes and companies to enhance the economic and social development of the district.

10.3.3 Tourism

Vision and Objectives

The proposed tourism project seeks to promote the unique cultural and historical heritage of Thrissur. Through these projects, a vibrant and sustainable tourism industry is created in the area by highlighting its cultural attractions, inviting heritage and culture-minded travelers to explore the region, and providing them with the best possible experience. Also, Economic and social opportunities for local communities are created by encouraging tourism-related businesses to open in the region.

These projects involve the development of tourist attractions and activities that are both interesting and educational. Collaboration with local tour operators will be done in order to create packages that will appeal to a variety of travelers. Also collaboration with local businesses will be done to create unique souvenirs and products that will be marketed to tourists. Additionally, work with local authorities will be done to ensure that all necessary safety and security protocols are in place. These projects will create lasting economic, social, and cultural benefits for the area. The projects altogether have targeted to achieve 7 Sustainable development goals including Sdg 3, 7, 8, 9, 10, 11, and 12.

Projects for Tourism

Following projects are proposed for tourism industry.

Responsible tourism

Introduction of a responsible tourism mission as it helps in developing the community and attracting people for experiencing something new. The main focus of RT focuses on the 'triple bottom-line' economic responsibility, social responsibility and environmental responsibility and encourages the industry to take responsibility for making tourism more sustainable and demonstrate their responsibility.

Developing Kuthampully (Pazhayannur) and Kalashamala as a responsible tourism destination so that tourists can experience/ Learn the local culture, skills like weaving, rubber plantation, local arts and craft making, brass work, pottery etc can be done which will help in their growth.

Different packages can be made according to the activity like: A day with the Weavers, Boating, Sightseeing, nature walk etc. A general orientation programme can be organized and training can be given to those interested. Giving tent accommodation including farm stays and homestays in which people can stay. A Program/ seminar can be conducted with the participation of Panchayats, LSGs, Kudumbasree and farmers to educate them regarding the mission. The Funding of 3-4 cr approx. is needed which can be done by the private as well as government sector.

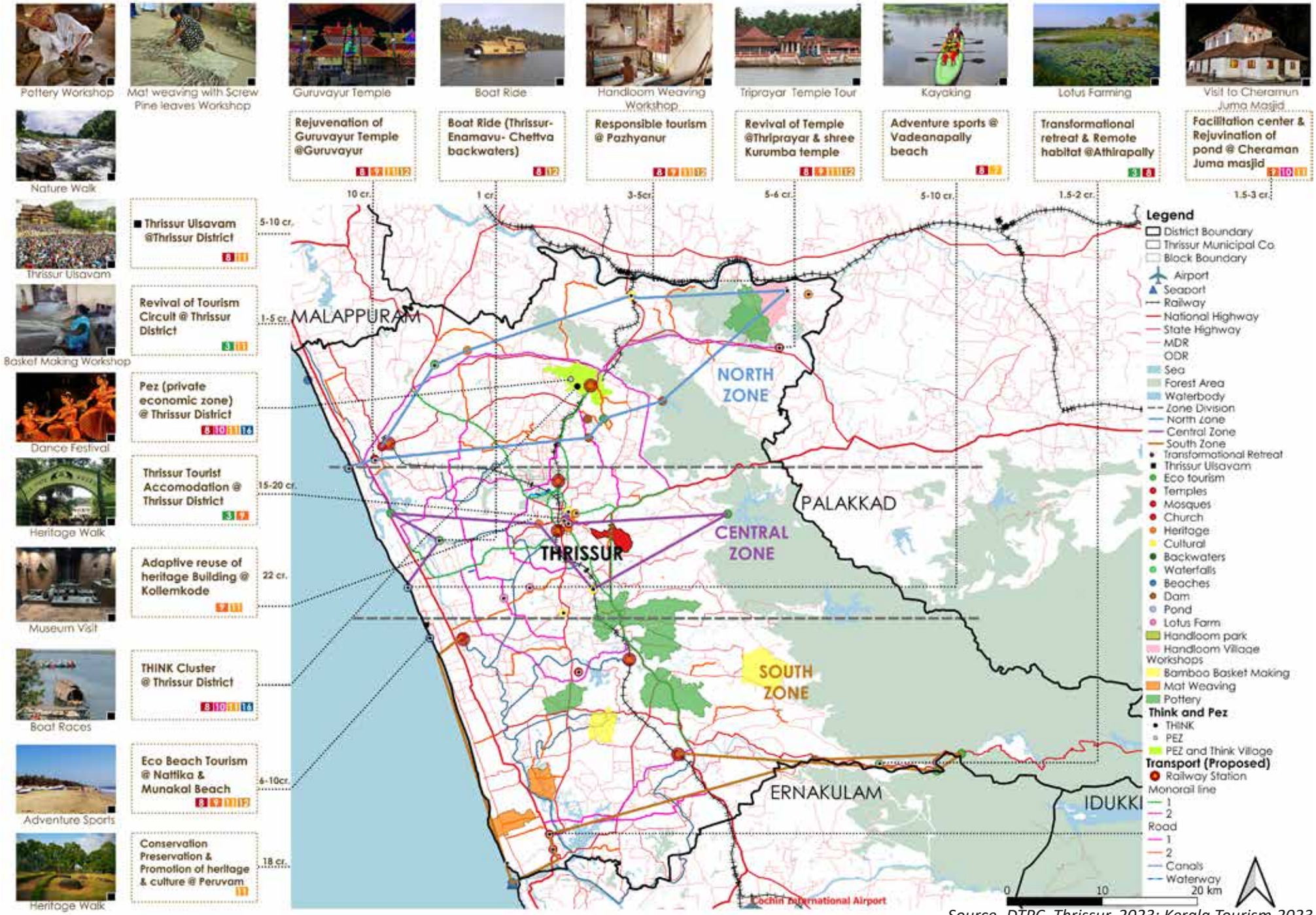
Rejuvenation of Guruvayoor temple

Need of infrastructure, facilities and waste management system for the management of the crowd as it sees footfall of 25-40 thousand people daily. The temple needs the funding of 8-10 cr for the development. The requirement of the new waste management system as current Capacity is 3 MLD which is not sufficient for the population and allocation of land for the plant. Need of hotels and other facilities as it gets difficult for people to stay during high time.

Revival of Vadanappally Beach

Revival of Vadanappally Beach is proposed with an approximate budget of 1.5-3 Crores. It includes recreational activities like beach volleyball, beach yoga, etc., in order to attract more visitors. Adventure sports such as Jet Skiing will be introduced. Improved infrastructure of Vadanappally beach by providing more amenities like changing rooms, restrooms, showers, and beach umbrellas. Workshops and seminars will be conducted in order to educate the locals about the importance of protecting the beach and its resources. There will be proper signages so that tourists can easily commute.

Figure 10.3.1 Proposed PEZ, THINK Cluster, Tourist circuits and projects



Source- DTPC, Thrissur, 2023; Kerala Tourism,2023

Dustbins and other necessary infrastructure will be provided to make sure that the beach is kept clean and free of any litter. Boat races will be conducted after during the best suited seasons in order to maintain the interest of the tourists. Promotional activities for the beach through digital platforms like websites and social media will also be included.

Revival of Cheraman Juma Masjid

A tourist information and facilitation center is proposed under the PRASHAD Scheme with a budget of 5 to 10 crores as part of the proposal to revive the well-known mosque. The proposal also calls for the revitalization of the pond using landscaping elements like fountains, fish, and aquatic plants. The interpretation center will inform and educate visitors about the mosque's fascinating past. Indian visitors of both religions will be drawn by this. The mosque will be included in the suggested tourist circuit, which will raise awareness of the location and boost revenue generation. There is a need to restore such destinations in order to preserve the rich heritage and make way for development in a sustainable manner.

Transformational Retreat and Remote Habitat

The project aims to provide travel experiences for those seeking a profound personal or spiritual transformation. Meditation, yoga, counseling, workshops, and other experience activities are all included in the retreat. Forests can be as simple as taking a long stroll in the woods or sitting by a lake and taking in the sights, sounds, and fragrances of nature.

Also, the Retreat center will be located at Athirapally (Figure 10.3.1) in collaboration with Dream land resort, and will act as a work-cation, planned for corporate organizations to send their staff to recharge their batteries by living and working remotely from safe spaces in attractive natural settings. The employees revitalize themselves by living in nature, eating nourishing and organic food, participating in transformative workshops, group activities, and learning immersions. The project cost will be 1.5-2 crores and will be developed by Kerala Forest Department and managed by Divisional office, Athirapally.

Revival of Temples

The proposal aims at reviving 2 of the famous temples in Thrissur, Thriprayar temple and Kodungallur Sree Kurumba Temple. This project will be funded under PRASHAD scheme and managed by Devaswom Board. First phase includes development of a multimedia musical fountain show (30 minutes) at Thriprayar temple taking inspiration from Akshardham temple, Delhi, that will display the story of Thrissur, and depicts its history and culture. This will attract a major share of tourists from within the district as well as outside the district. The project cost will be 2 to 3 crores. The second phase includes revival of Kodungallur sree kurumba temple that includes fairs and exhibitions at 2 days a week, attracting tourists as well as local people. This will generate employment for the local community. The project cost will be around 2.5 to 3 crores.

Eco-beach development

The proposal aims at developing one of the beaches that has a unique character but is not much popular among the tourists. Nattika Beach possesses beautiful ayurveda resorts. The beach can be developed as an Adventure tourism destination including various water sports like wakeboarding, flyboarding, knee-boarding and parasailing that will be done under various skilled experts. An adventure skill development center is also proposed. The project will result in employment generation as well as attracting young and solo travelers to the district who ultimately aim to have entertainment in the Adventure sector. Also, Night beach festivals at Nattika and Munakkal beach are proposed. Also, fishing hamlet programs would be promoted at Munakkal beach. The projects will cost around 6 to 10 crores and can be developed by private agencies such as Spyke Trip Private Limited, and Angel Amusement Private Ltd. under the Public Private Partnership (PPP) model. DTPC will act as a management Authority.

To Conduct 'Thrissur Ulsavam'

Thrissur Ulsavam will be a five day festival celebrated to showcase Thrissur's rich culture and heritage. It will be conducted all around the Thrissur district once in a year in November - December for 5 days and will attract approximately 15000 visitors initially which will reach more than 10 lakh visitors by the year 2047. This event will provide visitors with the opportunity to explore the city's heritage sites, pilgrim sites, cultural sites, eco tourism village, handloom village, beaches, and waterfalls. It will not only attract tourists but will also benefit the local people of Thrissur. Thrissur's artisans and craftsmen will display their skills, promoting unique crafts like pottery, handicrafts, handloom and food stalls serving Thrissur's traditional cuisine.

Workshops such as handloom weaving, mat weaving with screw pine leaves, bamboo basket making and pottery will be conducted in Pazhayannur Handloom Village, Edavilangu, Vallivattom, Kodungallur, Kaduppassery, Vellikulangara, Kondazhy, Pazhayannur, Nenmanikkara, Amballur, Chengalur, Kodakara and Irinjalakuda. The activities include Heritage walks, Exhibitions and Trade Fairs, Dance and Music Festival, Adventure Sports, Boat Race Festival, Museum Visits, Temple Tours, Church Visits, Nature Based Activities such as Visit to Eco Tourism Village and Nature Walk, Village Life Experience and Food Festival.

The destinations covered during the food festival are Peruvanam Palace, Kudakallu Parambu, Cheramun Juma Masjid, Punarjani Cave, Koothambalam, Kerala kalamandalam, Kerala Sangeet Natak Academy, Kerala Sahitya Academy, Nattika Beach, Munnakal Beach, Muziris Kottapuram Fort, Chettuva Backwaters, Ayurveda Museum, Archaeological Museum, Appan Thampuran Museum, Guruvayur Temple, Vadakunnathan Temple, Thriprayar Sree Rama Temple, Pazhayannur Bhagavathy Temple , Kalashamla- Eco Tourism Village, Ilanjippara Waterfall, Dolour's Basilica, Thomas Church and Holy Cross Shrine Church.

The five-day schedule includes workshops, heritage walk, church visit on the first day, nature walk, visit to eco tourism village and exhibitions on the second day, temple tours, food festival and museum visits on the third day, workshops, boat race festival and adventure sports on the fourth day and museum visit, dance and music festival and food festival on the fifth day.

There will be online bookings for the festival and a basic amount will be charged from the visitors. Amount will be charged from the visitors as per the activities they choose to do. There will also be a package of 5 days which will include accommodation and all the activities as per the 5 day schedule for which an amount will be charged. The accommodation units that are registered on the website will only be used for the accommodation of the visitors.

Conservation, Preservation and Promotion of Heritage and Culture

A project to Conserve, Preserve and Promote Heritage and Culture is proposed which includes raising public awareness by educating the public about the heritage and culture of Thrissur through educational programs, lectures, and seminars. Documentation of the cultural heritage of Thrissur will be done through photography, video, and other media. Heritage sites and monuments will be identified and protected. One such heritage building includes Irrattichira Kovilakam which will be protected under this project. Traditional festivals and ceremonies will be promoted at national and international level. Traditional artisans and craftsmen of Thrissur will be supported under this project. Collaboration with local and international organizations will be done to promote and conserve the heritage and culture of Thrissur.

Proposed Tourist Circuits

The introduction of new circuits in the district with an objective of designing a time bound package connecting destinations and increasing the staying time of tourists in the district. It will be divided into 3 zones namely, **North Zone, Center Zone and South Zone** (Figure

Figure 10.3.2 Proposed North Zone Circuit



Figure 10.3.3 Proposed Central Zone Circuit



10.3 .1). Each part will have an urban area that can offer adequate services to the tourists and acting as the hub for that zone which will have sufficient infrastructure and connectivity to the main city. Due to the addition of new circuits, tourists can now adequately explore the district as each circuit will take 1-2 days to complete. This will assist the government in managing the growing population, district's economy, and showcasing tourists that Thrissur is much more than only Guruvayoor. The parameters taken for development of the proposed tourism circuits are connectivity, hospitality, sports activities/ festivals / other events and infrastructure.

Authorities: DTPC, Kerala Tourism Development Corporation (KTDC), Kerala Adventure Tourism Promotion Society (KATPS), Devaswom Board, LSGs, Vana Samrakshana Samithies(VSS), MUZIRIS HERITAGE PROJECTS LTD, INTACH, ASI, Kerala Institute of Tourism and Travel Studies (KITTS), Kerala Tourism Infrastructure Limited (KTIL), KFDC, Eco Develo Committees (EDC), KSBDB, DFO Athirapally. Also, private agencies such as Spyke Trip Private Limited, DTPC and Angel Amusement Private Ltd. can collaborate under the Public Private Partnership (PPP) model. **Schemes:** PRASHAD Scheme, RT Mission, Swadesh Darshan, RT Network for products sale and RT Art & Cultural Forum under Responsible Tourism Mission.

Figure 10.3.4 Proposed South Zone Circuit



Circuit 1 - North Zone

This zone consists of different tourist destinations which can give different experiences with a new proposed circuit. Earlier the northern zone experienced the least footfall in comparison to other zones by introducing new destinations and implementing Responsible tourism mission the increase in footfall is expected this mission gives the tourist to experience a different view of Thrissur and helps them to learn and know more about the culture, nature and local art and skills. The Destinations covered in this zone are: Guruvayoor temple, Punnathur Kotta, Kallaayi Kannu (Kallazhy hills), Kalashamala Eco tourism, Kala Mandalam, Kuthampully (Pazhayannur), Vazhani Dam, Poomala Dam, and Chavakkad Beach.

Figure 10.3.5 Tourism Project Implementation Flow



Circuit 2 - Central Zone

Central Zone is in the center of the Thrissur district. This zone consists of the most number of tourist spots . It will attract domestic as well as foreign tourism. Since it is located in the central region it has better connectivity. The tourism typologies included in this zone are heritage, cultural, pilgrim, beaches, backwaters and eco. Many destinations which have potential are unexplored. The destinations covered in this zone are: Vadakkunnathan Temple, Vadakkechira, Paramekkavu Bhagavathi Temple, Basilica of Our Lady of Dolours, Kerala Sangeet Natak Academy, Ilanjippara Waterfalls, Peechi Dam, Ayurveda Museum, Appan Thampuran Museum , Enamavu, Chettuva Backwaters, Vadanappally Beach.

Circuit 3 - South Zone

South zone lies in the bottom of the Thrissur district and consists of major eco-tourism spots as well as serene beaches. It also has famous Kodangallur town having culturally and historically significant destinations, initially known as Muziris by the Greek, and was a legendary port in international maritime trade

during ancient days. The circuit also includes boat rides from Cheraman mosque to Munakkal beach exploring the rich muziris sites and trade activities of the kodanagallur town through the boat tour. Also, cruise tour might also be included travelling from Munakkal to Nattika beach. (Figure 10.3.4).

Destinations covered in this zone are: Athirapally Waterfalls, Vazhachal Waterfalls, Thumboormuzhi Dam and Garden, Sree Kurumba Temple, Kodungallur, Cheraman Juma Masjid, Munakkal Beach, Nattika Beach , Thriprayar temple.

10.3.4 Proposal - Kuthampully handloom village upgradation and Handloom Park

Location of village

Kuthampully is located at 50 km northeast of Thrissur town. It is a traditional cotton weaving village. Kuthampully village, located in the Thalapally Taluk of Thrissur District in Kerala, India, is well-known for its Kasavu handloom weaving of traditional attire. The village is bounded by the Bharatha Puzha and Gayathri Puzha rivers and is situated about 5km from Thiruvilwamala.

History

Kuthampully hand-woven products have a rich history dating back to the 18th century, closely associated with the Kochi Royal family. The Devanga Chettiar community of weavers, originating from the Mysore state, were brought to Kuthampully to exclusively weave dress materials for the palace. The Devanga Chettiar community is skilled in weaving fine cotton handloom products and has gained a good market reputation in Kerala and some parts of Tamil Nadu. Kuthampully has become renowned for its Dobby/Jacquard designs in Kasavu Sarees (Zari sarees) and is branded as Kuthampully Sarees. The production of Kuthampully Sarees and fine cotton fabrics has spread across the Thrissur and Palakkad districts, but Kuthampully remains the main marketing center.

Method of production

These sarees are known for their unique weaving techniques and intricate designs. Manufacturing process of Kuthampully saree includes. The manufacturing process of Kuthampully saree begins with the selection of raw materials such as cotton and silk yarn. The selected yarn is washed and dried before being dyed in various colors using natural dyes. The dyed yarn is then arranged on a warping frame, which creates a warp beam that is used for the weaving process. The prepared warp beam is placed on a traditional handloom, and the weft yarn is interlaced with the warp yarn using a shuttle. Intricate designs are created on the saree using a jacquard loom or by inserting additional weft yarns during the weaving process. After the weaving process is complete, the saree is washed and starched to give it a stiff texture. Embellishment: Embellishments like Zari or thread work are then added to the saree to enhance its beauty. Packaging: The finished saree is then packaged and sent to the market for sale.

Kuthampully Saree was given the GI tag

Kuthampully Sarees are made using the finest cotton yarn of counts 80s and 72s, which are combed to create super combed cotton yarn. This is a unique feature, as very few clusters in India use such fine cotton yarn. Kuthampully Sarees use half-fine Zari in the border, cross-border, or Pallav. This is a special type of Zari that is used for extra warp, extra weft, and motifs in the fabric. Traditional weavers in this cluster used pure Zari, but have shifted to half-fine Zari due to the rise in the price of pure Zari. Kuthampully Sarees are eco-friendly and do not involve any bleaching or dyeing, except for the dyed yarn used in the weft for the border or cross-border. Otherwise, the yarn used is of natural colored grey cotton yarn. Kuthampully Sarees are made using fly shuttle pit looms and frame looms. Weavers use fly shuttle pit-looms for the production of exclusive traditional Sarees with half-fine Zari. The usage of dobby & jacquard for intricate design work using half-fine Zari, dyed yarn in border, cross-border, Pallav, buttas on body is rampant in this centre. The healds used in the weaving looms in Kuthampully are made out of Nylon twine. These healds are locally known as Bombay type healds and are most suitable for weaving with finer count yarn. They allow only small shedding and hence withstand the breakage of yarn and also helps to retain the sizing effect of the yarn. Unlike other handloom clusters, the sequence of processes is reversed in Kuthampully. The loom is first prepared and then taken for beaming. This allows for the production of longer length warp beams that can manufacture up to six Sarees. Kuthampully Sarees are made using modern devices such as Dobby, Jacquard, and Jala. In case of small designs, the Jacquard lifts the required threads in the warp and the Butta Design is laced in the body of the Saree with extra weft by hand. These features and techniques are what make

Kuthampully Sarees unique and highly sought after.

Backward linkages

Cotton Yarn – considering one saree is 5.5 m the weight is 450 gms. It is imported from Tamil Nadu, Kerala HANTEX and HANVEER. Average price is 160 Rs per kg. Polyester Yarn - considering one saree is 5.5 m the weight is 500 gms. It is imported from Tamil Nadu. Average price is 72 Rs per kg. Silk Yarn - considering one saree is 5.5 m the weight is 500 gms. It is imported from Tamil Nadu. Average price is 1350 Rs per kg. Dye – its quantity depends on the shade of the saree and is imported from Salem, Tamil Nadu. Its average cost is 160 Rs per kg. Kasavu(jerry) – is sourced from wholesale dealers in Coimbatore, who collect it from Surat. Its average cost is 320 Rs per kg. Other tools include small bobbins, charaka equipment, scissors, measuring tape, rice kanji, chalk powder, sticker gum, piece of fabric, sand paper, safety pins. Average cost of a saree is between Rs. 600-25,000.

Forward Linkages

The forward linkages include 68 production units in local market, 2471 production units master weaver, 16447 production units co-operative Society, 177 production units in organized Fair/exhibition, 12692 production units in Export, 5783 production units in e-commerce, 2,71,192 production units in Others and Category in the all-India handloom census 2019-2020 for Kerala. Total forward linkage unit sales make up for 0.6% of total units sold in India 2019-2020. From the export summery report period from April 2020 To March 2021 we see Kerala's share is Rs. 78 crore.

Case study – 1. Pochampally Handloom Park Ltd (PHPL) - Hyderabad, Telangana

It was created on July 2000 and completed on March 2011. The investment is of Rs. 34 crore through the national scheme for integrated textile park. It is located at 5 km from the Pochampally village. The area of the park is 24 acres. It has employed 2000 weavers and 5550 related employments. Its turnover till date is of Rs. 100-200 crore. Pochampally handloom park limited (phpl) was created to promote and preserve the art of handloom weaving, which has been practiced in Pochampally for centuries. The park was established with the aim of providing a platform for weavers to showcase their work and to create employment opportunities for the local community. The park is home to several handloom cooperatives and serves as a hub for the production and marketing of Pochampally sarees and other handloom products. Its distance from Hyderabad is 46 km. Business dealing is in ikat cotton fabric manufacturer, cotton double bed sheets supplier, Pochampally sarees wholesaler, ikat sarees retailer, ikat cotton furnishing material exporter.

Proposal

Kuthampully Handloom Park and village upgradation –Currently Kuthampully Handloom co-operative society has 100 weavers. 600 weavers used to work in the society before 2019. After the COVID-19 pandemic the profit in the textile industry dramatically decreased. The workers shifted to the construction industry. The average daily wage of a construction workers is Rs. 829. Per month this worker earns about Rs. 24,870. A weaver gets Rs. 350 per saree. A weaver on an average produces 200 saree per day. Monthly income of this weaver is Rs. 5,833. The same saree is sold for Rs.600-25,00 at an average. If each saree is sold for Rs. 1500 without any middle man through the co-operative society each worker can earn Rs. 25,000 per month.

To increase the wage of each worker a Handloom Park can be created within a 5 km radius of the Kuthampully village. This can be done under the Mega Handloom Cluster Development Programme (previously known as the comprehensive handloom cluster development scheme) in the National Handloom Development Programme (NHDP). A funding of Rs. 70 crore per cluster will be provided by the central government for a 5-year period. In the Assam Textile Park proposal, we saw the budgeting for 200 looms. The proposal for Kuthampully handloom park is for 2000 weavers over a 10-year period. For every 5 year the budget will be of 5580 lakhs that is Rs. 55.80 crores for 5 years and a 1000 looms the common infrastructure will be of 1075 lakh, buildings for common facilities will be 720 lakhs, building for weaver's block 2400 lakh, equipment for common facilities 410 lakh and the other costs involved is of 975 lakhs. Mechanisation of the looms can also be done to speed up the process of weaving.

