LOCAL SELF GOVERNMENT INSTITUTIONS AND WATER CONSERVATION IN KERALA; A STUDY OF KOZHIKODE DISTRICT

Thesis submitted to
the University of Calicut in partial fulfillment of
the requirements for the award of the degree of

DOCTOR OF PHILOSOPHY IN POLITICAL SCIENCE

by

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CERTIFICATE

This is to certify that the thesis entitled "**LOCAL SELF GOVERNMENT INSTITUTIONS AND WATER CONSERVATION IN KERALA; A STUDY OF KOZHIKODE DISTRICT"** submitted to the University of Calicut by **Renjith Kumar O. S.** in partial fulfillment for the award of the Degree of Doctor of Philosophy in Political Science is a *bonafide* record of research work done under my guidance and supervision. No part of this work has been presented elsewhere for any Degree or Diploma previously.

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DECLARATION

I, **Renjith Kumar O. S**., do hereby declare that this Ph.D. thesis entitled "**LOCAL SELF GOVERNMENT INSTITUTIONS AND WATER CONSERVATION IN KERALA; A STUDY OF KOZHIKODE DISTRICT"** is the summary of the research work carried out by me under the supervision of **Dr. Zacaria T. V**., Principal, Amal College of Advanced Studies, Nilambur in partial fulfilment of the requirement for the award of the **Degree of Doctor of Philosophy in Political Science**. I also declare that no part of this thesis has been submitted by me for the award of any other degree or diploma, and it represents original work done by me.

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CONTENT

		Page No.
1.	**Introduction**	**1-29**
1.1	Statement of the Problem	4
1.2	Brief Profile of the Study	5
1.3	Theoretical Framework	8
1.4	Review of Literature	10
1.5	Research Objectives	19
1.6	Research Questions	19
1.7	Research Hypothesis	20
1.8	Chapter Scheme	20
1.9	Research Methodology	20
1.10	Findings of the Study	22
2.	**Decentralized Governance and Water Conservation: A Conceptual Framework**	**31-71**
2.1	Major Concepts used in the study	31
2.1.1	Decentralization	31
2.1.2	Political Decentralization	32
2.1.3	Fiscal Decentralization	32
2.1.4	Administrative Decentralization	33
2.1.5	De-concentration	33
2.1.6	Devolution	33
2.1.7	Delegation	34
2.1.8	Dis investment	34
2.1.9	Decentralized Governance	35
2.1.10	Local Self-Government Institutions	35
2.1.11	Water Conservation	36
2.1.12	Integrated Water Conservation	37
2.1.13	Water Harvesting	37
2.1.14	Watershed Management	38
2.1.15	Water Efficiency	38

2.1.16 Water Budgeting 39
2.1.17 Water Prizing 39
2.1.18 Virtual Water 39
2.2 Theoretical Framework 40
2.2.1 New Institutionalism Framework 42
2.2.2 Behaviourist Framework 46
2.2.3 Sustainability Framework 53
3. Water Conservation in Kerala: Policies and Practices 73-117
3.1 Introduction 73
3.2 Major Policy Developments on Water Conservation in India 76
3.2.1 Colonial Period 76
3.2.2 Post – Independence Period 78
3.2.3 National Water Policy 1987 80
3.2.4 National Water Policy – 2002 81
3.2.5 National Environmental Policy – 2006 82
3.2.6 National Water Mission (NWM) – 2008 83
3.2.7 National Water Policy – 2012 84
3.2.8 The Draft of National Water Framework Bill – 2016 85
3.3 Water Policy Developments in Kerala 86
3.3.1 State Water Policy of Kerala – 1992 88
3.3.2 State Water Policy of Kerala – 2008 90
3.4 Major Reforms in the Water Policy Framework of Kerala 92
3.4.1 Water is a vital natural resource with economic value 93
3.4.2 Decentralization and Community