Other components of the NHDP can be used to augment the handloom park. Under the Cluster Development Programme (CDP) the Kuthampully village can have a space created for the women to come together and do the spindle work for the looms in the handloom park and get paid for it. The main selling point

can be the village where the current weavers can continue working and new weavers can work in the handloom park which will be the Head of production. This village can also become an experience center for tourists to understand and see the process of making of the Kuthampully saree. A space for fair and exhibition can be created in the village itself.

Social media can be used as a way of advertisement and marketing through the handloom marketing assistance with special emphasis on uncovered & talented weavers.

Under the Handloom Weavers' Welfare, we can provide health insurance schemes and income. Support scheme for at least 100 days. From the age of the weavers in Kuthampully handloom co-operative society it was seen that 48% of the weavers are above the ages of 50. This scheme will be beneficial for the weavers of the upper limit of the working class.

Under the Miscellaneous Components, Research & Development projects and a Handloom Census can further help understand which types of forward linkages are working best for the industry and which market can further be explored. The existing issues holding back the industry can also be identified.

Through the publicity, advertisement, monitoring, training & evaluation of scheme we can provide a training center in the village where weavers who have had the art of weaving the Kuthampully sarees taught to them generationally teach the new weavers the same.

Education of weavers/their wards through National Institutes of Open Schooling (NIOS)/ IGNOU we can provide weavers with scholarship for the education of their children. This will help attract the younger generation into the trade as it will help them support their wards education

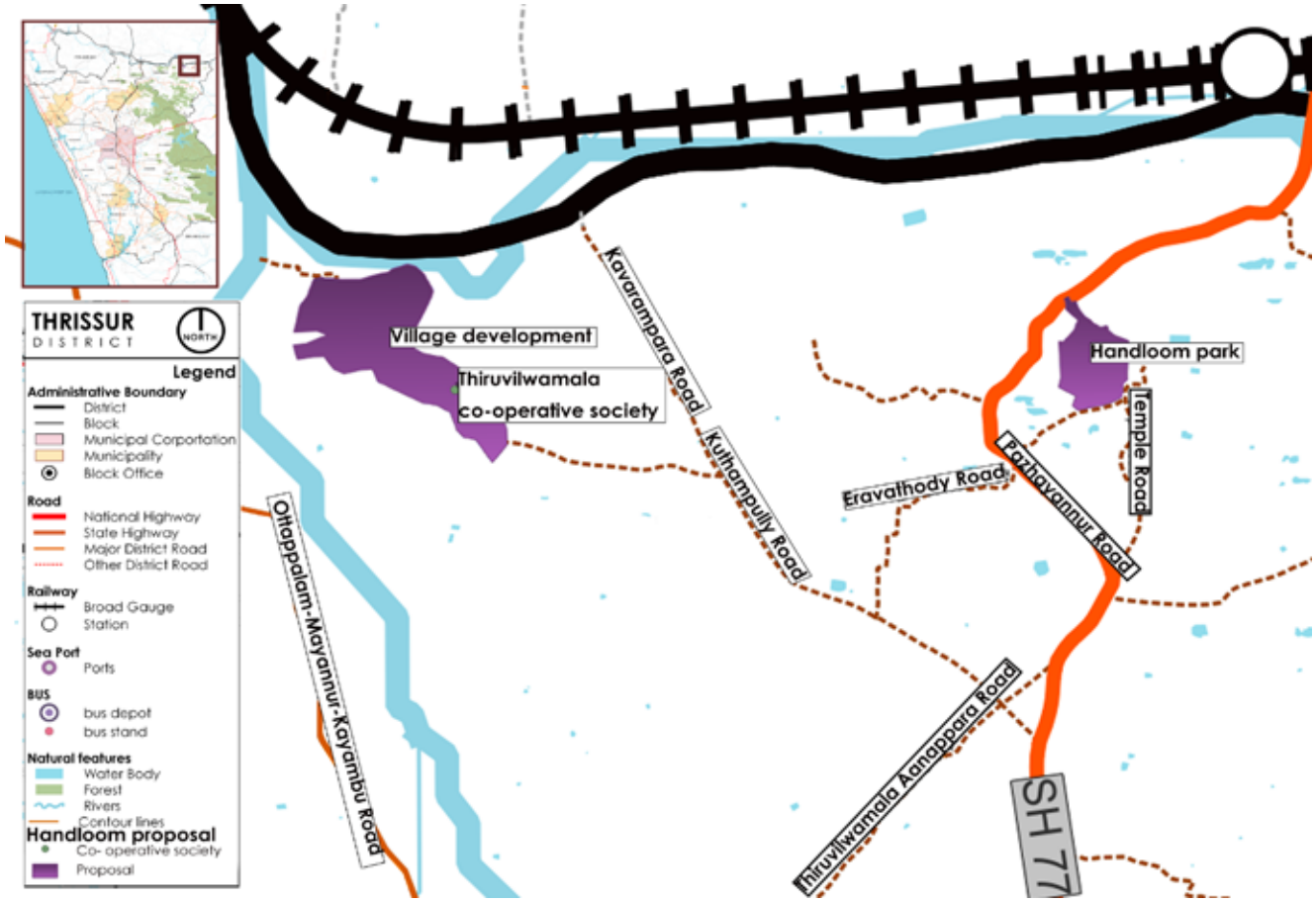
Branding of the Kuthampully saree should be done and outlet stores in different places of sales like malls and airports can be done.

Diversified products for the youth should be created like shirts, pants, and tops. It should be made of the same cotton yarn and touch of kasavu zari. A diversification will expand the market and include the current trends in youth.

Water requirement

1 weaver produces 200 sarees on an average in a year. 1 saree is 5.5 m of wool yarn and 1 kg of wool is 3 m of cloth. 200 saree is 1,100 m of cloth which is 366.66 kg of wool. According to URDPFI guidelines 100 kg unit of production in textile industry requires 8-14 kilo litre of water per unit. Considering 8 kilo litre per unit 200 saree require 3.6 trimes 8 that is 29.33 kilo litre of water. Now considering water requirement of 2000 workers will be for 4,00,000 sarees that is 58,665 kilo litre per year after 10 years. Creating

Figure 10.3.6 Location of Kuthampully village and proposed handloom park



employment for 1000 weavers in 5 years water requirement will be 29,332.8 kilo litre.

10.3.5 Proposal for the Construction industry - Phosphogypsum products manufacturing industry

The building material and construction industry includes manufacturing industries of bricks, cement, and tiles. Gujarat has emerged as the world's largest cement plant. The use of industrial byproducts as building materials can help this industry achieve sustainability. Phosphogypsum (PG) is a waste product of the phosphoric acid (PA) manufacturing process that is widely used, particularly in the soil fertilizer industry. Alternatively, to control the hydration reaction rate of cement, several studies have used PG as a substitute for natural gypsum in the production of portland cement as well as in concrete, bricks, plaster panels, and other materials.

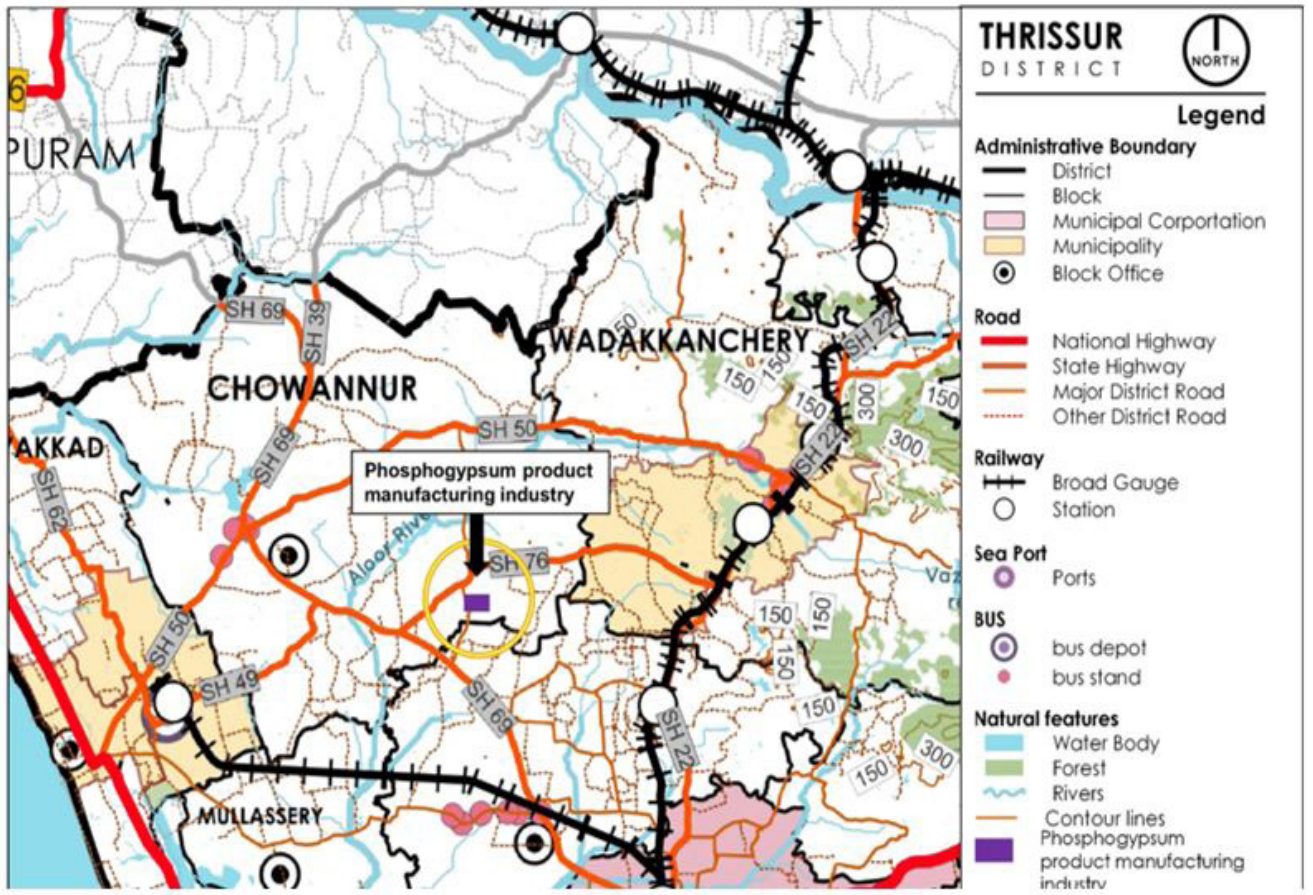
Phosphogypsum is a solid waste product of the phosphoric acid manufacturing process. Currently, a large amount of phosphogypsum is discarded without being treated, resulting in significant land occupation and serious environmental contamination. Currently, only 15% of global phosphogypsum is used to make building materials, agricultural fertilizers, soil stabilization amendments, portland cement retarder, sulphate acid, and other products, while the remaining 85% is typically discarded in landfills, rivers, seas, and lakes without treatment.

The annual production of PG is 12 million tonnes, with 40-45% of the waste being reused in the production of building materials. 5 tons of PG are produced from 1 ton of phosphoric acid. The primary use of PG remains in cement manufacturing, where it substitutes natural gypsum (about 5%) the possibility of using PG in construction materials such as raw blocks and fired bricks. The average market price of phosphogypsum in India is Rs 250/metric ton.

Phosphogypsum can be used to enable holistic socioeconomic growth across all regions, to attract investment in the District in order to boost manufacturing and exports, to create jobs in the District, to create an ecosystem for innovation and the use of technology at the district level in order to make them competitive in both the domestic and international markets.

A process known as "the Hydration-Recrystallization process" for producing non-fired bricks from waste phosphogypsum is proposed to effectively recycle waste phosphogypsum and solve an environmental problem. The optimal mix composition is 75.0% phosphogypsum, 19.5% river sand, 4.0% Portland cement, and

Figure 10.3.10 Location of proposed Phosphogypsum product manufacturing industry



1.5% hydrated lime, with as-prepared bricks having compressive strength, water-saturated compressive strength, and bending strength of 21.8 MPa, 13.7 MPa, and 5.2 MPa, respectively.

Raw materials

Phosphogypsum is imported from Andra Pradesh (Vishakhapatnam) and Rajasthan at an average price of Rs 250 metric tons, lime is found in Palakkad (Nattuvanki, Athurasram, Vannamadai, Thavalam), and Idukki districts at an average price of Rs 20-25/kg, fly ash is found in coal-fired power plants or thermal power plants, sand is mainly found in Kochi port where sand is drenched at an average price of Rs 800/ ton.

Lime-activated flyash-phosphogypsum blend as a low-cost alternative binder

The current study's cost analysis of masonry construction using conventional mortars as well as the optimal blend revealed that the waste blended paste was 31% cheaper than OPC masonry. At an elevated temperature of 80 °C for 4 days, a mixture of 20% raw PG, 70% lime-FA in a 1:2 ratio, and 10% BOF developed a strength of 7.4 MPa. Thus, to use two commonly used industrial wastes, PG and FA, along with lime, in the development of a cement-free binder for use in the construction of low-cost houses.

The cost analysis of the masonry construction using conventional mortars as well as the optimal blend developed in the study revealed that the waste blended paste was 31% cheaper than OPC masonry. Thus, it can be concluded that the alternative blended paste as well as mortars is cost-effective and can play a vital role in providing affordable housing.

Proposal

Phosphogypsum product manufacturing industry,Area - 2 acres,Location Chowannur block,Employment generation – 250,Investors through the PPP model.3. Gold exhibition center.

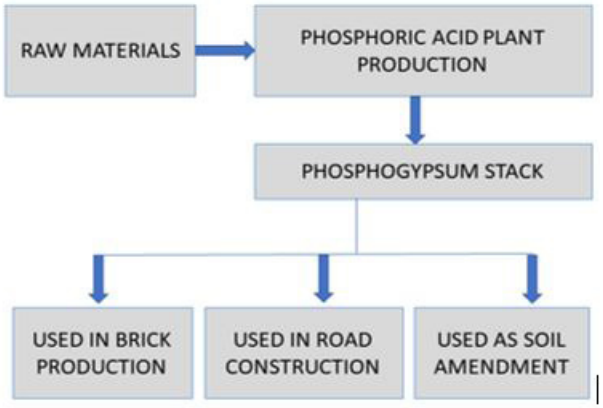
10.3.6 Gold exhibition Center

In recognition of Thrissur's reputation as a hub for gold, a proposal has been put forth to establish a gold exhibition center. This center aims to celebrate the district's rich culture and emphasize the significance of its gold heritage. It will serve as a platform to showcase a diverse range of crafted jewelery designs created by skilled artisans. This initiative not only aims to preserve and promote the district's cultural legacy but also contribute to its economic growth.

Backward Linkages

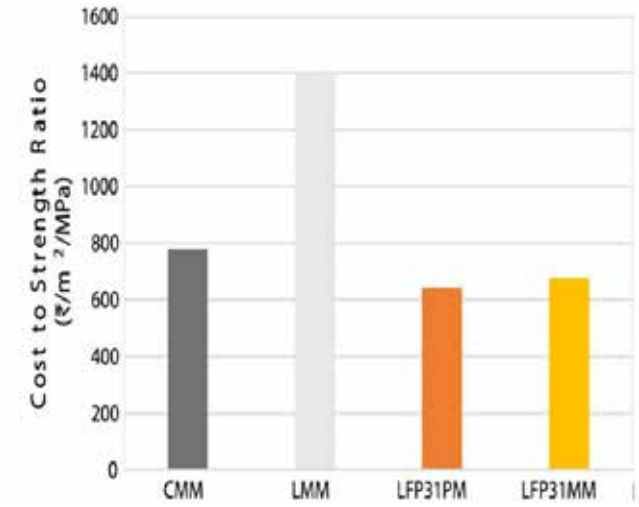
Gold obtained in India is only 1% from domestic production, 10% from recycling old jewelleries and the rest 89% comes from

Figure 10.3.7 Raw materials



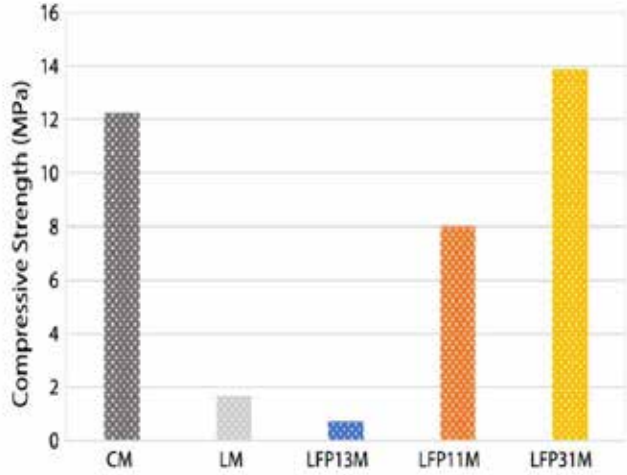
Source: Sri Sivasubramaniya, Lime-activated flyash-phosphogypsum blend as a low-cost alternative binder, 2021

Figure 10.3.8 Raw materials cost to strength ratio



Source: Sri Sivasubramaniya, Lime-activated flyash-phosphogypsum blend as a low-cost alternative binder, 2021

Figure 10.3.9 Raw materials compressive strength



Source: Sri Sivasubramaniya, Lime-activated flyash-phosphogypsum blend as a low-cost alternative binder, 2021

imports. Out of the 10% of the recycled gold, the majority of it is extracted from old pieces of jewellery and 10% is industrial gold. These imports include both refined and dore forms of gold. Bullion makes up approximately 78% of the total gold imports, while the rest is in the form of dore. India is the second largest consumer of gold but the share of India in the global gold production is less than 0.05%. Switzerland, UAE, and South Africa are the countries from which Thrissur imports gold.

India has a considerable demand for gold, making it the second-largest gold market globally, with an average annual domestic demand of around 800-900 tonnes. It constitutes approximately 25% of the world's gold demand. The gold demand in India is primarily driven by the jewellery industry accounting for approximately 73.1% of the total demand and Thrissur is one of the districts of Kerala which contributes to jewellery making and exporting.

The raw materials used in the manufacture of gold jewelry are usually bought in gold bars, while some are recycled from old pieces of jewelry and turned into new ones. Only a few are brought from Karnataka and Jharkhand and the rest account for imports. The pieces of jewelry are either handmade or machine-made. Currently, in Thrissur, the gold rate per gram is Rs 5,585 and one sovereign gold is Rs. 44,680.

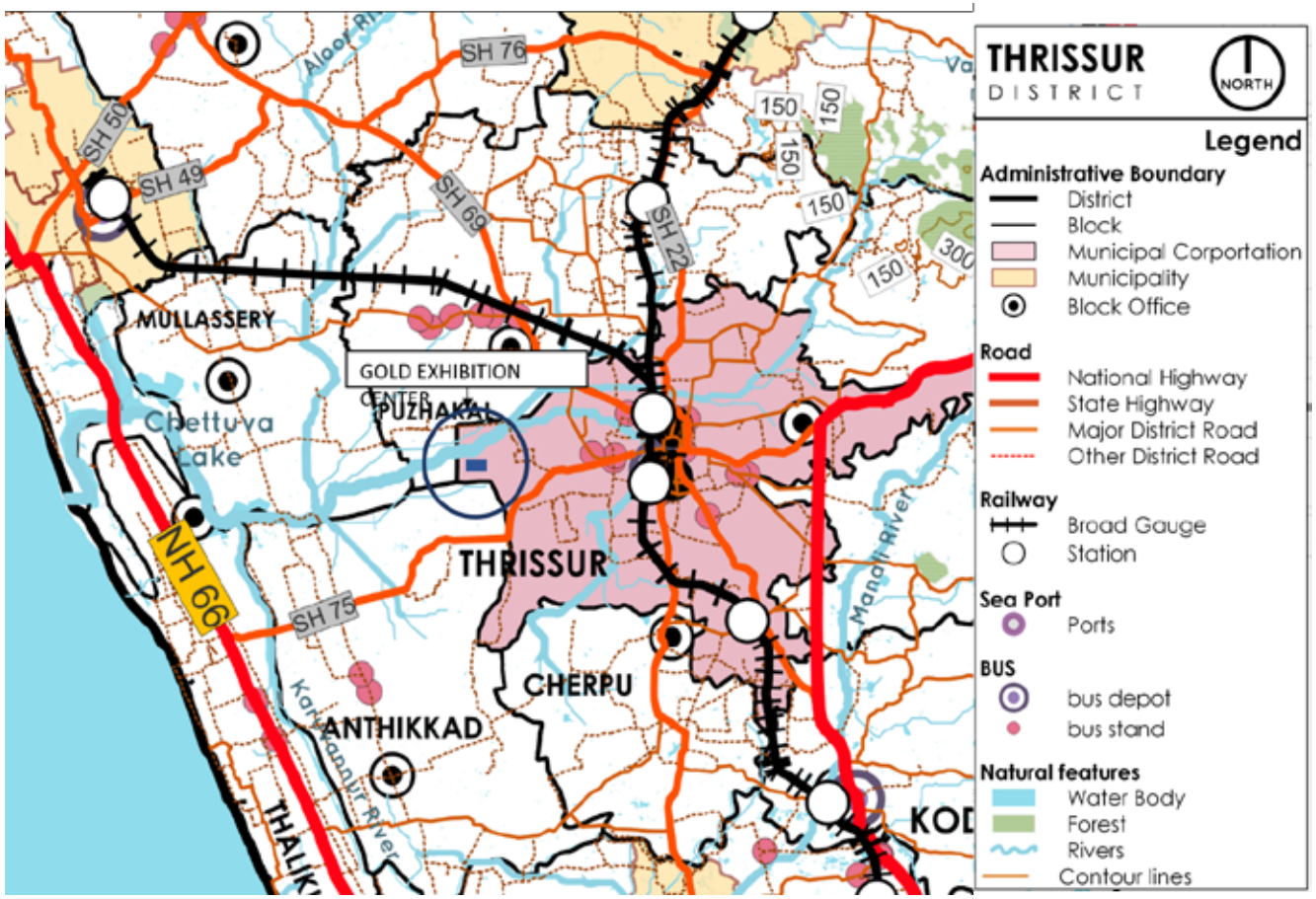
Approximately 60-65% jewelleries which are manufactured in India are handmade. Artisans typically work from their homes or in small homegrown units as part of a cottage industry where the jewelry is primarily handmade. These skilled workers receive gold bars or raw materials from the jewelry factories where they transform them into exquisite jewelry pieces which are later given back to the factories that provided the gold.

Forward linkages

As of 2017, there were a total of 2457 exporters in India, Thrissur being one of them. The export summary report for Kerala from April 2020 to March 2021 showed 2083.89 crores worth of exports highlighting the important contribution of the gems and jewelry industry to the Indian economy. Gems and jewelry contributed 7% to India's gross domestic product

India's export destinations are diverse, with Hong Kong and the UAE being two major contributors to the country's total exports between 2021 to 2022. Hong Kong alone accounted for 24% of India's total exports while the UAE contributed 14.5%. As for the exports from Thrissur, it has been observed that they typically consist of plain jewelry sets or chains. In fact, approximately 50% of the jewelry sets exported from Thrissur fall under this category.

Figure 10.3.11 Location of proposed Gold exhibition center



Proposal

The proposal contains creating a gold exhibition center and gallery in Thrissur that will showcase various types of jewelry made by skilled artisans. This center will also host competitions based on the uniqueness of the jewelry design. The Public Private Partnership and the government can partner for the investment. The exhibition center will be divided into two parts, one for hosting exhibitions and competitions and the other for providing workspace to skilled artisans and workers. The proposed area for the exhibition center is 17 acres and is located in Thrissur M. Corp. as it has the highest concentration of gold units.

The initiative is expected to generate employment for 3000 people and 1000 exhibitors. It will promote Thrissur's gold heritage and traditions which are highly valued by the people. Additionally, the exhibition center will provide a proper working environment for artisans who currently work from their homes or in unorganized units, which can be detrimental to their health.

Overall, the proposed gold exhibition center will provide a platform for showcasing the craftsmanship of skilled artisans and workers and promoting the importance of Thrissur's gold heritage. It will also create job opportunities and improve the working conditions of workers in the industry.

10.3.7 Agriculture

The proposals pertaining to agriculture are focused on the issues in the sector that were previously mentioned in Chapter 8. The key intervensions are to increase agricultural area and production, farmers' income, shared value creation, export potential development, younger generation involvement in the sector, and adoption of new technologies.

Table 10.3.2 Existing and proposed scenario calculations of Chowannur block

	Total crop area (Ha)	Paddy (Ha)	Production paddy (T)	Cultivators (No.)	Agricultural Labourers	Net returns (Cr)
Existing	11817.3	3094.25	12108.53	2163	4658	32.4
Proposed	13032.3	4309.25	16863.11	2385	5137	45.2

Table 10.3.3 Existing and proposed scenario calculations of Thrissur district

	Area (Ha)		Production	
	Existing	Proposed	Existing	Proposed
Paddy	23946	27785.9	87,702.7 T	1,01,766 T
Banana	2299.8	6139.7	22,972.6 T	61,330 T
Coconut	80831.3	84671.2	496 mil.no	520 mil.no

Fallow & Waste land conversion through Lease

As per the Agriculture Statistics 2020-21, the percentage of cultivable waste and fallow lands to total geographical area of district has been increased from 1.03% (3136 Ha) to 3.80% (11519.8 Ha) from the year 2005 to 2020 due to shift of workers from agriculture to other sectors. One way to increase the crop area and yield and to make money from fallow lands is to convert them through lease.

As per proposal, a district level committee headed by Principal Agricultural Officer will identify lands for lease, and a block level Assistant Agricultural Officer will allocate the land for 30 years lease to farmers. Farmers/leaseholders will have to register themselves and pay one-time security deposit. They will not have to pay any taxes or rent for initial years and it would be mandatory for them to develop a leased land within those years. Then particular Rent/Ha would be charged from them.

A condition will be that the leaseholders will have to grow only those crops identified by the state government as an intention to increase exports through value addition i.e. rice, banana and coconut. If in a case, leaseholder wants to return a land ahead of lease period i.e. 30 years, no compensation would be given. Infrastructure required will be provided by subsidy through 'Corporate Social Responsibility (CSR)', following the Companies Act, 2013, which will help in Creating Shared Value. In this case, corporate will help growth of agriculture and agriculture will help corporate/business to improve & flourish.

Sample block- Chowannur block details

Chowannur block has 1215 Ha of fallow land, which could get cultivated. With the implementation of this model and paddy cultivation, total crop area would increase from 11,817.3 Ha to 13,032.3 Ha, wherein, paddy area would increase from 3,094.25 Ha (15.78%) to 4,309.25 Ha (21.98%) in the district. There will be increase in production of paddy from 12,108T to 16,863T. There will rise in involvement of total cultivators and labourers from 6821 to 7522. Net returns from total paddy land will be 45.2 Cr. (Table 10.3.2)

Following the same in each block, Total

agricultural area in Thrissur, which is 1,24,474 Ha (41%) now, would be tentatively 1,35,578 (45%) with the cultivation of paddy, banana and coconut. Total number of cultivators and labourers would increase from 34,477 to 37,668 and from 58,179 to 63,865, respectively. There will be a rise in area and production of paddy, banana and coconut as shown in table 10.3.3.

Also, to capacitate each farmer in the block, farmers' groups will be developed by organizing around 500 farmers into each group and identifying lead farmers in the group. With the help of private sector participation and CSR fund, the chain of capacitating lead farmers by introducing innovative techniques of farming and then capacitating each group will be maintained.

GI products marketing strategy planning

Marketing strategy is proposed in four stages with an involvement of Agriculture and Processed Food Products Export Development Authority (APEDA). The first stage will be to protect products with localized focus, in which the focus will be to protect the product from cheaper substitutes and the solution for that is logo design, tagline, Made in Thrissur strategy and quality packaging.

Second stage will be to protect and enhance earnings in limited market with the focus to increase unit value realization though creating awareness about the products and their uniqueness. The solution for that is to conduct annual festival, trade fairs and exhibitions, etc.

Next stage is to protect and expand market by developing websites and social media to achieve the goal of creating awareness in existing as well as new markets. Promotion activities and product innovation should be encouraged to reach out to a larger market.

Last stage is to protect and expand earnings to encourage innovation in production process and packaging to provide higher value to customers to ensure growth in profitable market segments by special packaging for expanded markets, value addition and exhibitions, etc.

District Export Hub

As mentioned in chapter 8, the district export performance of primary sector in Thrissur is much lesser than other sectors. To enable MSMEs, farmers and small industries to get benefit of export opportunities in the expanded markets, attract investment in the District to boost manufacturing and exports, reduce transaction cost for the exporter at various stages of export cycle and to generate employment in the district, District Export Hub is proposed at two potential locations i.e. Pappinivattom village in Mathilakam block and Karamuck village in Anthikad block, considering the connectivity and production of crops in the domain.

Implementation

The proposed plan for the development of agriculture in the district has five phases. First phase involves encouraging farmers to support and adapt private partnership which will led to an involvement of private entities and more funding for the rapid development of sector.

Second phase focuses on an adoption of new and innovative methods of farming for better yield. This will involve Farmers' groups and technical assistance provision in each block.

Third phase is the promotion and marketing strategy planning of GI tag products and the process will be as explained earlier in this chapter, which eventually will lead to more Gross Value Added, better export opportunities and economic prosperity.

Next phase involves the promotion of export of major crops through proposed District Export Hub.

Final phase is to adopt new and innovative technologies like Smart-crop monitoring, farming, Autonomous farming machinery and Smart- building and equipment management which will help to transform farming in Thrissur by 2047 by adapting and developing Digital Infrastructure.

10.3.8 Animal Husbandry and Dairy Development

To improve and enhance the efficiency of the sector in Thrissur district, the key issues needs to be focused upon as discussed in Chapter 8. Also to address these in a holistic manner few objectives needs to be focused upon inculding self sufficiency in production, development and preservation of livestock, ensuring optimum fodder availabiliy, eco-friendly technological interventions in the market throuh this, facilitating subsidies and providing livestock insurance backing to promote the business.

The proposals are framed on the feasibility of different sectors as per high, mid and low land areas supporting allied activities.

- **Dairy Development**

Dairy sector lags in demand and supply

gap, which needs to be bridged through various interventions at different level of administration. This can be done by focusing on three factors - Cattle Rearing at Household level, Ensure fodder Availability and Integrated Indigenous Cattle Centre.

Coastal blocks have less production due to unavailability of grazing land and infrastructure facilities for animal husbandry including Chavakkad, Mullasery, Thaikulam, Anthikkad.

Blocks including Chowannur, Puzhakkal, Mullasery, Irinjalakuda and Vellangallur have potential for dairy and fodder development as they have Kole wetland with an area above 40 Sq. Km. This can be used as a basis for basic inputs in the dairy sector like fodder and water availability provisions.

Cattle Rearing at Household Level

This can be promoted through introducing modern practices and equipments through public training workshops, incentivizing the initial investments in business to bring more people on board for practicing dairy and increasing the overall milk production.

The investment under setting up small dairy units of upto 10 milch animals costs 5 lakhs with all facilities for which subsidy of upto 25% of the expenditure (33.3% for SC/ST farmers), up to a maximum of Rupees. 1.25 lakh (Rs. 1.67 lakh for SC/ST farmers), would be given as a back-ended capital subsidy. For a 2 animal unit, the maximum capital subsidy is Rupees 25000 (Rs 33,300 for SC/ST farmers) under NABARD Dairy Entrepreneurship Development Scheme.

Ensuring Fodder Availability throughout the Year

Yearly fodder management plan should be prepared in conjunction with agriculture and animal husbandry department to ensure the fodder availability required for dairy in all blocks across the year.

For this purpose, integration of kole lands for grazing activities and fodder development should be done and special attention towards coastal block due to lack of grazing land should be given.

Integrated Indigenous Cattle Centre

Due to Tolerance to extreme climatic Conditions, these breeds play crucial role in the national economy through supply of draught animal power, milk, cow dung (organic manure) and cow urine (medicinal value).

The annual loss in milk production of cattle and buffaloes due to thermal stress in 2020 will be about 3.2 million tonnes of milk costing more than Rupees 5000 Crore at current price rates(RGM, 2014).

Rashtriya Gokul Mission needs to be brought into line through setting up Gokul Grams in a): the native breeding tract of an indigenous bovine breed and b): on the suburbs of metropolitan and large cities (for urban cattle).

Biogas, bio pesticides and Improvement of soil fertility and nitrogen content through green technology bio fertilizers, biomass for humus can be obtained through these cattle centers. Biofertilizers from biogas have the potential to raise the yield of the crop from 15% to 25%. Innovation factor in this includes products from cow dung like hand-made paper, mosquito repellents, heat resistant roofing tiles, dry and oil bound distemper etc. Dairy byproduct processing units locations have been marked on Figure - 10.3.12.

Long term goal for this centre entails greater access to organised market for A2 milk and milk products and higher Farmers stake in conservation and development of indigenous breeds.

Land required for gaushala of 1000 cow unit is 7.5 acres as per ICAR(2016) For project estimated, Assam's plan is referred as an example in which milk processing unit of 5000 lit/day costs around 50-75 lakh as per strategy paper on town milk supply scheme, and as per various case studies in the sector, waste product processing units needs an area of about .25 to .5 acres with an investment of 1-1.05 cr As per Niti Aayog's Task Force report on "Production And Promotion Of Organic And Bio Fertilisers With Special Focus On Improving Economic Viability Of Gaushalas 2023", the 25 tonne/day bio-CNG plant has a total initial cost of about Rs. 2.1 crores, and the annual running costs, including the cost of buying cow dung from gaushalas, are about Rs. 1.51 crore. The plant's annual gross revenue (including biogas revenue+ revenue from phosphate rich organic manure) comes to Rs. 1.78 crore. 20-40% profit margin can be generated across different products from dairy waste.

- **Fodder Development**

Enhancing current yield Capacity of 200MT/Ha through green fodder and enhancements to be done for a high and longer yield period. Fallow land can be used as a fodder devel-

opment project with Agriculture Department for managing fodder.

Creating management plan for fallow lands distributed across blocks and type of fodder defined for production throughout the year. Fodder management units have been marked on Figure - 10.3.12.

Make provision of agriculture and animal husbandry in specific blocks like Ollukara, Chowannur, Puzhakkal, Mullasery to rely on each other to reduce dependency on external inputs. Agricultural residue to be used as fodder and processed manure from husbandry sector to be used as bio fertilizer which would lead to promotion of organic farming and branding of organic produces for higher incentives.

- **Mixed Farming**

Incentivising mixed farming practises through subsidies to farmers engaged in agriculture and dairy. Provision of Dairy and farming together as crops are susceptible to climate related damages. Provision of mixed crops in a year so that soil quality remains good.

- **Egg and Meat Production**

New egg nurseries to be introduced to bridge the gap in demand and supply. Fowl population to be enhanced and introducing new nurseries at deprived blocks. Attaining a high village level production in poultry farming through improvement in household level rearing along with merging of school poultry club through creating markets at village level. Also with modern technological interventions for high yield and advancements in the feed for reducing the maturing time period of fowls.

For increasing meat production, pig fattening units to be established for enhanced piggery development through improved feed for rapid fattening. On the other hand, cattle procurement schemes to be formulated. Procurement of cattles through integrated indigenous cattle centre of unproductive stray animals.

Accredited and modernized slaughterhouses to be focused upon the coastal belt. Common markets to be developed at village level so that clean and good quality meat and eggs can be sold. Focusing on direct to consumer market creation and improved shelf life processing for export or use within district.

Meat byproducts processing can be done through private partnership model at infrastructure level interventions. Meat processing and pig fattening units are marked on Figure - 10.3.12.

Implementation

The implementation plan for the respective sector is prepared in three phases. First phase entails promoting household livestock rearing and incentivizing for increasing production and self sufficiency at household level. Second phase involves developing indigenous breeds for good yield for longer goal of milk sufficiency by 2047 and creating infrastructure facilities at different blocks and villages. Third phase includes infrastructural interventions for byproducts processing units of dairy and meat industry with creating new employment opportunities.

10.3.9 Fisheries

Key Challanges of the Fisheries Sector

The fisheries sector in Thrissur faces several key challenges that hinder its growth and development. One of the primary issues is the slow adoption of new techniques and technologies, which can improve the efficiency and productivity of fish production. Limited extension services also pose a challenge as they limit access to information and knowledge required for the optimal functioning of the sector. Furthermore, the lack of quality inputs and access to credit, along with the absence of entrepreneurship, further exacerbate the problems in the sector.

In terms of infrastructure, the lack of cold chain facilities and unorganized retail markets with quality issues hinder the proper handling and preservation of fish products. Inadequate infrastructure leads to post-harvest losses, which can be attributed to physical, quality, and market-induced losses. These losses can be mitigated through better infrastructure, including cold chain facilities and organized retail markets.

The fisheries sector also faces issues related to the economy, including a poor price discovery mechanism. This leads to income insecurity for fisher-folk and limits their ability to invest in the sector. Finally, quality concerns around fish products for export and domestic consumption hinder the growth of the sector, as it affects consumer demand.

Fisheries Proposals

The fisheries sector faces several challenges such as slow adoption of new technologies, limited extension services, poor

Figure 10.3.12 Proposed map for Primary sector economy

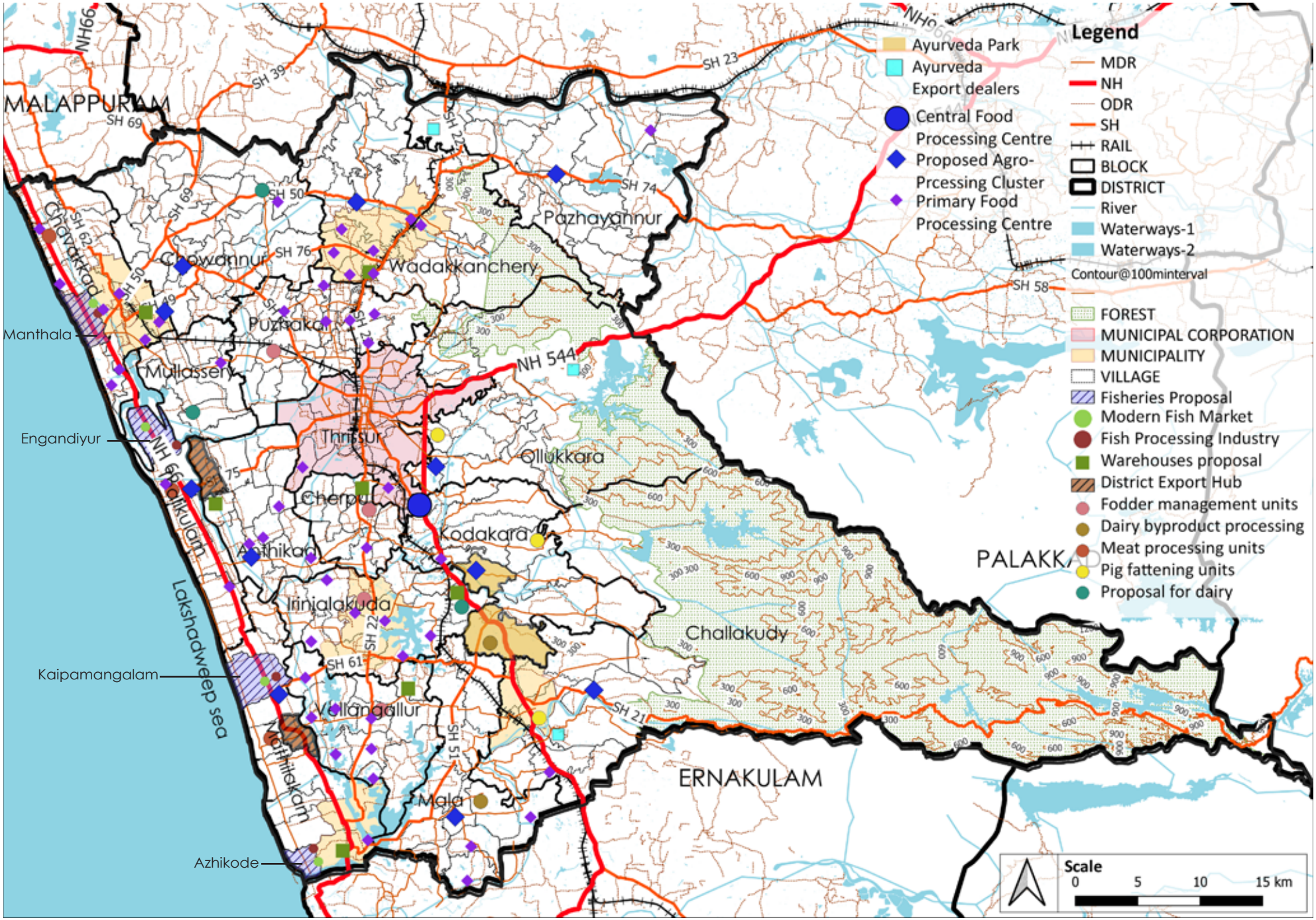


Table 10.3.4 Area Calculations for Fisheries Infrastructure related Proposal

Sr.No	Villages	Modern Fish Market		Fish Processing Industry	
		Area (ha)	Cost (in Cr)	Area (ha)	Cost (in Cr)
1	Manthala	0.2	4.75	0.25	1.8
2	Engandiyur	0.16	4.3	0.25	1.8
3	Kaipamangalam	0.16	4.3	0.2	1.5
4	Azhikode	0.2	4.75	0.25	1.8

infrastructure, poor price discovery mechanisms, and post-harvest losses. However, there are several proposals that could help to address these challenges and support the growth and development of the fisheries sector.

One of the proposals promotes the use of recirculatory aquaculture systems (RAS), an innovative and sustainable fish farming technique that recycles water and maintains optimal water quality, leading to increased productivity while reducing water usage. Private sector participation could enhance the fishing community's environment by providing investment and expertise to the sector. Converting community ponds into fisheries, implementing awareness and training programmes, developing modern fish markets near harbours, and establishing small-scale fish product businesses are other proposals that could help improve the competitiveness of the sector.

Overall, these proposals could significantly support the growth and development of the fisheries sector, improve the livelihoods of fish farmers and fishery workers, and promote food security and economic growth in the sector.

Convergence of Schemes

The convergence of various schemes has been initiated to support the growth and development of the fisheries sector in India. The Pradhan Mantri Matasya Samapada Yojna and Shrimp Farming scheme aim to improve the production and export of shrimp, while the Biofloc Tech Fish Farming Scheme promotes sustainable fish farming techniques. Parivarthanam is aimed at enhancing the livelihoods of fisherfolk, while the Blue Revolution promotes the integrated development and management of fisheries. The Fisheries and Aquaculture Infrastructure Development Fund (FIDF) and the Fish Farmer Development Agency (FFDA) provide financial assistance to fish farmers and fishery workers for infrastructure development and capacity building.

Implementations

The proposed plan for improving the fishery industry has three phases. The first phase involves encouraging the fishing community to adopt and support private participation, which will lead to an increase in the per capita production of fishery. This can be achieved by providing them with necessary resources, knowledge, and support to adopt modern fishing techniques and technologies.

The second phase focuses on promoting small-scale industries to improve the standard of living and quality of life of the fishing community. This will involve providing skill development programs under the Blue Revolution Scheme, as well as loan distribution and allotment by co-operative banks.

The third and final phase will involve outsourcing and marketing the market to improve productivity. This can be achieved by developing better marketing channels and infrastructure, promoting exports, and providing assistance to small-scale industries to access domestic and international markets. By implementing these phases, the fishery industry can be transformed into a more sustainable and profitable sector, benefiting both the fishing community and the economy as a whole.

Manthala, Engandiyur, Kaipamangalam, and Azhikode are the villages addressed for the development of advanced fish markets and fish processing industries. Figure - 10.3.12 mentions the location of the villages. These villages are well connected to the fishing harbours and national highways. The details regarding the required area and cost for the project are mentioned in table 10.3.4. The project is divided into two phases, with phase 1 focusing on the development of modern fish markets and phase 2 focusing on the development of fish processing industries.

The proposed project is beneficial for the fishermen and their families as it will increase their economic value and improve their life chain. Furthermore, the development of the fisheries sector will lead to an increase in economic growth in the district. Overall, the project has

the potential to bring positive changes to the lives of the fishing community and boost the local economy.

10.3.10 Ayurveda Park

Thrissur is the centre of major Ayurveda companies and contributes to 20% of manufacturing units in Kerala. 65% population rely on medicinal plants for livelihood and healthcare in kerala. It has 500 species and a potential of major marketplace in Kerala. But the potential of global marketing gets limited due to various reasons like medicinal species non-availability, limited production, restriction for collection from forest leading to import of major medicinal species and increased price due to high annual consumption. Other issues analysed are absence of standardization of raw species as supply chain is not proper which limits the trade in global markets. Lack of use of modern cultivation technologies due to less knowledge of modern techniques to cultivators. *(Source: KFRI Report, 2020)*

Objectives and its approach

Presently, a cluster-based approach with concept leveraging the interlinkages between production, industries and health care attempting to incorporate most modern scientific technologies in production as well as preservation of genetic endangered species would help in solving the major issues faced.

The main objectives are education and training to farmers, use of modern technologies for more and faster production, creating market for more and sustainable products and provision of valid certification of production would be the step towards long term planning for increasing ayurveda industry in Thrissur. The main approach is linking backward and forward linkages with the aim to achieve sustainable use of medicinal materials by using modern technology.

Overcoming constraints through PPP Model

The PPP (public private partnership) Model approach would help in removing bottlenecks in production, processing and marketing. It can be done through contract farming model linking cluster-based approach. At village level, formation of farmer's organisations with group of farmers interested in learning and collaboration with private industries on contract basis under panchayat. These organisations will be involved in partnership with private companies and research institute. The research institute/seed centres like KFRI, KAU and rayirath gardens (well-known nursery) would provide seedlings and work with these farmer's organisation as the ultimate aim is to provide cultivation technology of medicinal plant species available to farmers (Figure 10.3.12) . From Industrial purposes, the district committee or private cluster committee at each block level would collabe with government and private companies of their block on contractual basis for their investment in exchange of production, processing and certification.

The figure 10.3.13 shows the linkage of the cultivators of villages who would assure quality material, and regular supply to private companies and these companies would ensure employment opportunities along with assure market and fixed market rate and research institutes would fullfill requirement of good

Figure 10.3.13 Collaboration feature of Public private partnerships in thrissur district

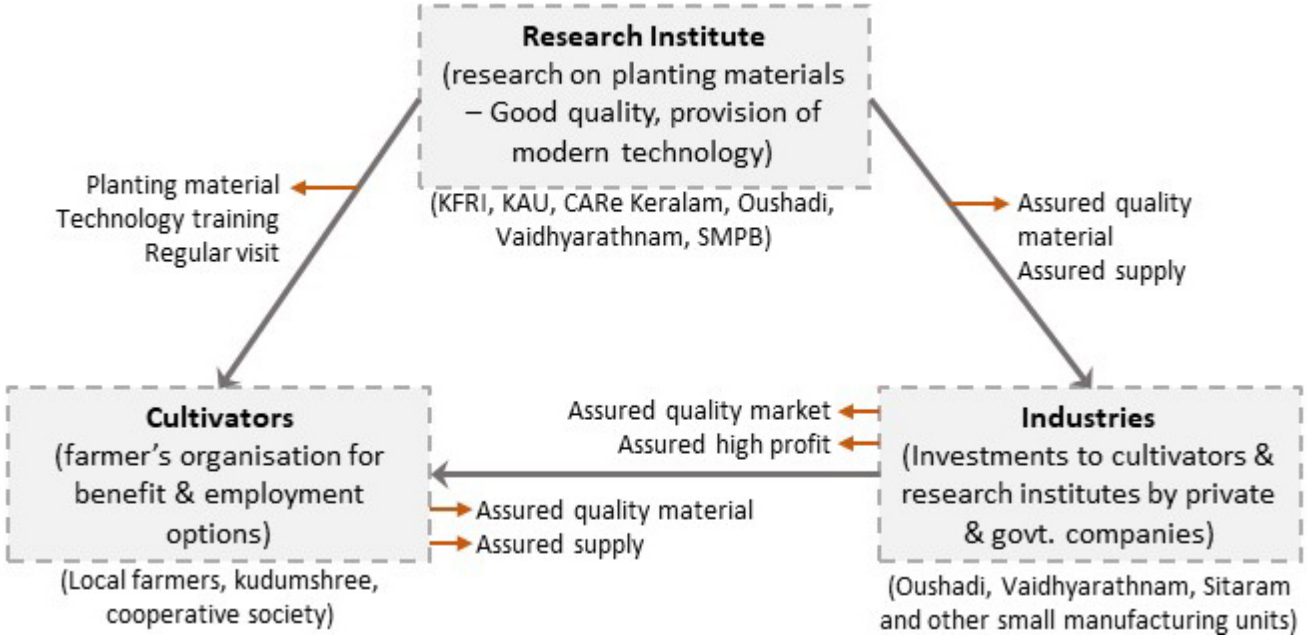
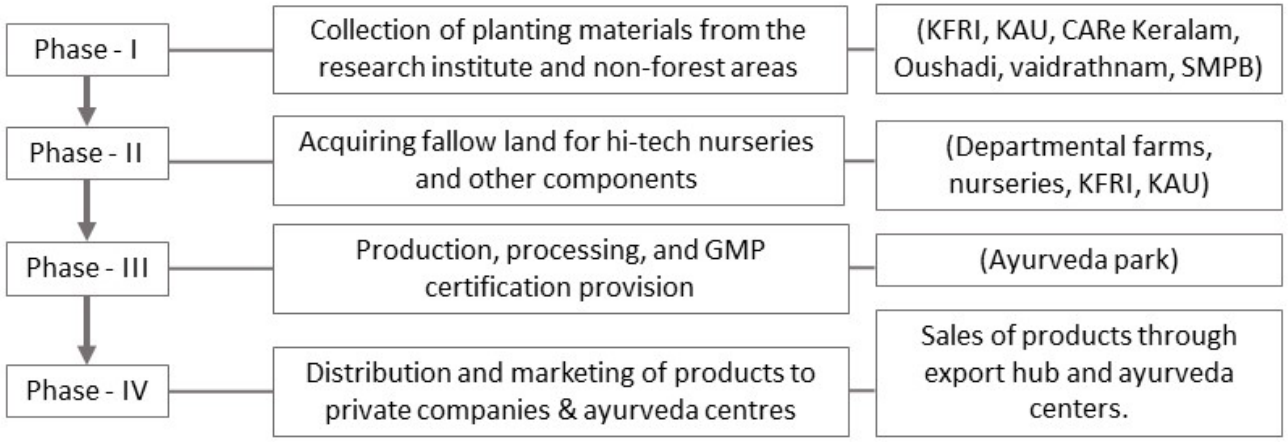


Figure 10.3.14 Phase wise developement strategy and associated agencies.



quality seedling with technological training under agricultural department. The Research institutes would be funded by Government schemes (2 crore annually), Kerala government and private companies involved in it. The private companies would invest in research institutes and farmers organisations for best quality and quantity of processed medicinal products for export and globalized market. Hence, the increased production through good quality seedlings, and trained cultivators, proper processed products will increase marketing aspects in Thrissur.

Ayurveda park proposal

The cultivators, industry and research institutes are brought together on a single platform and Ayurveda park is proposed for increasing production of commercially important and endangered medicinal species through hi-tech nurseries. The Processing methods would be applied using modern technologies and marketing would be done through distribution of processed ayurveda products to private and ayurveda centres. These private companies would do value addition and export at larger scale to foreign countries.

Selection of kodakkara block

The ayurveda park is proposed in kodakara block in chengallur village of area 20 hectares as this block has high potential and land suitability of medicinal plants production. (The seed centres, Thrissur municipal corporation, major ayurveda private companies and hospitals and dispensaries) comes within 10 km of distance which would ensure better supply and export of medicinal both raw and processed materials through road, rail connectivity. The export to other other states will be done through 3 export dealers' location in pazhayannur block (road SH22), ollukkara block (NH544) and Chalakuddy block (NH544) and export to foreign countries will be done by Agro - export hub provided in Thalikullam and mathilakam blocks. Figure 10.3.12 shows that NH544 industrial corridor serves as major transport corridor.

The land acquired will have various facilities and infrastructure like hi-tech nursery for production through tissue culture at various primary, secondary levels. The genetic centre will preserve all the endangered and commercial species and would increase through replication and other methods. The other facilites like Research & development centre, common facility centre (quality certification, benchmarking and valuation), provision of training centres for educating farmers with modern techniques for cultivation and encouraging them for entrenuership and introduction of herbarium for herbal tourism will be proposed. Figure - 10.3.14 shows phase wise development strategies for this proposals.

Employment Generation

The employment generated through this proposal would be 40-50 farmers per hectare. The cost of seedlings acquired from research institutes would be at the rate Rs.15 per seedling standardised. The 5 potential plants identified and other endangered species would be grown for commercial marketing. The cost of cultivation primarily estimated is 3 lakh per hectare and rate of assistance from government is 1.25 lakh per hectare under National AYUSH Mission and the rest would be from private investors for production and machinery assistance.

Funding strategiess

Before private investors gets interested in investments, there is requirement of public sector investment to initiate the PPP Model approach and build necessary infrastructure and also to build social capital to increase the efficiency of medicinal plant chain. The other strategies would be through creating greater demand for cultivated material through large

Table 10.3.5 Guidelines of One Block Two Industries (OBTI) Scheme

Approch of OBTI Scheme	Implementing Agency	Schemes / Programme	Beneficiaries
• The scheme adopts the One Block Two Industries (OBTI) strategy to take advantage of the raw materials that are available block-wise, availing common services, and market products. The framework for value chain development and support infrastructure alignment will be provided by OBTI scheme. One block may contain more than one cluster of OBTI industries. There may be a cluster of OBTI industries consisting of more than one adjacent block in the state. • Industries would receive support for processing, waste reduction measures, accurate assaying, storage, and marketing. • For providing support to existing individual micro-units for capital investment, preference would be given to those OBTI industries. However, existing units producing other products would also be supported. In the case of capital investment by groups, predominately those involved in OBTI industries would be supported. • Support for common infrastructure and marketing & branding would only be for OBTI industries. In case of support for marketing & branding at the District or block level, the same industries products of blocks not having that product as OBTI could also be included	1. District Industries Centre (DIC) 2. The Khadi and Village Industries Commission (KVIC)	Prime Minister's Employment Generation Programme [PMEGP]	- Micro-enterprises - Self-Help Groups - Co-operative Societies - Charitable Trusts
		PM Formalisation of micro food processing Enterprises Scheme (PM FME Scheme)	- Farmer Producer Organizations (FPO) - Self-Help Groups (SHG) - Producers Cooperatives - Individual micro food processing unit
		Entrepreneur Support Scheme(ESS)	- Micro, Small and Medium Enterprises (Individual / Group)

Source: Author, Ministry of Food Processing Industries, GoI and Directorate of Industries and Commerce, Govt. of Kerala

Table 10.3.6 Block-Wise Selected Industry for OBTI Scheme

Block	Industry 1	Industry 2
Anthikkad	Rice Products	Papad
Challakudy	Dairy Products	Masala Mill
Chavakkad	Fish Products	Coconut Products
Cherpu	Rice Products	Food Powder
Chowannur	Coconut Products	Rice Products
Irinjalakkuda	Biscuit & Snacks	Fish Products
Kodakara	Papad	Food Powder
Mala	Masala Mill	Papad
Mathilakam	Fish Products	Biscuit & Snacks
Mullassery	Rice Products	Fish Products
Ollukkara	Dairy Products	Beverages
Pazhayannur	Papad	Masala Mill
Puzhakal	Food Powder	Rice Products
Thalikulam	Coconut Products	Fish Products
Vellangallur	Biscuit & Snacks	Beverages
Wadakkanchery	Coconut Products	Papad

exporters and private sector like ayurveda centre and also by increasing the cost of cultivated material. Funding strategies would also include increased involvement of civil society (farmer's groups) to deal with public institutions, collect market information and build entrepreneurship.

Certain policies or agreement would be signed to carry out PPP model approach between farmers, research institutes and private companies for faster, better and equal initiation of all the parties.

Through PPP Model approach it is expected that all the parties involved will be benefited from partnership, farmers will have guaranteed access to markets, reduced risk, lower transaction cost, and capacity strengthening of their organisation. The industries will have access to larger production volumes of organically produced raw materials. This collaboration would bring market and economy in a long vision making Thrissur a centre hub of ayurveda industry. The vision of sustainable developement for thrissur is met by SDG's Goal 3 which ensures healthy life and promote well being for all at all ages.

10.3.11 Agro-Industries

Various proposals have been made for the empowerment of farmers, farmer-producing organization (FPO), shelf help groups (SHG), co-operatives, micro-enterprises, non-governmental organizations (NGO)/charitable trusts involved in farming as well as in food processing industry. By providing modern infrastructure and effec-

tive supply chain management, this will create effective forward-backward links that will spur the growth of the food processing industry and reduce food waste while also raising the number of employment, income and boosting the export of processed foods to outer market.

Guidelines of One Block Two Industries (OBTI) Scheme-

On the basis below parameters, block-wise analysis has been done to identify two industry that has the potential to grow in that block (Refer Table 10.3.6)

- Raw material available
- Existing industry's number
- Existing employment industry wise
- Last 25-year (1997-2022) growth rate in industry numbers

There are total nine industry has been selected for the whole district (Figure - 10.3.12). The scheme's objectives are to assist the block in realizing its full potential, foster economic and sociocultural development, and generate employment possibilities, particularly in rural areas. The detailed guideline of the above scheme has been given in Table 10.3.5.

Primary Processing Centre (PPC)

The term primary processing centre (PPC) refers to a location or subset of manufacturing where all the facilities necessary for pretreatment, processing, drying, packaging, storage, and collection centre are sequentially available for the raw materials and intermediate products derived from the agricultural sector. PPC includes agro-horticultural sectors such as fruits and vegetables, cereal/other consumer food products, pulse processing, spice grinding, oilseeds processing, and other food processing industries. PPC can belong to an individual, a group, or a cooperative business. The PPC adds value to a product in order to boost the marketability of excess production that is available in the village, group of villages, or nearby community. Processed materials are further transfered to the agro-processing cluster (APC) and packed food products prepared in the PPC are sold in the market. For the setting up of a primary food processing centre minimum two acres of land would be required.

The primary food processing centre is available in 65% (165) of the village in the Thrissur district. According to the village involved in the primary sector, the projected agricultural workers and cultivators in 2047, new primary food processing centre has been proposed in 64 villages of the district (Figure - 10.3.12).

Agro Processing Cluster (APC)

The next phase is to create agro-processing clusters after placing sufficient primary processing facilities in each block to support the growth of the food processing sector. The goal of the agro-processing cluster is to build cutting-edge food processing facilities close to agricultural areas. The goal is to provide integrated and comprehensive infrastructure facilities for food preservation from the farm to the consumer as well as to create effective supply chains that link cooperatives of farmers and producers with processors and markets, forming backward and forward connections.

The two fundamental parts of an agro processing cluster are the basic enabling infrastructure and the core infrastructure. A basic enabling infrastructure consists of site development, the construction of industrial plots, boundary walls, roads, drainage, water supply, electricity supply (including power backup), effluent treatment facilities, parking spaces, weighbridges, shared office space, etc. A food testing laboratory, cleaning, grading, sorting, and packing equipment, steam-generating boilers, a dry warehouse, cold storage, pre-cooling chambers, ripening chambers, an IQF (Individual Quick Freezing), specialised packaging, and other typical processing facilities are all part of the core infrastructure. The aforementioned facilities may differ from project to project based on the requirements of the units in the cluster and the availability of agricultural and horticultural products in the project's catchment region.

At least five food processing facilities with a combined investment of at least Rs. 25 crore will be part of the agro-processing cluster. Additionally, food processing facilities will be built in conjunction with the establishment of the cluster's basic infrastructure. The agro-cluster's central infrastructural facilities must be able to handle the raw materials that can be handled locally or the demands of the food processing units that will be located there.

In Thrissur, eleven agro-processing clusters have been proposed. Wadakkanchery, Chavakkad, Chowannur, Pazhayannur, Thalikulam, Anthikkad, Ollukara, Mathilakam, Mala, Kodakara, and Challakudy are the blocks where the clusters would be set up. (Figure - 10.3.12)

Implementing agency: The Project Execu-

tion Agency (PEA), which is in charge of overseeing the projects' overall implementation, performs a variety of tasks, including creating the Detailed Project Report (DPR), purchasing land, obtaining financing, constructing infrastructure, ensuring the project's connectivity to external infrastructure, etc.

Land requirement: At least 10 acres of land the PEA must secure for the project, either through outright acquisition or a minimum 50-year lease.

Financial Assistance: Grants-in-aid at 35% of the eligible project cost will be provided with the help of MoFPI scheme. The grants-in-aid are credit linked but not back-ended.

Central Processing Centre (CPC)

Building Central Processing Centres (CPC) is an essential step towards connecting agricultural production to the market. CPCs bring together producers, processors, and retailers, maximising value addition, minimising wastage, and enhancing farmers' incomes, especially in rural areas. The establishment of cutting-edge food processing facilities with well-established supply chains and support infrastructure will create jobs in a clearly defined agri/horticultural zone. Standard storage facilities and equipment such as controlled environment chambers, pre-cooling chambers, and ripening chambers, cleaning, grading, sorting, and packing facilities, reefer vans, packing facilities, and irradiation units, are all available at the CPC.

The CPC in Thrissur's Kodakara Block will benefit about 25,000 farmers and generate employment for approximately 5000 people. The central government provides financial assistance of up to Rs. 50 crore under the MoFPI Scheme to build a CPC, requiring a minimum of 50 acres of land.

10.4 Social and Physical Infrastructure

10.4.1 Socio-economic Infrastruture

- **Housing**

Deriving from the data as well as on ground condition of housing in the district, most of the houses are in good condition (as per Census 2011). While the condition of the houses are good currently, the projected surge in population would be needed to be catered with houses, and in turn the housing stock needs to be increased. The projected population of 46.32 lakh for the year 2047, will be accommodating in a total of 10.29 lakh households with an average household size of 4.5. As housing serves the basic need for the population, it needs to be incentivesed and in needs to be provided to all the sections of the population. Currently in Kerala, LIFE Mission identifies the beneficiaries as discussed before and gives the houses as per the priorities of different socio-economic groups and other factors. But, in this, currently, there is no identification of migrant workers who work in industries and other sectors. There should be a different section under which migrant workers and their families get incentivsed and get identified as beneficiaries.

The projected population will be mainly located in the projected growth centres as well as growing urban areas. The main targets which are needed to be addressed is to create a thorough and robust database at the LSGD level that contains information on the recipients as well as the houses. There should be interventions to verify the land's viability for housing after considering factors like location, accessibility, topography, and closeness to unfavourable natural and man-made characteristics like landfills and flood plains, among others, and thus disaster resilient housing should be provided in these areas by identifying the blocks and beneficiaries.

A need of promoting economical and environmentally friendly methods by utilising local building supplies and suitable alternative technology. Improving the governance, management, and oversight of housing programmes for the most vulnerable groups by utilising the IT tools and services provided by banking institutions. Improvement and allocating money for building facilities for research and development is also the needed intervention which should be made at the LSGD level.

As the number of workers and specifically migrant workers will increase, there will be a specific need of affordable housing segment in several blocks where major industrial areas will be setup. Certain mechanisms to improve the provision of housing to them should be initiated. At each LSG level, establish a housing fund in order to encourage and support people-centered NGO organisations operating in the housing sector to act as a conduit between final recipients and the government. Along with it, the beneficiaries which are being identified by LIFE mission, should also consider the migrant worker population and their households with a better identification process and with increased

financial and technological support so they can build inexpensive homes. Also, the basic housing with room for expansion to the most vulnerable groups, including the poor, the disabled, the elderly, the chronically ill, households headed by women, etc.

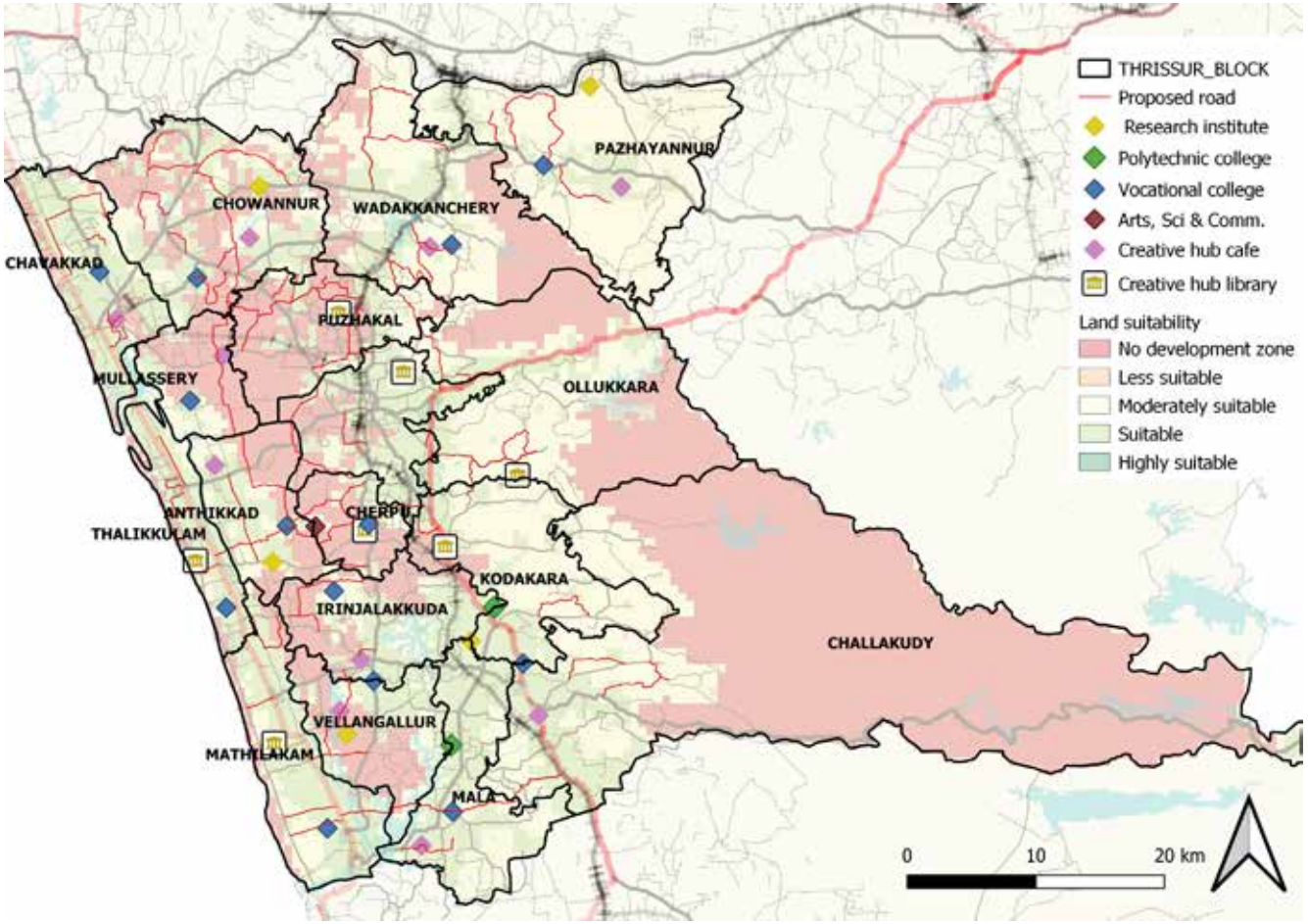
The said targets which are set and issues which are addressed in the housing sector can be also achieved by adopting models for development in the sector. Provision and interventions using Public Private Partnership approach for the sector of housing and its policies and schemes, which can actually help to provide adequate development are:

Model – 1 : Mixed housing with inclusive community housing and infrastructure

According to this approach, the public authority will be providing land to the chosen private developer.

This would essentially be the project receiving state funding. The private developer will be held accountable for planning, constructing, and financing a supply of affordable housing that meets set requirements, is priced appropriately, and is delivered on schedule. When the housing stock is satisfactorily finished and turned over, in accordance with the required standards, costs, and timelines, the public body agrees to reimburse the private developer. The payment to the private developer must be dependent on the achievement of project milestones. The trunk infrastructure will be provided by the local authorities while the other aspects will be delivered by the developer itself. Integration of services and housing will be beneficial for the developer too.

Figure 10.4.1 Locations of proposed institutes and hubs in Thrissur district, based on the identified growth centers.



Model – 2 : Direct developer – worker rental housing

Though this is one of the models in which the developer bears a high amount of risk, the developers would continue to own the dwelling units, but the allottees would be forced to pay the developers a rental fee for their use. Only EWS and LIG units would be permitted under this concept for unit types. As a result, the private developer will promise to seek direct reimbursement from the allottee for the cost of affordable housing. For a specific amount of time, the developer will also be in charge of keeping the housing units in good condition. The developers and the LSGDs can work in close contact to ensure the identification of beneficiaries is done and they get the allotment of the rental housing schemes.

Model – 3 : Incentivising renting of vacant houses

There can be an implementation of introducing taxes on vacant houses and can be added in the local level. It may act as a source of revenue and also will help to increase the rental mechanism in the district. In turn, on renting out homes, the real owners of houses can be incentivized on basis of property taxes. This may help in improving the stock of rental housing too without investing into construction of new properties for the same purpose.

- **Education Infrastructure: Enhancing Human resource through optimization of infrastructure**

Thrissur has a good potential in education sector, which can be used judiciously in making it a competitive district. It gets enormous exposure during the Pooram festival, using which certain events can be scheduled like exhibitions in the cultural institute of Kerala Lalithakala Akademi, live performances in Kerala Kalamandalam, etc. Apart from this, events like annual fests, having inter college competition at a national level, in collaboration with other colleges of the district, can be initiated for scaling the cultural identity as well as opening up opportunities of entrepreneurship, skill development etc.

Thrissur has been tagged as a UNESCO Learning city, generating scope for global intervention, which can be envisioned as a tool for holistic development like promoting intergenerational learning initiatives (encouraging children and their caregivers to learn together), initiating diverse entrepreneurial training opportunities for all groups of society etc. All the activities taking place through UNESCO can be carried out in two ways. Some of the hubs are proposed in the existing public libraries, wherein certain social activities usually take place. Whereas for the blocks without public library, the other hubs shall be created from scratch with private sector intervention, by providing them a specific area for monetizing the land through setting up a cafeteria, and creating the hub within the same infrastructure, through which a larger group of people can be targeted as well.

Optimum school infrastructure is present in the district, which can be utilized for incorporating new complexes. The addition of Vocational training institutes shall be done in the existing campus, which will raise awareness for skill development, leading to individual growth and productivity. Similarly, there is a potential for incorporating Research institutes in existing college infrastructure, mitigating the need for land requirements. As per the need of the hour, keeping in mind the current issues faced by Thrissur, there are five categories of research institutes proposed- Waste to wealth, Bio science for human health, Climate research ecology and environmental science, Monitoring smart mobility and transportation using artificial intelligence and Smart manufacturing technologies- to remain aligned with the ongoing industrial revolution 4.0. These will further exhibit employment opportunities for high technical graduates, creating innovation as well as reducing migration.

Taking a bottom-up approach, the

Table 10.4.1 Proposed locations blockwise

Type of Institute/ hub proposed	Total number	Taluk	Block
Research Institute	1	Vellarakkad	Chowannur
	1	Thanniyam	Anthikkad
	1	Poomangalam	Vellangallur
	1	Kallettumkara	Mala
	1	Mayannur	Pazhayannur
Polytechnic	1	Puthenchira	Vellangallur
	1	Kodakara	Kodakara
Vocational institute	1	Alappad	Anthikkad
	1	Vellookkara	Vellangallur
	1	Kodakara	Kodakara
	1	Lokamaleswaham	Mathilakam
	1	Valappad	Thallikulum
	1	Perakam (CT)	Chavakkad
	1	Alur	Chowannur
	1	Thekkumkara	Wadakkanchery
	1	Chelakkara	Pazhayannur
	1	Kuruvillasery	Mala
	1	Chevvoor (CT)	Cherpu
	1	Chembukavu	Thrissur (Municipal)
	1	Peechi	Ollukara
	1	Peramangalam	Puzhakal
	1	Kuttichira	Challakudy
	1	Karalam	Irinjalakkuda
	1	Mullassery	Mullassery
Arts, Science & Commerce	1	Cherpu	Cherpu
Creative hub			
Library	1	Koolimuttam	Mathilakam
	1	Nattika	Thalikulum
	1	Toravu	Kodakara
	1	Cherpu	Cherpu
	1	Puthur	Ollukara
	1	Choolissery	Puzhakal
	1	Vilvattam	Thrissur (Municipal)
Café	1	Pulakode	Pazhayannur
	1	Thekkumkara	Wadakkanchery
	1	Chiranellur	Chowannur
	1	Guruvayoor (M)	Chavakkad
	1	Karamuck	Anthikkad
	1	Irinjalakkuda (M)	Irinjalakkuda
	1	Poyya	Mala
	1	Kizhake Chalakudi	Challakudy
	1	Annakara	Mullassery
	1	Poomangalam	Vellangallur
Existing structure		New structure	
Phase 1		Phase 2	Growth center

educational infrastructure is being classified broadly into two categories of lower-level education i.e., Schools, and higher education i.e., colleges and universities. Both categories have been worked upon according to their authority of functioning.

For Gram panchayat level, schools shall be mandatorily included with English subject in the syllabus, to overcome language barrier and attract investment from private sector, in setting up different companies. Inclusion of courses supporting the current requirement of the job market like Climate Change Education (CCE), technical courses like Coding, ICT etc. and development of soft skills. For regular degree (B.Sc, Management etc) colleges, a single college can be used for targeting larger group by introducing dual batches for morning and evening time simultaneously. Distance education should be included for major number of courses to target national and global level students, eliminating the need for infrastructure.

For Block panchayat level, Vocational training institutes can be incorporated into existing school infrastructure, having at least one vocational institute per block, to instill skill development for every child. Also, entrepreneurship education should be included in the curriculum that shall be monitored by University programmes, to encourage self-entrepreneurship. Research institutes shall be incorporated into existing college infrastructure, categorized into five different categories as discussed above. Blocks like Cherpu, which doesn't have a single college yet, is proposed with a regular degree college, requiring upto 10 acres of land, which can be given by the government to private body for building the college infrastructure, where private party can monetise the land by including cafe's and tuck shops at the college. Technical colleges, which are low in number and as per future demands like Polytechnic colleges are being proposed in blocks like Anthikkad and Vellangallur, where the number of institutions are quite low. These technical institutes shall be constructed in phase two of development.

For Municipal corporation, which has the most number of cultural institutes, they can get a good exposure through annual fests, exhibitions etc. which can attract tourists as well. Colleges should include entrepreneurship cell, in collaboration with private sector, to encourage self-entrepreneurship and monitor the schools under it including entrepreneurship as a course in the curriculum.

Governing bodies for the institutes shall be monitored at the district level, wherein yearly revaluation of teachers shall be done to ensure optimum teaching quality and raising the standard of regular education.

The agencies involved with these projects are private, government and collaborations with similar organizations. KITE is one of the Edtech arm of the state government of Kerala, which can invest in technical aspects of the projects dealing with Vocational training institutes and Polytechnic colleges. Collaborations with IIM Kozhikode, which holds Ragam fest every year, attract a huge amount of crowd, can be done for exposure of the cultural institutes as well as entrepreneurship cells in the colleges can have state and national level exposure. Art festivals like Kochi- muziris biennale can be collaborated with for global exposure of Kerala Lalithakala Akademi. New phases of Kudumbashree organization can be worked upon that aims on holistic development of the overall youth, with focus on overall technical skill development, linked directly to placement industries. UNESCO identifying Thrissur as a learning city can bring global exposure to the district if envisioned in a planned manner. Government schemes like Start-up India Seed fund, Scheme for Higher Education Youth in Apprenticeship and Skills (SHREYAS) etc can be utilized for skill development purposes of the children and linking them with current employment scenario.

Some of the sustainable goals attained through this project are- SDG 4, 5, 8, 9, 11, 13, 16 and 17, which are important players in the scenario of education.

- **Sport Infrastructure: District Sports Grid**

According to the analysis, Thrissur district has a commendable healthcare system with accessible, equitable, affordable, and quality healthcare services for all. However, there are new threats to the health scenario, such as mental health problems, suicide, substance abuse and alcoholism, adolescent health issues and rising number of diabetes, hypertension, cardio vascular diseases, obesity and lung diseases patients, which have emerged as major issue throughout the nation. Unless immediate interventions are made to control these lifestyle diseases, their burden is likely to increase immensely in future because of ageing population and changes in life style.

This can constitute a greater financial burden for low-income groups due to the high cost of treatment. Rapid urbanisation, drastic lifestyle changes, heavy alcohol and tobacco use, affinity for corporate jobs, unhealthy eating patterns, low priority for exercise, high levels of stress in all strata of population are some of the reasons contributing to the prevalence of these diseases. Hence, sports sector deserves due importance, to ensure healthy, active and productive life to the people of Thrissur and in the coming years special emphasis should be on strengthening, maintaining and optimally utilising high-quality sports infrastructure.

The goal should be to use sports as a vehicle to promote healthy living among all segments of society, in line with the Kerala Sports Act 2000's guiding philosophy of "Sports for All" and "Health for All". Also, according to Kerala sports policy 2012 sports are a way of life for the people of Kerala and there is an urgent need to promote it in a systematic manner to achieve optimum results. In order to achieve excellence in sports, both at the National and International level, there is also the need to streamline the functioning of sports not only as a vehicle to help the people to achieve at least a minimum level of physical fitness but also create a culture of sports and explore the opportunities for sports as a career opportunity and adopt a uniform structure of amenities in consultation with the Departments of Education, Health and Local Self Government so that activities of sports and games are broad based across the district.

In order to built the necessary infrastructure for development of sports there is a need to work in phased manner over a period of time. There is an immediate need to create a network of basic sports infrastructure throughout the district to enable more people to participate in sports thereby broadening the base for scouting of talent. Therefore, to develop sports infrastructure uniformly throughout the district, a 'District sports grid' is proposed to maximise accessibility and mass participation. This grid will ensure availability of various sporting facilities (including fitness training, learning and competitions) in different level of hierarchy i.e., village Panchayat, block panchayat, municipality or municipal corporation and district level. Figure 10.4.2 and Table 10.4.2 clearly demonstrate how this grid will be developed in a phased manner in

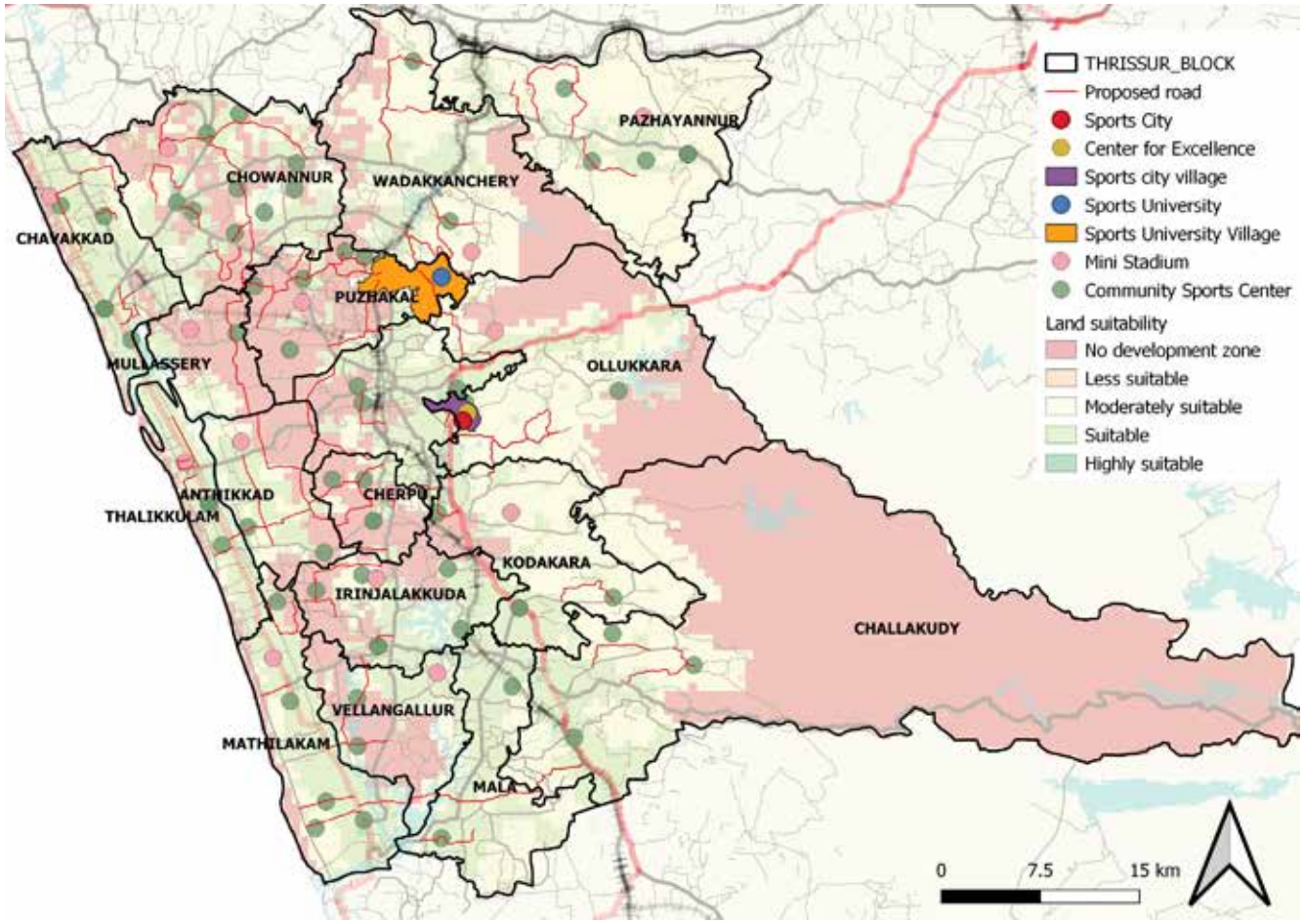
Table 10.4.2 District Sports Grid

		Village Panchayat	Block Panchayat	Municipality	District (Sports council)
Fitness/ Competition	Proposal	**Dedicated sports Ground*** **	**Community sports center (each Central Village)*** Mini Stadium (each Block)*** **	**Multipurpose Sports complex**	**Sports City**
	Description	Natural turf ground with facilities including 400m athletics track and Yoga center 3 11 16	Multisport facility equipped with short course swimming pools & Sports equipment Mini Stadium (5000 capacity) 3 9 11 16	10000 capacity stadium (**High Performance Sports**) and sports academy (shared infrastructure) 9	Outdoor stadium (40000); Indoor stadium (10000); Aquatics complex; convention center; other retail and recreational facilities 9
	Land	3 Acre*	10 Acre**	20 Acre	100 Acre
Training	**Proposal**	**Local coaching support**	**Elite Talent Sourcing & Training Programs for**	**For-profit sports academy**	**Center for excellence**
	Description	3 Olympic sports and 2 Indigenous sports identified by LSGD (consultation with local sports club)	Mandatory Sports: Football, Basket ball, Aquatics, parasports 4 Sports to be identified by Block panchayat (different in all CV)	Sports academies for elite sports training of state level athletes Reservation for women, Under-privileged and para-sports athletes 5 16	Advanced training facility and specialized coaching support for National level athletes
	Land	-	--	-	40 Acre
Learning	**Proposal**	**Physical education**	**Sports University**		
	Description	As compulsory subject in High schools and colleges (emphasis on girls participation) 3 4 5	THEORY 4: Physical Edu. Sports Education	MEDICINE 3 4: Sports Medicine, Sports Physiology, Sports Psychology, Sports Physiotherapy	ALLIED FIELDS 4 16: Sports Management, Sports Journalism, Sports Administration SCIENCE 4 9: Sports Science, Sports Nutrition, Sports Biomechanics
	Land	-	50 Acre		

*School property (subject to the availability of requisite quantum of land)
**School and college property (includes commercial area allotted to private party to incentivize development)
***Upgradation of an existing facilities should be prioritized

Project Phasing | 2027 2037 2047
Sustainable Development Goals | 3 4 5 9 11 16 17

Figure 10.4.2 Location of infrastructure proposal under 'District Sports Grid' project



various locations throw-out the district

At the village panchayat level, it is intended that a dedicated sports facility shall be created in each panchayat which shall include a natural turf ground along with a 400m athletic track and a yoga centre in an integrated approach to provide training in at least five outdoor sports (3 Olympic sports and 2 indigenous sports) identified by the Local Self Government after consultation with local sports clubs. For such a facility 3 acre of land shall be provided, in which schools may be given first priority for development of playfields subject to the availability of requisite quantum of land with them. Panchayats that already have basic sports infrastructure, including school playgrounds which can also be used for community sports beyond school hours and during holidays, shall ensure that such infrastructure already created is upgraded and made available for community use.

All central villages identified in the district shall have a community sports complex, be developed in each block of the districts over a period of next 5 years. In these, sports facilities and training for about three sports disciplines: football, basketball and aquatics, shall be provided along with sports equipment of requisite quality would be created by convergence of resources under different schemes. Apart from these four other sports facilities should be identified by the block panchayat ensuring that different sports facilities are available in different central village in a block ensuring variety of sports disciplines. For such a facility 10 acre of land shall be provided, in which schools and higher education institutes may be given first priority for development of playfields subject to the availability of requisite quantum of land with them. Along with this, at least one block level community sports complex shall have a mini stadium with both indoor and outdoor facilities, having a 5000-seating capacity.

In a municipal town it is intended that one Multipurpose Sports complex shall be created which shall include a stadium for high performance sports with 10,000 seating capacity and a for-profit sports academy to train athletes of state level sporting competitions and talent scouting for national level competitions. Conscious efforts shall be taken by the authorities to reduce disparities in access to sports education for different segments of society, the economically weaker sections being the most disadvantaged, along with girls and the physically challenged by providing reservations in these academies and scholarship support from various national and state level schemes. To develop these facilities, 20 Acres of land shall be reserved in the urban areas within municipal jurisdiction, details of which shall be incorporated in the respective

development plans and requisite sports facilities shall be created in a time bound manner in consultation with sports department.

To make the district future ready and to churn out benefits of the National vision of making India 'the destination' for hosting international events in the next few decades, it is envisaged that the district shall have an international level 'Sports City' by the end of 2047, to provide a conducive environment for athletes to excel. Its development shall provide a pathway to the athletes for competing in international events and allow for proliferation of elite sports in Kerala. It shall also be utilized for developing league culture in India. This city shall at least have an outdoor multipurpose stadium with 40000 capacity and an indoor stadium with 1000 capacity and aquatics complex along with convention centre, retail centres and amenities for other recreational activities. For promoting excellence in the sports and enhancing states representation in Indian contingent for international competitions a 'Sports Centre of Excellence' would be set up for selected games as a part of an overall Sports city project. This shall provide advanced training facility and specialized coaching support for National level athletes along with accommodation facilities for National level sports persons. This facility shall be developed using PPP model under the authority of Sports Department, the Kerala State Sports Council and the Directorate of Sports & Youth Affairs and 140 Acres of land shall be provided by the district including 40 acres for developing the center of excellence.

Promotion of sports across all facets of society not only encourages inclusion but also provides job opportunities for its citizens.. In order to explore the opportunities for sports as a career, not only core sports training is required but emphasis should also be given on developing manpower in allied sectors of sports. As more focus is given on sports as a career, scope of these allied sectors shall also increase steeply. Due to the increasing and evolving role of eentertainment and corporates, business of sports has changed faces very rapidly in the recent past. Therefore, to develop a sports ecosystem in the district, 'Sports University' shall be developed in the district, which will play a pivotal role in providing sports education, research opportunities and sports science support. It shall offer courses in theory and academics, medicine, physiology, psychology, physiotherapy, nutrition, science, biomechanics, management, journalism and administration. This university shall be created under combined efforts of Sports Department, the Kerala State Sports Council and the Directorate of Sports & Youth Affairs, Departments of Education, Directorate of Health Sciences, KUHS, Thrissur Government Medical College and private investors for which 50 acres of land shall be provided.

Although the government has implemented several schemes to provide sports infrastructure, their reach and range has been limited owing to the constraint of resources. The promotion of sports shall be the collaborative effort of all stakeholders especially the various Departments and organisations of the State Government, educational institutions, sports bodies, sportspersons and other persons actively involved in sports. To ensure sustainable financial support to maximise regular activity in the field of sports, involvement of Private and Corporate entities in the development of sports infrastructure, training and conduct of sports competition shall be encouraged. All the aforementioned infrastructure facilities shall be created under Public- Private partnership model to mobilize additional resources for development and maintenance of sporting infrastructure. This shall include for profit organisations and non-profit organisations. Also, financial institutions shall be involved for providing funding for development of sports infrastructure in the district.

This proposal shall work in tune with the National and state vision to promote sports in both grassroot and elite level along incorporating values of the Sustainable Development Goals in provideing good health, quality eductation, inclusive development, strong communities and institutions and exploring role of private organizations in sustainable development.

- **Infrastructure for elderly and Disabled**

Thrissur, a city nestled in the picturesque state of Kerala, has a growing elderly population that deserves the highest standard of care and support. As individuals age, they often face unique challenges that require specialized infrastructure to ensure their well-being and quality of life. In light of this, we propose enhancing the elderly infrastructure in Thrissur to create age-friendly environments that are conducive to palliative care, providing compassionate and dignified care for older adults facing serious illness or end-of-life care.

Elderly may experience physical, emotional, and cognitive changes as they age, necessitating specific medical approaches. Palliative care, which focuses on relieving suffering, managing symptoms, and improving overall quality of life for people facing serious illness or end-of-life care, necessitates specialised infrastructure that meets the specific needs of older adults. This proposal emphasises the importance of investing in elderly infrastructure in Thrissur, such as facilities, equipment, and amenities designed to create a safe, comfortable, and accommodating environment for older adults receiving palliative care.

Proposal of palliative care infrastructure

Palliative care is a specialized medical approach that focuses on improving the quality of life for individuals with serious illnesses. It addresses their physical, emotional, social, and spiritual needs, aiming to provide comprehensive support and comfort throughout the course of their illness. Palliative care is provided by a team of healthcare professionals and can be given alongside curative treatments. It is patient-centered, considers the patient's values and goals, and is appropriate at any stage of illness. Palliative care is not limited to any specific condition and can be provided in various healthcare settings. Its primary goal is to enhance patients' comfort and quality of life while supporting their families.

Palliative care services are three different levels

1. Palliative home care: Palliative care can also be provided at the patient's home, where a palliative care team visits the patient to provide care and support. Patients who want to receive care in the comfort of their own home and be surrounded by their loved ones may prefer this option.

2. Hospices provision of day care programs where patients can receive palliative care during the day and return home at night. This can be advantageous for patients who prefer to receive care during the day and return home in the evenings.

For this at every 30 min distance palliative care units are proposed from which 32 were existing and 9 are proposed by analysing the study area Thrissur

3. Palliative care can be provided in hospitals, where a specialized palliative care team collaborates with the primary medical team to manage pain and symptoms, provide emotional support, and improve the quality of life for patients with serious illnesses.

For palliative care at home time bank concept in proposed. Time banking is a community-based system in which people exchange services using time as the currency. Participants volunteer their time, talents, and expertise to others in their community in exchange for time credits that can be used to receive services from other members. This idea is based on the belief that everyone has something valuable to offer and that members of the community can help each other by leveraging their skills and time. Time banking fosters reciprocity, trust, and social cohesion by encouraging members of the community to collaborate and support one another in a mutually beneficial manner, resulting in a vibrant and interconnected network of exchange and goodwill.

The concept of time banking can be a valuable tool in connection with palliative care to improve the support and care provided to patients facing serious illness or end-of-life care. Time banking allows community members to donate their time and skills to help patients and their families with things like companionship, emotional support, respite care, meal preparation, transportation, and household chores. Carers and patients can earn time credits in exchange for receiving services from other members of the community when needed. By developing a supportive network of individuals willing to share their time and skills with those in need, this approach can foster a sense of community engagement, promote social connections, and alleviate the burden of caregiving. Time banking in the bigger picture of palliative care can improve patients' and families' overall well-being and quality of life while promoting a collaborative and compassionate approach to care.

Implementation of this project is at 3 level at the panchayat (village level), block (cluster of villages) or district (administrative unit) level:

Panchayat Level:

– Community Engagement: Holding community meetings, awareness campaigns, and outreach activities to promote the concept of time banking among the village's residents.

– Member Registration: Creating a system for member registration that includes gathering basic information, verifying identities, and providing orientation about the time bank and

its community benefits.

– Coordination: Appointing a local coordinator or a small team to manage the time bank's day-to-day operations, such as member registration and service coordination.

– Communication: Creating channels of communication, such as a helpline, email, or social media, to facilitate member communication and address inquiries or issues.

Table. 10.4.3 Project phasing for Infrastructure for elderly and disabled

	Present	2047
Estimated Employment	4967 Female & 2936 Male	9684 Female & 5739 Male
Identification	For once free hours to 80+ age group + disabled elderly = 79040 to start the chain of hour exchange.	Open for all age groups and all type of needy in exchange of hours.

Block Level:

– Networking and Partnerships: Building partnerships with local community organizations, non-profits, government agencies, and businesses to support the time bank, provide resources, and expand service offerings across multiple villages or panchayats within the block.

– Capacity Building: Providing training and support to members and coordinators to ensure smooth operation of the time bank, including training on service logging, time credit management, and conflict resolution.

– Promotion and Outreach: Conducting promotional activities, such as community events, workshops, or campaigns, to raise awareness about the time bank, recruit new members, and encourage participation at the block level.

District Level:

– Governance and Policy: Developing governance mechanisms, policies, and guidelines for managing time banks across multiple panchayats or blocks within a district, including membership, service standards, dispute resolution, and data management issues.

– Coordination and Oversight: Establishing a district-level coordination and oversight mechanism to monitor time bank performance, provide support, and facilitate inter-panchayat or inter-block collaborations.

– Exploring funding opportunities, partnerships with local businesses, or grants to ensure the financial sustainability of the district-level time bank initiative.

– Establishing a system for assessing the impact and effectiveness of the time bank initiative, as well as producing regular reports to assess progress, address challenges, and make informed decisions.

This project is divides into two phases in the form of presently needy and needy will be in 2047

10.5 Economic Infrastructure: Banking and Finance

The banking opportunities in the district are examined in this report, along with the potential for intensive lending, expansion in the manufacturing and service sectors, start-up funding, and sector-specific investment initiatives. Here also highlights the strengths and opportunities in each block of the district, which can aid in the development of policies to promote economic growth.

The analysis shows that the current CD ratio of 61% suggests that there is plenty of room for intensive lending, which can stimulate economic activity and growth. The manufacturing and service sectors are expanding, and there is optimism for future growth in areas such as the environment, social, and financial sectors. This implies that businesses in these areas may benefit from increased investment and support to help them grow and develop further. The identification of start-up funding as a key segment for accelerated growth creates an additional opportunity. Finally, sector-specific investment programs can aid in the development of policies to promote economic growth in the district.

The analysis of the contribution of various sectors to the district's deposits suggests that there are strengths and opportunities in each block. For example, Chalakkudy, Pazhayannur and Kodakara Blocks are primarily agricultural, whereas Cherpu and Puzhakkal Blocks have the potential for industrial growth. The district's remaining blocks have a mixed economy. Wadakkanchery Block has the potential to grow in the service sector. Furthermore, the Chavakkad, Irinjalakkuda, Mathilakam, Mullassery, and Vellangallur Blocks have a high concentration of NRI deposits.

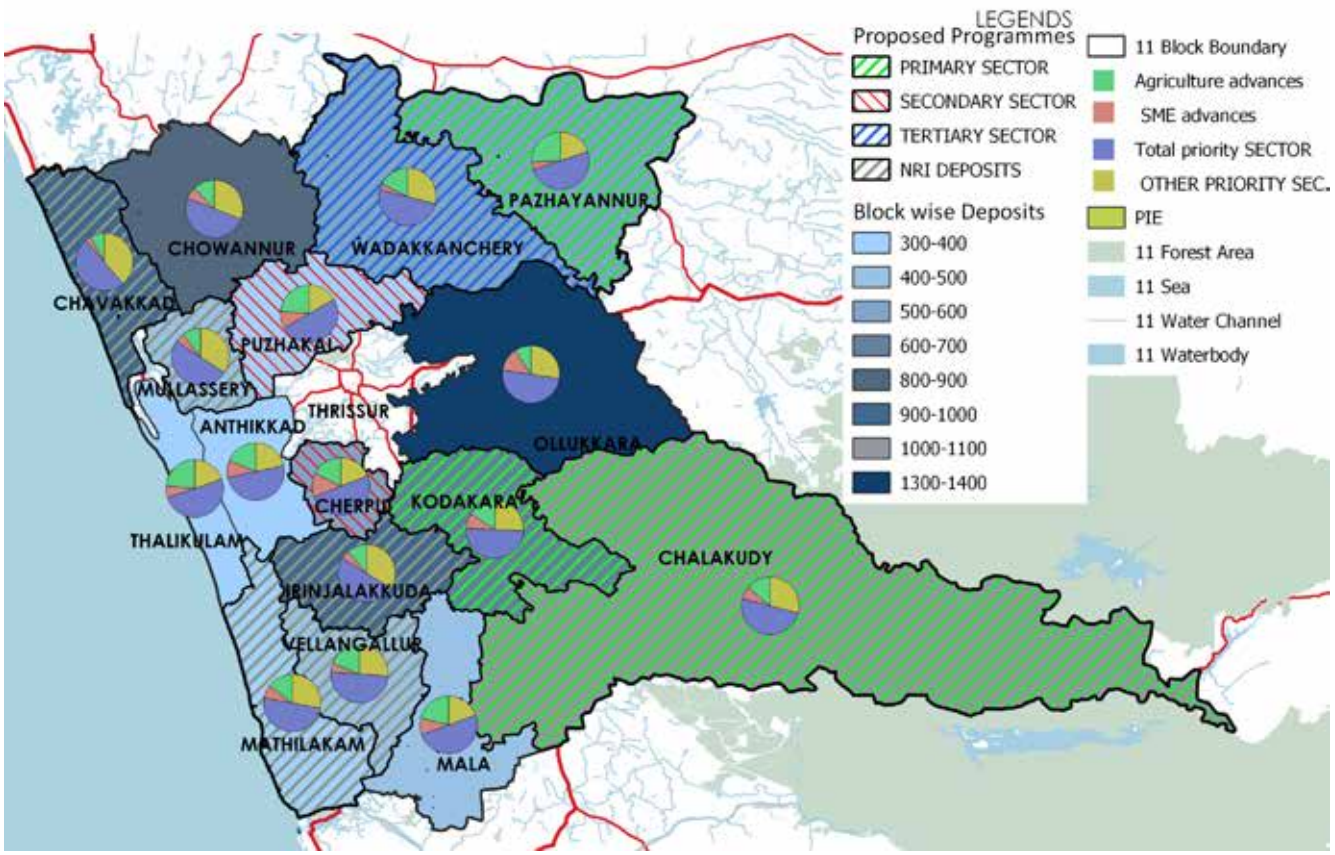
Sector-Specific Investment Proposals-

This report aims to examine the potential of the primary, secondary, and tertiary sectors and to propose schemes that are categorized based on their impact on the environment, social issues, and start-up business financing. The proposed approach is designed to provide a comprehensive analysis of the economic and social development potential of these sectors. It also highlights areas where interventions can be made to ensure that the schemes implemented are sustainable and socially responsible, aligning with the United Nations' Sustainable Development Goals.

The research analysis conducted into the specific potential and challenges of each sector enables a more informed approach to be taken, which will support sustainable development goals. To operationalize the proposed schemes, allocation of funds will be required. Furthermore, identifying potential stakeholders and partners who might be interested in supporting or implementing these schemes is crucial. The stakeholders could include government agencies, non-profit organizations, and private sector companies, and their support can lead to successful implementation of the proposed schemes.

The proposal presented offers three sector-specific investment programs focused on finance, social welfare, and environmental mitigation. The aim of the proposal is to provide sector-specific investment programs for each block in order to target the social welfare needs, environmental mitigation, start-ups business financing with the greatest potential for growth, leading to a sustainable and inclusive economy. The proposed schemes are divided into three areas - Finance, Social, and Environment - and will follow the Sustainable Development Goals 1, 3, 5, 8, 10, and 12. Refer Map:00 for proposed sector-specific schemes

Figure 10.4.3 Sector-Specific Investment Proposals



Source- Lead Bank, 2021-22

Financial Level Schemes

The direct Beneficiaries are Rural Youths, women, artisans, micro enterprises & the Indirect Beneficiaries are Farmer community, small business ecosystem, Family, Rural Community; the stakeholders are Research institutions and universities, local governments, SIDBI, Participating Banks and Financial Institutions; And In financial sector there are schemes proposed:

The first scheme under the financial sector is the **'Village Level Entrepreneurship Acceleration Programme'**, which aims to support entrepreneurship in the agricultural sector by providing training, mentoring, and financial support to rural entrepreneurs in Chalakkudy, Pazhayannur, and Kodakara

Blocks. The beneficiaries of this program are entrepreneurs and startups at the village level. The Ministry of Micro, Small and Medium Enterprises (MSMEs) is the agency involved, and the stakeholders include entrepreneurs, MSMEs, and the government.

The second scheme is the **'Innovation Incubation Center funding scheme'**, which is aimed at supporting the development of the industrial sector in Cherpu and Puzhakkal Blocks. The incubators will provide access to specialized training, mentoring, and funding for startups and SMEs, as well as connect businesses with potential investors and partners to facilitate growth and expansion. The beneficiaries are entrepreneurs, startups, and innovative projects, and the Atal Innovation Mission (AIM) is the agency involved. The stakeholders include entrepreneurs, startups, government, and industry.

The third scheme is the **'Credit Guarantee Fund for Micro and Small Enterprises'**, which aims to provide financial support to micro and small enterprises in all blocks by providing a credit guarantee to banks for loans provided to these businesses. This will help reduce the risk for banks and encourage them to provide financing to SMEs, supporting their growth and development. The beneficiaries are micro and small enterprises, and the agency involved is the Ministry of Micro, Small and Medium Enterprises (MSMEs). The stakeholders include micro and small enterprises, banks, and the government. The funding amount is up to 85% of the loan amount.

Table 10.4.4 Sector-Specific Investment Proposals

Sustainable Development Goals | 1 3 5 8 10 12

	Sectors	Schemes	Beneficiaries	Stakeholders	Funds
FINANCIAL LEVEL		Village Level Entrepreneurship Acceleration Programme (1 3 5 8)	Direct: **Rural Youths, women, artisans, micro enterprises** Indirect: **Farmer community, small business ecosystem, Family, Rural Community**	Research institutions and universities, local governments, SIDBI, Participating Banks and Financial Institutions	42,00,000
		Innovation Incubators (1 8 12)			50,00,000
		Credit Guarantee Fund for Micro and Small Enterprises:			25,00,000
		Capacity Building and Market Linkages for Entrepreneurship Collectives (1 8 12)			50,00,000
SOCIAL		Emergency Relief & Community Intervention (3 10)	Direct: **Farmers, Farmer Collectives, FPOs and farmer institutions,women** Indirect: **Rural Agricultural**	NGOs, local governments, community-based organizations, healthcare providers,	60,00,000
		Mahila Udyam Nidhi Scheme:			10,00,000
ENVIRONMENT		Clean Energy Scheme:	Direct: **Frontline workers, Migrant Labourers, Tribals, Geriatric population, specially abled persons, other marginalized communities.** Indirect: **Family, Health**	PPP,Energy Service Companies (ESCOs),Wetland conservation authorities,Local govt. (KILA) members,New and Renewable Energy.	20,00,000
		Wetlands Conservation Scheme:			70,00,000

Primary Sector | Secondary Sector | Tertiary Sector

The fourth and final scheme is **'the Capacity Building and Market Linkages for Entrepreneurship Collectives'**, which aims to support the development of entrepreneurship collectives in all blocks by providing training, mentoring, and market linkages to these groups. This program can help these groups access new markets and develop their capacity to compete in the global marketplace. The beneficiaries are entrepreneurship collectives, and the agency involved is the Ministry of Micro, Small and Medium Enterprises (MSMEs). The stakeholders include entrepreneurship collectives, government, and industry.

Social Level Schemes

The direct Beneficiaries are Farmers, Farmer Collectives, FPOs and farmer institutions,women & the Indirect Beneficiaries are Farmer community, small business ecosystem,

Family, Rural Community; the stakeholders are NGOs, local governments, community-based organizations, healthcare providers; And there are schemes proposed:

The **'Emergency Relief & Community Intervention scheme'** is designed to provide support to communities in the district during times of crisis, such as natural disasters or pandemics. The National Disaster Management Authority (NDMA) is responsible for implementing this program, which can provide emergency relief funding and other forms of support to affected communities. The beneficiaries of this program are communities affected by disasters or emergencies, while the key stakeholders are NGOs.

The **'Mahila Udyam Nidhi'** is a program aimed at supporting women entrepreneurs in all blocks of the district. The Ministry of Micro, Small and Medium Enterprises (MSMEs) is responsible for implementing this scheme, which can provide financial support, training, and mentoring to women-owned businesses. This program can help empower women and support their economic independence, contributing to overall economic growth and development in the district. The beneficiaries of this scheme are women entrepreneurs, and the funding amount can be up to Rs. 10 lakhs.

Environmental Level Schemes

The direct Beneficiaries are frontline workers, migrant labours, tribals, geriatric population, specially abled persons, other marginalized communities, small business ecosystem, family, rural community and Iidirect beneficiaries are family, health of society and future generations; the stakeholders are NGOs, PPP, Energy Service Companies (ESCOs),Wetland conservation authorities, Local govt. (KILA),New and Renewable Energy resources. And Environmental Level schemes are proposed:

The **'Clean Energy Scheme'** is designed to support the development of the Blocks at Coastal area, Environent sensitive zone and environment related service sector in Wadakkanchery Block by providing funding and support for clean energy businesses. The program specifically targets renewable energy startups and green technology companies, which are expected to contribute to sustainable economic growth and development. By providing funding and support to these businesses, the program hopes to encourage innovation and entrepreneurship in the clean energy sector, which could have positive spill over effects on the local economy. The Ministry of New and Renewable Energy (MNRE) is the agency responsible for implementing this scheme, and clean energy projects and entrepreneurs are the direct beneficiaries. Clean Energy Projects are the stakeholders involved in this scheme.

The **'Wetlands Conservation Scheme'** is designed to support the conservation of wetlands in the district, with a particular focus on promoting sustainable agriculture and environmental conservation. The program identifies and supports projects that promote wetlands conservation, such as eco-tourism ventures, which create new economic opportunities while preserving the environment. Wetlands conservation-related projects and eco-tourism ventures are the direct beneficiaries of this scheme. The Ministry of Environment, Forests and Climate Change (MoEFCC) is the agency involved in implementing this scheme. Environmental organizations, local communities, and the government are the stakeholders involved in this scheme.

This proposal presents a comprehensive approach to sustainable and inclusive economic development through sector-specific investment programs. By targeting the primary, secondary, and tertiary sectors, this proposal seeks to address the social welfare needs, environmental mitigation, and start-up business financing in each block. The proposed schemes are designed to align with the United Nations' Sustainable Development Goals, specifically goals 1, 3, 5, 8, 10, and 12. The research analysis conducted into each sector enables a more informed approach, ensuring the proposed schemes are sustainable and socially responsible. To ensure successful implementation of the proposed schemes, the allocation of funds and identification of stakeholders will be crucial. The stakeholders could include government agencies, non-profit organizations, and private sector companies. Overall, this proposal offers a viable pathway to a sustainable and inclusive economy that addresses the needs of the present without compromising the ability of future generations to meet their own needs.

10.5.1 Physical Infrastruture

- **Energy**

The Proposal for Infrastructure Proposal for "To explore and optimally develop renewable energy resources in the District to meet the future electricity demand and save electrical ener-

gy through energy efficiency measures."

Overview:The proposal aims to establish a comprehensive infrastructure plan for exploring and developing renewable energy resources in the District. The plan focuses on meeting future electricity demand while prioritizing energy efficiency measures to save electrical energy. The proposed infrastructure will include the following key components:

1.Renewable Energy Generation Facilities

2.Grid Integration and Storage Solutions

3.Energy Efficiency Measures

4.Research and Development

5.Community Engagement and Education

6.Regulatory and Policy Support

Several government and private agencies are involved in promoting and implementing renewable energy projects in Kerala, India. The Ministry of New and Renewable Energy (MNRE) formulates policies and programs for renewable energy development at the national level, while the Kerala State Electricity Board (KSEB) promotes renewable energy projects and distributes power in the state. Other agencies include the Kerala State Industrial Development Corporation (KSIDC), the Agency for Non-Conventional Energy and Rural Technology (ANERT), the Solar Energy Corporation of India (SECI), and State Nodal Agencies (SNAs). Private developers also invest in and operate renewable energy projects, contributing to the growth of the renewable energy sector in Kerala

According to the Ministry of New and Renewable Energy (MNRE) in India, a solar park typically requires a minimum area of 500 acres for a 500 MW capacity. The area required for a solar park in India can vary depending on various factors such as Solar Resources, Land Availability, Grid Connection, Environmental Factors, Local Regulations, Social Acceptance, and Security.

Overall, the selection of a site for a solar park requires careful consideration of a range of factors, including solar resource availability, land availability, environmental factors, local regulations, social acceptance, and security.

Wind energy is a promising renewable energy source that has the potential to help reduce carbon emissions and battle climate change. According to the National Institute of Wind Energy (NIWE), the average yearly wind speed in India's Thrissur district ranges from 5.5 to 6.5 meters per second (m/s). This wind speed range is appropriate for erecting wind turbines for electricity generation. The average wind speed in the region is roughly 6.5 m/s, resulting in a power output of 900W (based on the power curve). The daily energy output of such a turbine would be around 21.6 kWh (900W x 24h).

Coastal locations such as Chavakkad and Vadanappally, hilly places such as Peechi, Vazhani, Chimmini, and Puthur, and wide fields such as Mullassery and Muriyad all offer favorable wind conditions for wind energy generation. Despite being far from the shore, Guruvayur, a town in the district's east, enjoys favorable wind conditions due to its closeness to the Western Ghats.

Wind turbines with a capacity of 2 to 3 megawatts (MW) can be erected to exploit the district's wind energy potential. However, such turbines need a total land area of around 1 acre, which includes the infrastructure, access roads, and transmission lines. To optimize wind turbine installation, meticulous planning, and site allocation are required.

Ultimately, due to its favorable wind conditions, the region has a high potential for wind energy generation.According to the statistics, Kerala has a high potential for generating renewable energy from a variety of sources, which may contribute to the state's long-term growth and lessen its carbon footprint.Renewable energy and reducing carbon emissions by erecting wind turbines, for supporting a sustainable future.

Thrissur district creates a substantial quantity of biodegradable garbage, with an estimated 918.08 tonnes per day in 2021, expected to rise to 1319.97 tonnes per day by 2047. Trash-to-energy technology may be used to turn this trash into power, with the quantity of biowaste required to create 1 kWh of electricity varying between 0.5 and 1.5 kilograms per hour depending on the technology employed. The districts of Ollukara and Chowannur have been recognized as potential sites for waste-to-energy projects. A capacity of 10 MW may be placed in the region, with a daily waste need of 500 tonnes. The anticipated cost of establishing such a project is between INR 250 crore and INR 500 crore. The estimated price of establishing such a project is between INR 250 crore and INR 500 crore. The district may decrease trash disposal issues and create electricity from a green source by establishing waste-to-energy initiatives.

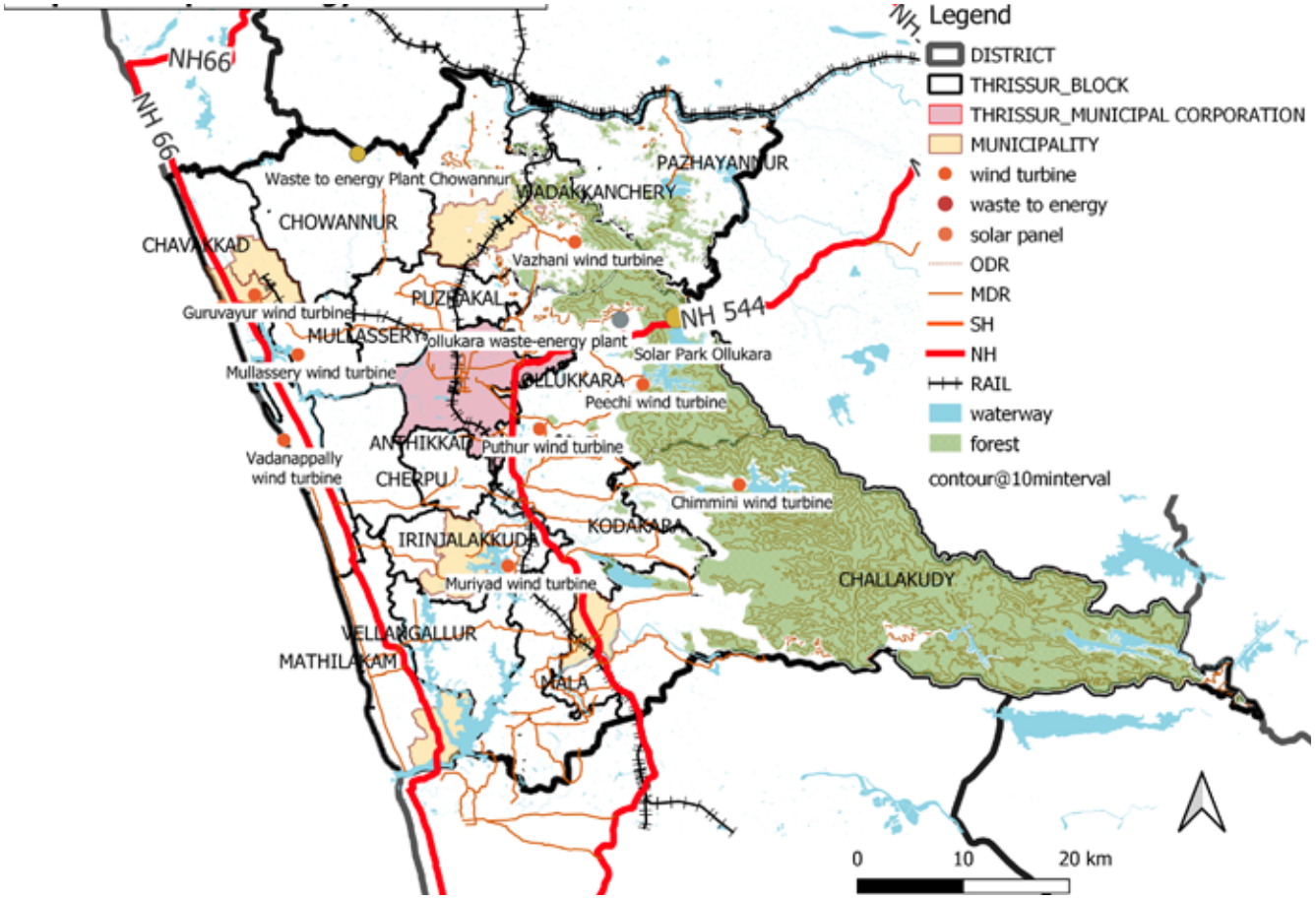
For a variety reasons, the utilization of renewable energy for power gener-

ation is becoming increasingly important: 1. Environmental Advantages: Unlike fossil fuels, which contribute significantly to global carbon emissions, renewable energy sources such as solar, wind, hydro, geothermal, and biomass create power with little or no greenhouse gas emissions. 2. Energy Security: Using renewable energy sources lessens our reliance on finite fossil fuels that are prone to price volatility and supply interruptions. Renewable energy sources, on the other hand, are numerous and widely dispersed, making them a more reliable source of power. 3. Economic Benefits: Renewable energy technologies are becoming more cost competitive with fossil fuels. Renewable energy sources are now cheaper than fossil fuels in many circumstances, and their costs continue to fall as technology progresses and economies of scale are achieved. 4. Job Creation: As the renewable energy sector expands, new jobs in manufacturing, construction, installation, and maintenance are being created. This has aided in the growth of local economies and the creation of job opportunities in both rural and urban locations. 5. Energy Access: Renewable energy sources may deliver electricity to rural places that are not linked to the grid, boosting energy access while also supporting economic growth. Overall, using renewable energy to generate power is critical for preventing climate change, ensuring energy security, and supporting long-term economic growth.

Table. 10.4.5 Proposal Details

Sr. No	Source	Area	Locations	Capacity Installed MW	Cost Estimated
1.	Solar Park	100 acres	Ollukkara	200 MW	10,000 crore
2.	Wind Farm	20 acres	Chavakkad, Vadanappally, Peechi, Vazhani, Chimmini, Puthur, Mullassery, Muriyad, Guruvayur	50 MW(25 Turbine)	300 crore
3.	Waste to Energy	5 acres	Chowannur, Ollukara	20 MW(2 Plants)	500 crore
	Total	125 acres		370 MW	10,800 crore

Fig 10.4.4 Phase Wise Proposal



- **Water Supply**

Idea Behind Proposal:

In order to prevent consumers from directly using groundwater and causing a rise in the ground water table, it is necessary to move people away from dependence on groundwater and towards water supply systems. This would help achieve Sustainable Development Goal 6 Clean Water and Sanitation which ensure availability and sustainable management of water and sanitation for all.

Procedure:

1. Fulfilling the Water Demand of the District by providing sufficient good quality treated water to all the households
2. Providing subsidies to people contributing towards Rainwater Harvesting.
3. Providing subsidies to people contributing towards Used Water Harvesting.
4. Applying user charges or license fee on existing Ground Water Extraction.
5. Construction of sufficient artificial recharge ponds, wells, etc to continuously recharge the acquifer.

Funding Agency:

The agencies that could fund the projects are Jal Jivan Mission (JJM), Government of Kerala, DEPO, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Rebuild Kerala Initiative (RKI), Kerala Infrastructure Investment Fund Board (KIIFB)

Phase Wise Development:

Phase 1 (2023-2028) minimum 20% of the population in the district should be served by a water supply infrastructure.

Phase 2 (2028-2035) minimum 50% of the population should be served by a water supply infrastructure. The remaining water demand is fulfilled in Phase 3 (2035-2047**)**

Sea Water Desalination Proposal:

To lessen reliance on ground water and fulfil the district's future water needs, a sea water desalination plant with a 100MLD capacity would be built on 60 acres of land in the Chavakkad block at a cost of 500 to 900 crores. This project is thought to meet the water needs of the industrial and agricultural land uses.

Funding Agency: PPP Model Private person will get benefitted by selling water to the Kerala Water Authority, While government can have some share in water supply pipelines and land.

Example: Minjur and Nemmeli Desalination Plant, Chennai, Seawater desalination plant in Dahej industrial area, Gujarat

- **Solid Waste Management and Sewerage Treatment System**

Sewage treatment plant and Solid waste management is an important infrastructure for a developing city. Deficient or improper disposal and discharge of sewage and solid waste has ramification for public health, the environment and also the economy.

Thrissur faces such issues due to its rapid

Fig 10.4.5 Water Supply Proposal

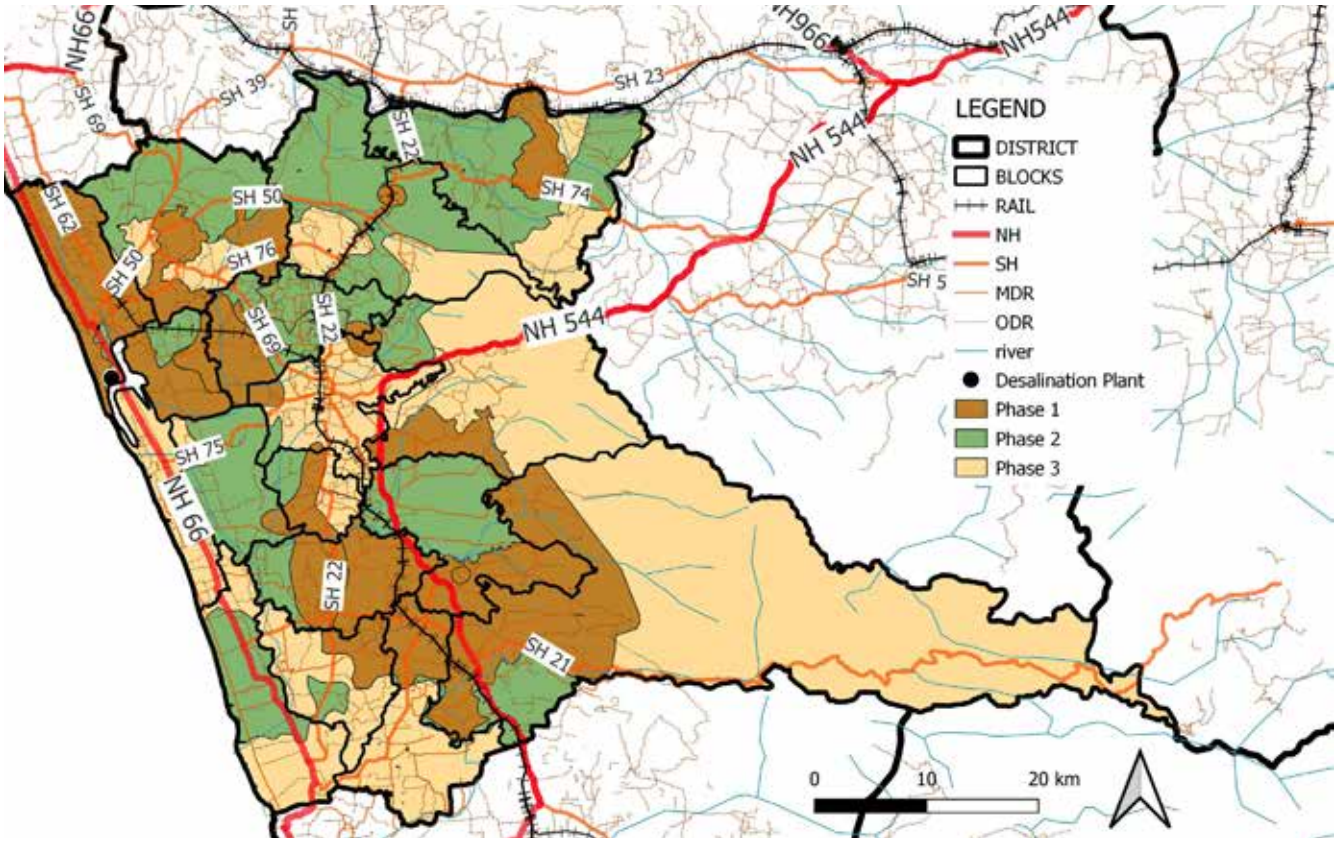


Table 10.4.6 STPs, area required and capital investment, 2047

S. No.	Block	Population	Sewage generated (MLD)	Total STPs	Proposed capacity (MLD)	Sewage for biomethane (MLD)	Capital investment for MBR plants (Cr.)	Area required for MBR plants (ha)
1	Kodakara	312124	42.14	4	42	0.14	21.84	3.36
2	Wadakkanchery	266098	35.92	5	35	0.92	18.20	2.80
3	Irinjalakuda	201340	27.18	3	27	0.18	14.04	2.16
4	Mala	285002	38.48	4	38	0.48	19.76	3.04
5	Mathilakam	355939	48.05	4	48	0.05	24.96	3.84
6	Thalikulam	165041	22.28	3	22	0.28	11.44	1.76
7	Vellangallur	190779	25.76	3	25	0.76	13.00	2.00
8	Chowannur	570139	76.97	6	76	0.97	39.52	6.08
9	Thrissur Muni. Corp	373621	50.44	3	50	0.44	26.00	4.00
10	Cherpu	120686	16.29	2	16	0.29	8.32	1.28
11	Puzhakal	278240	37.56	3	37	0.56	19.24	2.96
12	Chavakkad	314467	42.45	4	42	0.45	21.84	3.36
13	Pazhayannur	275040	37.13	3	37	0.13	19.24	2.96
14	Challakudy	311279	42.02	4	42	0.02	21.84	3.36
15	Ollukara	258031	34.83	3	34	0.83	17.68	2.72
16	Anthikkad	234044	31.60	4	31	0.60	16.12	2.48
17	Mullassery	120506	16.27	2	16	0.27	8.32	1.28
		4632376	625.37	60	618	7.37	321.36	49.44

Source- STP guidelines, CPHEEO

growth, the cities current SWM and STP cannot meet the demand of the solid waste and sewage generated by the city. Natural water bodies and sources are contaminated due to the lack of STPs and SWMs, and unscientific treatment method utilized in the district.

Objectives:

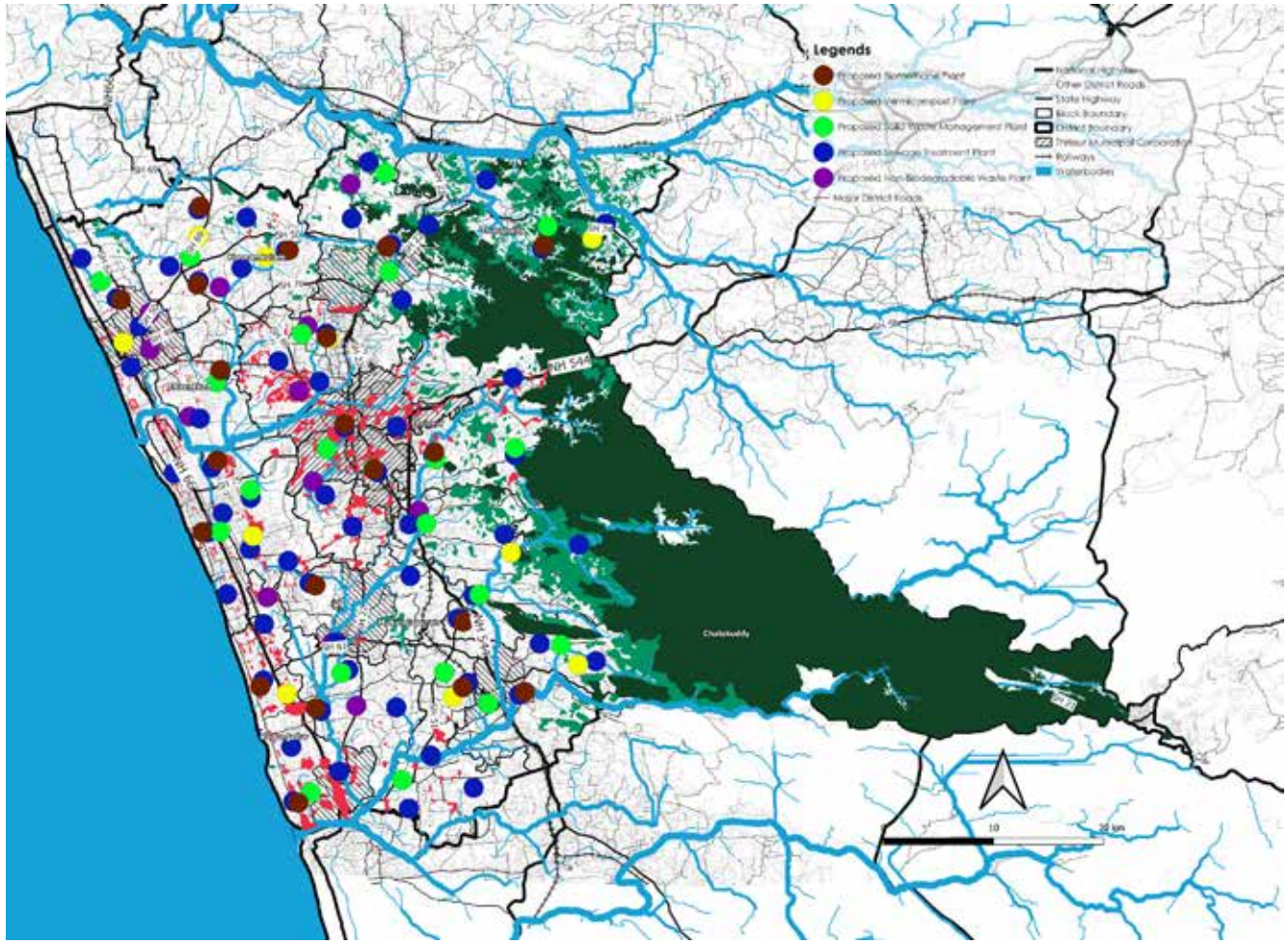
The proposal aims to address several issues to achieve a scientific treatment and to meet the demand of the growing waste and sewage generated.

One of the primary objectives is to promote the implementation of decentralized sewage treatment plants and community-level practices for faecal waste. This approach aims to ensure proper disposal of sewage and minimize contamination by encouraging the adoption of appropriate technologies and management practices suitable for local conditions. Another objective of the proposal is to promote waste reuse and recycling, with the goal of reducing the amount of waste that ends up in landfills. The proposal seeks to achieve sustainable waste management by developing appropriate systems and infrastructure for waste collection, transportation, and disposal. These systems will be designed to account for the specific needs of different types of waste and promote resource recovery and waste reduction.

The proposal also aims to create opportunities for the utilization of treated water in agriculture and fisheries, with the aim of reducing the consumption of fresh water and promoting more sustainable water management practices. This will involve the development of suitable systems and infrastructure for the treatment and distribution of treated water, as well as the provision of training and support to farmers and fishermen for the same.

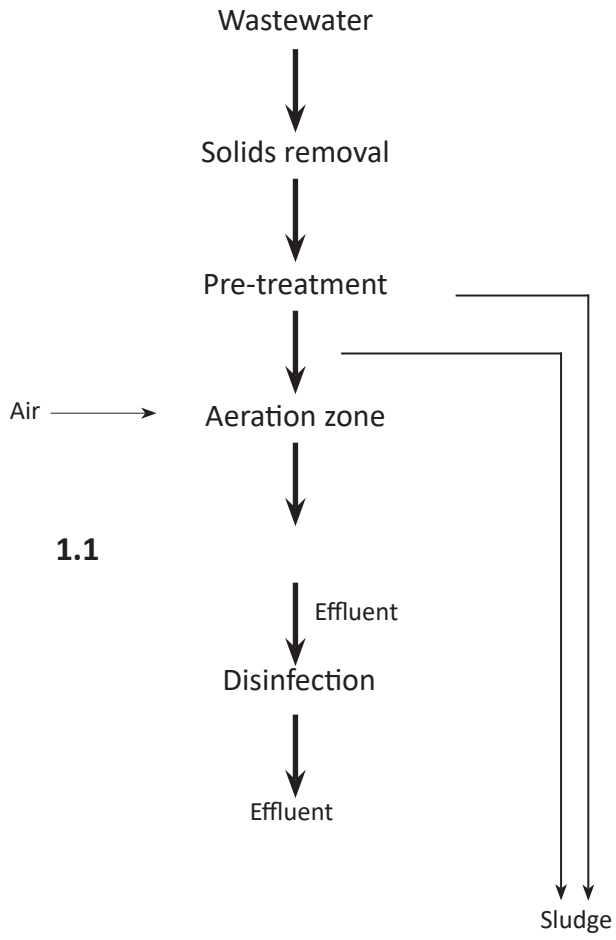
Lastly, the proposal aims to encourage industries to take responsibility for the waste they produce and promote recycling of waste. This will require the development of policies and regulations that support sustainable waste management practices, as well as the provision of technical and financial support to industries to help them adopt such practices. The proposal also aims to promote public awareness and education on the importance of responsible waste management practices and encourage public participation in waste reduction and recycling initiatives.

Figure 10.4.6 Proposed STPs and SWMs



Source- Secondary Data

Figure 10.4.7 Membrane Bio Reactor process



Sewage Treatment Plant:

i. Decentralized STPs: STPs will be implemented with smaller coverage areas, given the dispersed development and housing in Thrissur. Septic tanks will be provided in communities with limited spaces and at market places. New technologies like Membrane Bio Reactors will be utilized as it requires less area than conventional treatment plant and also achieves a higher treatment level, the system achieves more than 95% treated water from the sewage treated as compared to 80% to 85% of traditional treatment method. The location and number, and capacities of STPs proposed are shown in Figure 10.4.6 and Table 10.4.6. The capital investment Membrane Bio Reactor is Rs.0.52 crore per MLD, The cost and area required for implementing STPs in the district will be Rs. 321.36 for MBR plants with a capacity of 618 MLD, the area required will be 49.44 ha. and Rs. 276.38 Cr. for treating 7.37 MLD in Biomethane plant and area requirement is 0.06 ha.

Utilization of treated water: The treated water will be supplied to industries, agricultural fields and fisheries to reduce the demand of freahwater. Farmers, fishermens and industries will be provided with training and support on the use of treated water. With an efficiency of more than 95%, 587.1 MLD of treated water can

Table 10.4.7 SWMs, area required and capital investment, 2047

S. No,	Block	Population	Waste (TPD)	Biodegradable (75%) (TPD)	Vermicompost (TPD)	Area Vermicompost (ha)	Capital investment (Cr)	Windrow (TPD)	Area for windrow (ha)	Capital investment (Cr)	Biomethane (TPD)	Area for biomethane (ha)	Capital investment (Cr)
1	Kodakara	312124	109.24	81.93	20.00	1.25	1	45.55	0.76	1.37	16.39	0.14	2.46
2	Wadakkanchery	266098	93.13	69.85	-	-		55.88	0.93	1.68	13.97	0.12	2.10
3	Irinjalakuda	201340	70.47	52.85	-	-	-	44.92	0.75	1.35	7.93	0.07	1.19
4	Mala	285002	99.75	74.81	15.00	0.94	0.75	44.85	0.75	1.35	14.96	0.12	2.24
5	Mathilakam	355939	124.58	93.43	5.00	0.31	0.25	60.40	1.01	1.81	28.03	0.23	4.20
6	Thalikulam	165041	57.76	43.32	-	-		36.82	0.61	1.10	6.50	0.05	0.97
7	Vellangallur	190779	66.77	50.08	-	-	-	42.57	0.71	1.28	7.51	0.06	1.13
8	Chowannur	570139	199.55	149.66	40.00	2.50	2	64.76	1.08	1.94	44.90	0.37	6.73
9	Thrissur Muni. Corp	373621	130.77	98.08	-	-	-	68.65	1.14	2.06	29.42	0.25	4.41
10	Cherpu	120686	42.24	31.68	-	-	-	26.93	0.45	0.81	4.75	0.04	0.71
11	Puzhakal	278240	97.38	73.04	10.00	0.63	0.5	48.43	0.81	1.45	14.61	0.12	2.19
12	Chavakkad	314467	110.06	82.55	20.00	1.25	1	46.04	0.77	1.38	16.51	0.14	2.48
13	Pazhayannur	275040	96.26	72.20	20.00	1.25	1	37.76	0.63	1.13	14.44	0.12	2.17
14	Challakudy	311279	108.95	81.71	20.00	1.25	1	45.37	0.76	1.36	16.34	0.14	2.45
15	Ollukara	258031	90.31	67.73	-	-	-	54.19	0.90	1.63	13.55	0.11	2.03
16	Anthikkad	234044	81.92	61.44	10.00	0.63	0.5	42.22	0.70	1.27	9.22	0.08	1.38
17	Mullassery	120506	42.18	31.63	-	-	-	26.89	0.45	0.81	4.74	0.04	0.71
		4632377	1621.33	1216.00	160.00	10.00	8	792.23	13.20	23.77	263.77	2.20	39.56

Source- SWM guidelines, CPHEEO

be supplied to the above mentioned sectors.

Efficient Transport and Monitoring: GPS-guided transport vehicles are utilized to collect fecal waste from households and community septic tanks. The vehicles are programmed to collect waste when the septic tanks reach full capacity, ensuring an efficient route is taken.

Solid Waste Management:

Community-Level Waste Management: Waste management at community level will be promoted, with a focus on treating biodegradable waste.The local government bodies will actively promote community-level waste management by encouraging people to treat biodegradable waste within their communities. Composting bins and pits will be provided to facilitate this process. In urban areas, door-to-door waste collection services will be implemented, while in rural areas, community-level waste collection systems will be established. To ensure efficiency, waste segregation at the source will bw made mandatory. These initiatives aim to improve waste management practices and minimize the environmental impact of waste.

Promotion of Recycling: Plastic and Glass industries will be set up in proximity to waste

management plants to utilize treated waste and minimize transportation costs and exportation of non-biodegradable waste to other states. Location of Non biodegradable waste collection centres are shown in Figure 10.4.6.

Vermicompost Plants: Vermicompost plants are proposed at blocks with higher agricultural lands. The Vermicompost plants will be able to produce 32-48 TPD of compost, the subsidised rate for vermicompost is Rs. 6 per Kg. Location of Vermicompost plant waste collection centres are shown in Figure 10.4.6.

Efficient Transport and Monitoring: To ensure smooth and efficient routing during collection. Remote monitoring to observe and notify the collection vehicles when the bins are full.

Recycling plants for non biodegradable waste: Plastic and glass industries are promoted to use recycleable waste to minimize non biodegradable waste dumped into landfills.

Biomethane plant: Combined biomethane plant for biodegradable waste and sewage are proposed to maintain a consistent feeding of the plants. Biogas plants are proposed near solid waste management plants for easy transportation.

The capital investment and area required for Solid waste management is shown in Table 10.4.7. The total funds required for SWM plants will be Rs. 71.33 Cr. and the total area required is 49.50 ha.

Awarneness programmes: Awareness programs to promote the importance of sustainable waste management practices. The programs will educate people about the importance of STPs and waste management practices, and their role in sustainable development.

Funding and Schemes:

i. Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

ii. Swachh Bharat Mission (SBM)

iii. National Clean Energy Fund

iv. Urban Development Fund

The Central government and its schemes will fund 60% of the total budget, while the state government will contribute 40%. However, if ULBs (Urban Local Bodies) are involved, the state government will provide 30% of the funds, and the remaining 10% will be funded by the ULBs.

Conclusion

In the regional plan for Thrissur we focused on the symbolic economy and climate resilience that recognizes the importance of infrastructure, tourism, and creative industries as drivers of economic growth and identity while also focusing on conserving its natural resources , disaster management and mitigation of climate change. It promotes a symbolic economy that can leverage the unique cultural assets of Thrissur to generate employment, attract tourists, and strengthen local communities. Simultaneously, it prioritises climate resilience that ensures the region is better equipped to mitigate and adapt to the impacts of climate change, also conserving its natural resources. Climate resilience as a core element incorporates strategies for sustainable land use, green infrastructure, energy efficiency, water resource management, and disaster risk reduction. It seeks to protect vulnerable communities, conserve natural resources, and build resilience in the face of climate-related challenges, such as rising sea levels, extreme weather events, and changing rainfall patterns. By integrating the symbolic economy and climate resilience, the regional plan creates synergies between economic development, and environmental sustainability. It fosters a balanced approach that recognizes the intrinsic value of natural resources while addressing the urgent need for climate action. This holistic perspective not only enhances the region's economic potential but also safeguards its unique identity and protects the well-being of its residents.

CHALLENGES FACED

The limited availability of data outside of the native tongue was one of the main difficulties encountered when creating the Thrissur regional plan. For planners who were not fluent in the native language, language barriers were a considerable challenge. Accessing and analysing crucial data needed for the planning process was made challenging by this. To close this gap and ensure appropriate comprehension and use of the data presented, translation and interpretation services were required. The thrust of data that was gathered from each block in Thrissur was different, which presented another problem. The creation of a thorough and cohesive regional plan was hampered by inconsistent data gathering techniques, different data formats, and differences in data quality. A rigorous process of data validation, standardisation, and reconciliation procedure was necessary to overcome this problem.Furthermore, the planning process was significantly hampered by the unclear way that some departments operated. The roles and duties of many departments within the local government frequently overlapped or were vaguely defined. Due to such confusion, it was challenging to compile the essential information, create efficient coordination, and distribute resources in the right way. To clarify duties, streamline procedures, and ensure a collaborative approach to regional planning, there was a need for substantial interaction and cooperation with the pertinent departments.

IMPLEMENTATION OF PROJECTS

The regional plan prepared for Thrissur provides a guiding framework for development of local plans by Local Self Government (LSG) institutions, particularly the Gram Panchayats. These can be derived from the broader perspective of regional planning and provide detailed guidelines for land use and development at the local level. LSG can focus on identifying local needs and phase development by setting priorities while ensuring integration of regional plans into their local planning process. The need is to align development strategies, policies, projects with the objectives. The implementation of the regional plan can be carried out at the local level by LSG by enforcing development rules and regulations and maintaining uniformity in development practices by adhering to the vision of the regional plan. Local institutions play a crucial role in implementing infrastructure development projects in line with the regional plan. This can be implemented by collaborating with relevant departments and agencies to initiate and execute projects related to transportation, water supply, sanitation, waste management, electricity, and other essential services. LSG can mobilise resources and seek funding for infrastructure projects within their jurisdiction. Implementation can be successful when LSG facilitates public participation and engage with local communities, conduct public consultations, and seek feedback on development proposals, projects, and policies. The regional plan can be further monitored and evaluated while implementing at the local level as their close proximity to local communities and grassroot level governance enables them to address specific local needs and ensure that development efforts are inclusive and sustainable.

Local governments need to conduct feasibility studies of the projects proposed in the regional plan to determine the practicality and

viability of implementing the plan. The study identifies potential challenges, risks, and obstacles that may arise during plan implementation. It would provide detailed analysis of costs associated with regional plan development, including infrastructure and resources. A well conducted feasibility study would enhance the credibility of regional plans and increase the likelihood of securing funding and support from relevant stakeholders.

The local government is also motivated to prepare a Comprehensive Mobility Plan to take a comprehensive and integrated approach to transportation planning within a region to promote efficient and sustainable mobility networks. Preparing CMP as part of regional plan development would serve as a roadmap for future transportation development ensuring that it aligns with the region's goals and meets the needs of the population.

PHASING OF THE PLANS

The proposals have been carefully prioritised and phased across multiple sectors to guarantee effective execution and optimal resource allocation.The regional plan of Thrissur can effectively handle urgent concerns and establish a strong foundation for the city's sustainable growth by phasing the suggestions according to these priority sectors.

Phase 1 is done for a period of first 5 years for issues requiring immediate attention. In the first 5 years major focus will be given on conserving the existing resources and kole area by preventing the encroachment and proposing regulation zones around eco-sensitive areas. Improving the condition of polluted stretches in the river by removing the solid wastes dumped into it and identifying the inlets that dispose the untreated and taking measures to stop them. For tackling the connectivity issues during flooding ,stretches of roads are selected. Fairway development and policy interventions would be taken up. Measures for erosion containment like providing breakwater and mangroves would be taken to control coastal erosion. Site selection, garbage removal, fencing and excavation in the identified blocks for sustainable groundwater. Provision for human wildlife mitigation strategies. Sustainable bus transport improvement plan would include projects like bus route plan, selection and maintenance of bus depots and electrification of buses. This is a long term project which takes over the span of 24 years with continuous updation in the development process in different phases as shown in table 1. Multimodal transport hub and monorail will continue for a span of 24 years. Provision for water supply and effluent monitoring for sewage and solid waste would be done in the first phase along with identification of location for sewage treatment plants. Initial development for sustainable energy provision would be done in the first phase. Firstly, there shall be a dedicated sports facility in each village panchayat, equipped with the necessary infrastructure to support identified sports and provide local coaching assistance. Housing is to be provided for lower income groups and economically weaker sections. For educational infrastructure, colleges for art, science and commerce would be provided along with institutions for research. It also focuses on providing infrastructure for elderly. The first phase involves encouraging the farmers, cultivators, and fishing community to adopt and support public- private participation which will lead to an increase in the per capita production of agricultural crops, fisheries, and raw medicinal plants. While the animal husbandry and dairy development sector encourages and rewards production for self-sufficiency by promoting domestic cattle raising. The Agro-based industry includes the 'One Block Two Industries' scheme which identifies two potential industries for each block in this phase. The first phase includes proper management of existing handloom industries and gold industries to boost the economy. Tertiary sector involves proposing Thrissur district as a competitive district by providing private economic zones and think clusters which is a continuous process to enhance the district's overall economy. It also focuses on developing tourism by providing a facilitation centre and rejuvenation of ponds at Cheraman mosque. It also aims to promote the concept of responsible tourism by creating awareness. Revival of beaches and temples as a way to attract foreign tourists in the district. Provision for tourist accommodation would also be looked upon.

Phase 2 is done for the next 10 years from the year 2028 to 2037. Arranging water source for rejuvenation for nearest STP and wetland constructions for sustainable groundwater. Regulation of coastal pollution by effluent monitoring and developing STP for proper discharge. Development of water management infrastructure to maintain river quality. Land and project management interventions for Kole area development. Provision for terminal berthing for water route revival. Focus on connecting all Central Villages, Service Centres, Growth Points, and Growth Cen-

ters. Road's geometry will be upgraded according to proposed bus routes connecting all central villages. The Monorail also connects all Blocks with each other. Second phase Multi-Modal Transport Hub consists of Triprayar, redevelopment of Guruvayur, and Wadakkanchery. The rest of the stations will be redeveloped under the theme of their socio-cultural significance to maintain the stature of Cultural Capital. IPT rationalises transportation routes, restricts use to inner areas, and promotes E-autos and E-rickshaws. Water taxis to connect inland canals and rivers will be the extension of National Waterway-3. For road transportation several key initiatives such as 27 sub-routes for buses identified along the Other District Roads, a further addition of 4 bus depots were proposed, integration of the proposed terminus with multi-modal hubs were proposed. It also includes an addition of 500 electric buses, to achieve net zero carbon footprint for 100% sustainability. Second phase would include implementation of the proposed sewage treatment plant to cater to the needs of the residents and establishment of an efficient solid waste management system. Renewable energy projects like wind farms and solar parks would be developed. The focus shall shift toward talent development. Elite talent sourcing and training programs will be implemented in all community sports centres. Furthermore, a district-level Center for Excellence will be established to train athletes for national-level sporting events. Provision for creative hubs for enhancing the young minds and vocational institutes. Sector specific investment schemes like Mahila Udhyam Nidhi Scheme, clean energy scheme and wetland conservation scheme would be promoted. The second phase focuses on promoting small and large-scale industries for cultivators and the fishing community by providing skill development programmes, schemes and fundings and loan distributions. In the agricultural sector, it focuses on adoption of innovative methods and promotion & marketing strategy planning of GI tag products involving farmers' groups with technical assistance provision in each block. This phase also includes building infrastructure for all sectors including fishery sector, ayurveda sector and agro based industry with primary processing units and 11 APC proposed in 11 blocks for agro based industry. The animal husbandry sector deals with infrastructure and cultivating indigenous breeds for long-term milk sufficiency for dairy development. There is a need to make provisions to expand the existing handloom industries to empower women and create avenues for employment generation. Construction industries would also grow to meet the need for new real estate and transportation projects coming up. Gold exhibition centre is promoted to highlight Thrissur's name in the global context. The third phase would also include monitoring of the revived beaches and temples along with transformation retreat and remote habitat. It also focuses on generating economies by promoting water sports and boat rides. Existing tourist circuits would be improved by enhancing connectivity and accessibility.

Phase 3 is done for 10 years for 2037-2047. Provision for landscaping and recreational spaces to avoid encroachment along the rivers and preparation for surface water management plan. Hazard mapping for vulnerable areas along the coast to provide mitigation strategies. For kole areas rejuvenation of canals for economic growth and flood mitigation measures. Proposals for smart-agri villages to enhance local economy. Includes IPT and Air Taxi. In IPT we will prioritise sustainability by introducing electric vehicles. Air Taxi will develop as a part of Multi-Modal Transport Hub to connect all major places within and outside the district. The third phase would include improved connectivity to the proposed STP and solid waste management plant to ensure proper discharge and disposal of effluents. Desalination water treatment plant would also be developed. To ensure renewable energy waste to energy mechanisms would be focused upon. Polytechnic colleges would be provided for improving educational level. The plan includes the development of a sports city. This city will benefit from the growing sports industry and will comprise outdoor and indoor stadiums, along with other necessary facilities. Sector specific investment schemes like village level entrepreneurship acceleration programme, innovation incubator, credit guarantee fund for MSME would be taken up. The third phase involves outsourcing and marketing of fishery and ayurveda products (GMP certificated) by developing better marketing channels and infrastructure involving small scale industries in international markets. While the animal husbandry sector would establish processing facilities for dairy and meat by products creating employment prospects. The agricultural sector and ayurveda sector will be boosted by increasing exports of major crops and medicinal plants through the proposed District Export Hub and adopting new and innovative technologies through digital infrastructure. The kodakara block has been selected with one CPC for agro based industry and

one CPC for ayurveda industry adjacent to the Kochi-Bangalore Industrial Corridor. Thrissur Ulsavam would be promoted as a cultural and religious festival on a global scale to attract tourists and help them understand the cultural diversity in the district. It also aims to monitor the progress of projects in phase one and two.

WAY FORWARD

The exercise to prepare the regional plan for Thrissur has been an attempt to guide the development for economic growth while preserving the natural resources taking into account the spatial, economic and environmental goals. Sustainable integrated development is a key to achieve growth. The policies and projects proposed have a larger and longer impact on the overall growth of the region. There have been certain limitations about availability of accurate data especially in the case of preparation of land use map. The existing land use was not available hence the map is being generated using landsat images to study the trend of urbanisation in the district. Conducting transport studies is important to assess the connectivity and accessibility within a region to identify the gaps and improve the existing mobility. The exercise lacks a detailed transport study which could have been closely linked to economic development. It is thereby recommended to prepare a Comprehensive mobility plan which would help in identifying strategic locations for industrial, logistics and commercial centres contributing to regional economic growth and employment generation. Analysis reveals that forest cover dominates the eastern part of Thrissur with densely populated settlements. There has been a rapid increase in incidents of human wildlife conflict due to changing cropping and cultivation patterns. We need a detailed study of the habitat and early warning system to develop a harmonic relation where we restrict the movement of humans in the forested areas thereby conserving them. Identifying and preserving wildlife corridors, which are crucial for the movement of animals between fragmented habitats and ensuring connectivity by providing natural pathways. There are certain aspects which are important while preparation of regional plan but have been minutely touched upon but would require detailed analysis to ensure equitable development. One such is migration of youth which is a significant phenomenon observed in the district. Analysis reveals lack of better employment opportunities, educational facilities to broaden career prospects as some reasons for migration resulting in brain drain where talented individuals migrate and contribute their skills in other regions. To address the challenges associated with youth migration, it is essential to focus on creating employment opportunities, promoting skill development within Kerala, and fostering an environment that encourages entrepreneurship and innovation which have to be further taken into consideration to contribute to the district's development. NASA has forecast that the sea level may rise by 0.11 m by 2030, submerging 374 square kilometres of coastal land. This is another urgent concern. Frequent and severe flooding are caused in part by the sea level rise. To implement adaptation and mitigation measures, a comprehensive action plan on climate change must be created. Realising that our future is doomed unless we transition to low-carbon and climate-resilient development is crucial. The prepared regional plans try to integrate the proposals and implement them to ensure climate resiliency. It is further required to conduct a comprehensive assessment of climate related risks and vulnerabilities in the region. A mechanism should be developed to integrate climate change considerations into the entire planning process. This involves considering climate projections, assessing the vulnerability of infrastructure and ecosystems, and incorporating climate resilience strategies into various sectors. Budgets play a crucial role in successful implementation of regional plans. The current time constraint didn't allow us to go into the budgetary allocation for various projects. It is recommended that effective resource allocation is done and sufficient funds are allocated to critical areas thus maximising the plan's impact and achieving sustainable growth. Budgets would help in translating the regional plan into actionable steps by assigning financial resources to initiatives.

Table 11: Phasing of the projects

REGIONAL PLAN FOR THRISSUR 2047

Project proposal			Phase 1	Phase 2	Phase 3
Particular			**Timeline**		
Sr.no	Sector	Task	2Y 4Y 6Y 8Y 10Y 12Y 14Y 16Y 18Y 20Y 22Y 24Y		
Sr.no	**Sector: Demography**	**Task**			
1	GrowTh - Grow Thrissur	Policy for population growth			
		Labour Mapping Cell			
		Barrier free schools, hospitals and Public spaces			
Sr.no	**Transport**	**Task**			
1	Sustainable Bus Transport Improvement Plan	Bus Route Plan			
		Bus Depots			
		Bus Terminus			
		Electrification of buses			
	Upgradation of road geometry				
2	Multi-Modal Transport Hub				
3	Monorail				
4	water taxi				
5	Air Taxi				
6	Logistic park				
7	Modernizing IPT Services	Integrated Transport Solutions (ITS)			
		Sustainable Urban Mobility Initiative			
		Electric Mobility Transition Program			
Sr.no	**Sector: Physical Infrastructure**	**Task**			
1	Water Supply	Water for All			
		Desalination Water Teatment Plant			
2	Sewerage Treatment Plant				
3	Solid Waste Management				
4	Energy	Solar Park			
		Wind Farm			
		Waste to Energy			
Sr.no	**Environment**	**Task**			
1	Sustainable Ground Water and Surface Water Management Plan	Site selection, garbage removal,fencing & excavation in the 4 identified blocks			
		Arranging water source for rejuvenation from nearest STP and wetland constructions			
		landscaping and creating public place			
2	Coastel zone management	Erosion Containment			
		Coastal Pollution Regulation			
		Hazard Mapping			
3	Kole Area Development	Kole Regulation Zones (KRZ)			
		Policy Intervention Guidelines			
		Land & Project Management Interventions			
		Rejuvenating Canal for Economy Generation & Flood Mitigation			
4	Carbon mitigation & Water route revival for transportation	Fairway Development & Policy Interventions			
		Terminal/ Berthing			
5	River regulation and redevelopment	Effluent Monitoring and surface cleanup and RRZ proposal			
		development of water mangement infra			
		recreational activities near the river to prevent encroachment			
6	Flood resilient connectivity routes				
7	Human-wildlife conflict mitigation strategy				
8	Smart agri village				

Project proposal			Phase 1	Phase 2	Phase 3
Particular			**Timeline**		
Sr.no	Sector	Task	2Y 4Y 6Y 8Y 10Y 12Y 14Y 16Y 18Y 20Y 22Y 24Y		
Sr.no	**Primary**	**Task**			
1	Agriculture	Fallow & Waste land conversion through Lease			
		GI products marketing strategy planning			
		District Export Hub			
2	Animal Husbandry	Dairy Development			
		Fodder Development			
		Egg and Meat Industry			
3	Fisheries	Fisheries Proposals and Schemes			
4	Ayurveda Park	hi-tech nurseries			
		central Processing Centre (CPC)			
		GMP certification of medicinal products			
5	Agro-based Industries	One Block Two Industries (OBTI) Scheme			
		Primary Processing Centre (PPC)			
		Agro Processing Cluster (APC)			
		Central Processing Centre (CPC)			
Sr.no	**Secondary**	**Task**			
1	Handloom Industry				
2	Construction Industry				
3	Gold Industry	Gold exhibition Center			
Sr.no	**Tertiary**	**Task**			
1	Thrissur as a Competitive district	Private Economic zones			
		Think Cluster			
2	Tourism Development	Facilitation center & rejuvenation of pond at Cheraman mosque			
		Revival of beaches			
		Revival of temples			
		Transformational retreat & Remote habitat			
		Responsible tourism			
		Thrissur Ulsavam			
		Revival of Tourist circuits			
		Boat rides			
		Adaptive reuse of heritage buildings			
		Tourist Accomodation			
Sr.no	**Social and Economic Infrastructure**	**Task**			
1	Housing	Vacant houses mapping/Potential rental housing mapping			
2	Education Infrastructure	Arts, Science & Commerce College			
		Research Institutes			
		Creative hubs			
		Vocational Institutes			
		Polytechnic Colleges			
3	District Sports Grid	Dedicated Sports Facility (Village Panchayat)			
		Community Sports and Fitness Center (Central Villages)			
		5000-capacity Mini Stadium (Central Villages)			
		Multipurpose Sports Complex (Municipalities)			
		For Profit Sports Academy (Municipalities)			
		Sports University (District)			
		10000-capacity stadium (Municipalities)			
		Center For Excellence (District)			

Project proposal			Phase 1	Phase 2	Phase 3
Particular			Timeline		
Sr.no	Sector	Task	2Y 4Y 6Y 8Y 10Y 12Y 14Y 16Y 18Y 20Y 22Y 24Y		
		Sports City (District)			
4	Infrastructure for Elderly				
5	Sector Specific Investment Schemes	Village Level Entrepreneurship Acceleration Programme			
		Innovation Incubators			
		Credit Guarantee Fund for Micro and Small Enterprises			
		Capacity Building and Market Linkages for Entrepreneurship Collectives			
		Emergency Relief & Community Intervention			
		Mahila Udyam Nidhi Scheme			
		Clean Energy Scheme			
		Wetlands Conservation Scheme			

Way forward to achieving climate resilience in Thrissur

To achieve climate resilience and consequently attain SDG 13 in Thrissur, there is a need to integrate climate change adaption and mitigation into the development processes. Climate adaptation aims to reduce the susceptibility as a result of the adverse effects of climate change, enhancing adaptability to the detrimental consequences of it, and fostering climate resilience and low-GHG development. Climate adaptation, when dealt holistically, can be utilized to build synergies across urban challenges by tackling numerous aspects of urban development at the same time, thus creating future climate-resilient district.

Climate change mitigation refers to entails lowering or preventing emission of heat trapping GHGs either by enhancing sinks that accumulate and store these gases or by reducing the sources of GHGs in order to limit global temperature increase. It also entails keeping the increase in global average temperature far below 2°C over pre-industrial levels, aiming for 1.5°C, which would substantially decrease the risks and impacts of climate change.

Taking the per capital GHG emissions of India as standards, CO2 emission constitutes about 80% of the overall GHG emissions. At present, the population of the district produces approximately 10.6 megatons of GHG emissions annually where per person contributes 3 tons of GHG emissions annually. Similarly, this would reach about 13.9 megatons of GHG emissions annually till 2047. As mentioned previously in Chapter 2, districts' soils, forest covers, Kole lands, mangroves, water bodies as well as the other natural environment which captures carbon are continuously degrading due to human activities which will impact various sectors, including tourism, human health and economy, etc.

CO2 emissions from fuel burning are the major source of overall GHG emissions. Thrissur needs decarbonize electricity generation before 2047 by phasing out coal-fired power generation, with renewable energy, such as wind power, hydroelectricity, solar power, and biomass development the most promising alternative. Transport emissions per capita (excluding aviation) accounts for 0.8 megaton CO2 emissions per capita per year as of 2023 which would increase up to 1.06 megaton CO2 emissions per capita per year. Both the passenger and freight transport industries rely heavily on fossil fuels, which must be decarbonized up to 80-95% by discontinuing fossil fuel-based vehicles and modal shift.

Industry related emissions also contribute to the energy related CO2 emissions which need to be reduced by 60-90%. One ton of cement production emits approximately 572 kgs of CO2. Subsidies directed away from fossil fuels and towards renewable energy sources might result in cost savings as well as considerable co-benefits such as better air quality. Building emissions are mostly determined by the amount of energy consumed in cooling, heating, lighting, domestic appliances, and so on. Building-related emissions (including indirect emissions) per capita is about 1.3 megaton CO2 emissions per year which is expected to rise up to around 1.7 megaton CO2 emissions per capita per year in 2047. Near-zero energy building strategy to reduce energy consumption to be pursued strictly in the

case of new construction of all building types in order to reduce emissions from energy used to build, heat and cool buildings.

During the period spanning from 2000 to 2020, Thrissur district observed a net decrease in tree cover by approximately 810 hectares, accounting for a negative change of 0.33%. This reduction corresponds to an estimated release of roughly 500 kilotons of carbon dioxide (CO_2) emissions. In order to remain within the boundaries of the 1.5°C temperature rise limit; the district should focus on transforming its land use and forest sector into a net absorber of emissions. This can be achieved by effectively curbing the expansion of mining activities, protecting forests against infrastructure and industrial ventures, and establishing new forested areas. Agricultural emissions within the district primarily arise from the digestive processes of animals (enteric fermentation), livestock manure, and the utilization of synthetic fertilizers and pesticides. Mitigating these emissions necessitates a transition towards organic farming practices, adopting more efficient approaches to fertilizer usage, and promoting dietary changes. Such measures would contribute to the reduction of emissions associated with agricultural activities.

The annual carbon absorption rate of CO_2 per square kilometer (sq.km.) of evergreen forest is approximately 1000 tons. The total forest cover in the district, which spans 1036.19 sq.km., absorbs 1040 kilotons of CO_2 emissions per year. Similarly, the Kole areas, covering 447.51 sq.km., sequester about 1340 kilotons of CO_2 emissions annually (3000 tons per sq.km. per year). Furthermore, the major rivers, with an overall catchment area of 75 sq.km., absorb 7.3 kilotons of CO_2 emissions in one year (according to D S Dwiputra et al, 2020, the rate is 97.43 tons/km2/year). Currently, the existing carbon sinks have the capacity to absorb approximately 2.4 megatons of CO_2 emissions per year, while the total greenhouse gas (GHG) emissions amount to 10.6 megatons. The government has already initiated various measures; however, there remains a critical need for reducing GHG emissions and enhancing the capacity of these carbon sinks.

In case of Thrissur district, the carbon sequestration potential lies in practicing organic and regenerative agriculture; conservation of eco-sensitive factors like soil, forests and coastal areas while restoration of the already-damaged ones as well as preservation of biodiversity & coastal ecosystems while regeneration of wetlands and mangroves. Some of the interventions that would involve in enhancement of carbon sinks is by rejuvenation of polluted river stretches and lakes, rejuvenating canals, ground and surface water management, ayurveda park, rejuvenation of ponds and eco-beach development as well as Kole regulation zones for conservation of wetlands and mangroves.

The mitigation measures aimed at preventing the emission of heat-trapping greenhouse gases (GHGs) involve minimizing reliance on fossil fuels for power generation and transportation, and promoting the use of cleaner fuels. These measures can be supported by imposing taxes on fossil fuel usage and CO_2 emissions. Additionally, reducing the use of synthetic fertilizers and pesticides, diversifying crops to enhance adaptability to changing conditions, and addressing air, water, and land pollution are crucial steps.

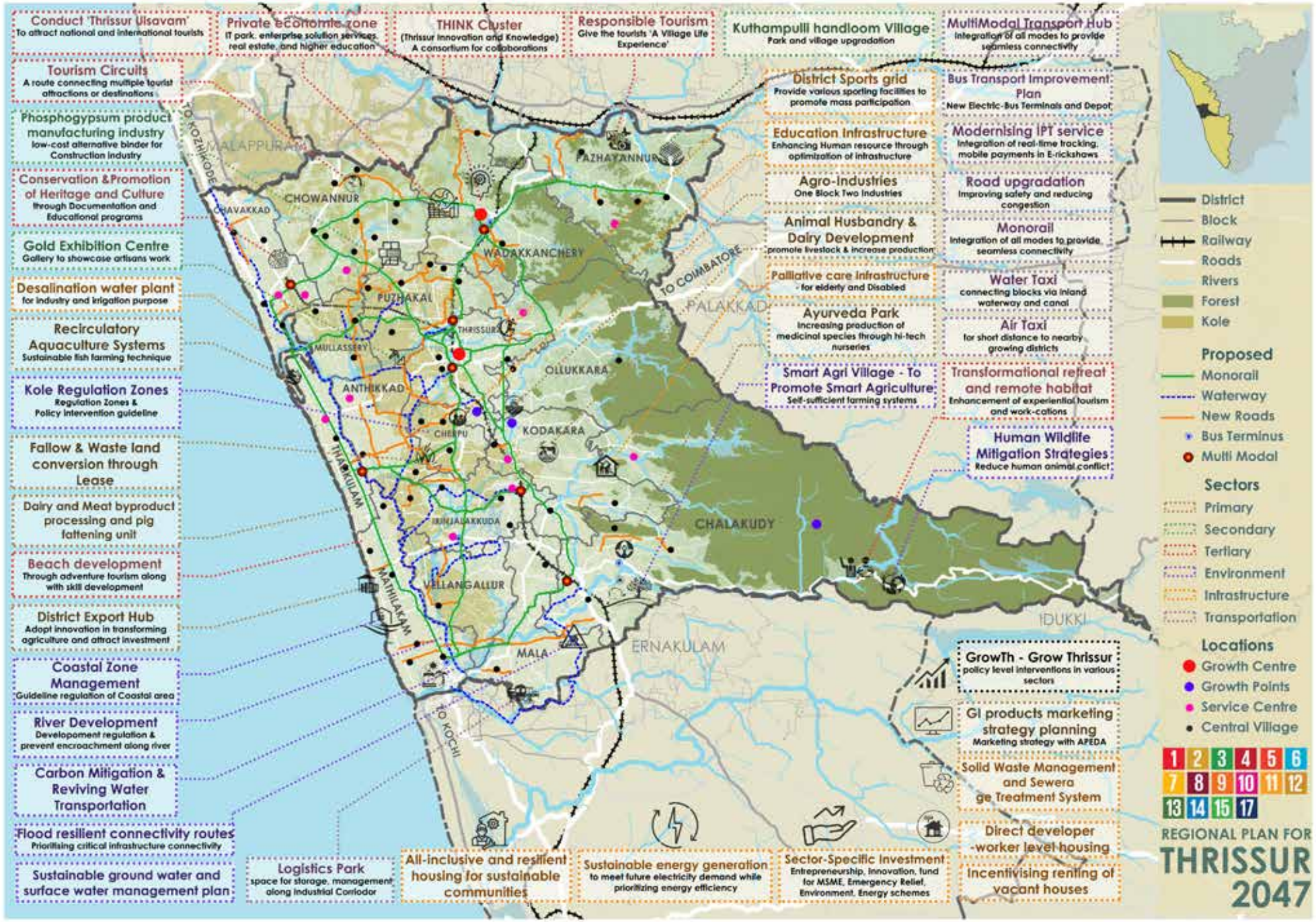
To achieve GHG emission reduction goals, targeted interventions should include the establishment of solar parks, wind farms, and waste-to-energy facilities for energy generation. Reviving water transportation with green policies and utilizing fuel-efficient vessels powered by hydrogen, solar energy, and compressed natural gas (CNG) are essential. Enhancing sustainable bus transport by introducing electric buses and expanding electric vehicle (EV) charging infrastructure is vital. Emphasizing the use of alternative fuels such as biodiesel, hydrogen, renewable diesel, natural gas, electricity, ethanol, and propane, which are environmentally friendly and economically viable, is recommended. Adopting climate-resilient green bus stops, promoting non-motorized transport for short distances, encouraging the use of electric rickshaws for intermediate public transport (IPT), and facilitating water taxis fueled by clean energy sources are recommended modes of transportation. Infrastructure facilities should be developed to minimize pollution, including solid waste management through vermicomposting, establishing recycling plants for non-biodegradable waste, implementing wastewater management plans, constructing wastewater and sewage treatment plants, incorporating membrane bio-reactors and bromoethane plants, and providing decentralized sewage treatment facilities with the reuse of treated waste. Regulations should be implemented to prevent industrial effluents from polluting coastal areas, and the manufacturing industry should focus on producing goods using byproducts. Construction practices should

prioritize climate-resilient housing, employing near-zero energy building strategies. Smart agricultural villages can be developed through initiatives such as organic farming, nurseries, integrated farming systems, value addition units, and the conversion of fallow lands. These measures, once implemented, will contribute to reducing GHG emissions and fostering sustainable development.

To tackle climate change, it is essential to allocate financial resources and make prudent investments aimed at reducing emissions, enhancing adaptation to existing impacts, and building resilience. Climate finance encompasses the provision of funds from various sources, including public, private, and alternative sectors, at local, national, or international levels, to support initiatives related to climate change mitigation and adaptation. Some of the international funding sources that can support interventions aimed at addressing climate change include the Adaptation Funds, International Climate Initiative (IKI), Green Climate Fund (GCF), and Special Climate Change Fund (SCCF). The Government of India has taken steps towards funding climate change initiatives through the National Adaptation Fund on Climate Change (NAFCC). This has already benefited the Kaippad and Pokkali regions in Kozhikode district, Kerala, specifically in promoting the “Integrated Farming System in Coastal Wetlands.”

In addition to implementing adaptation and mitigation strategies, it is crucial to effectively monitor the implementation of programs and policies at the grassroots level. As suggested in the Kerala State Action Plan on Climate Change 2.0, the present District Planning Committee (DPC) could potentially be reconfigured or delegated to operate as District Climate Change Cells reporting to the SCCC. This will aid in tackling the cross-sectoral and local level components of climate change initiatives more effectively. The proposal also includes the establishment of a separate unit within Local Self Governments to collaborate with the District Climate Change Cells. This position could be filled by existing working groups dedicated to the environment, biodiversity, climate change, and disaster management. The Local Self Governments play a vital role in effectively implementing mitigation and adaptation measures at the grassroots level. Climate change is a difficult battle, but with appropriate mitigation measures and apt monitoring the damage it causes can be minimized.

Figure 11: Final Proposals for the Regional Plan



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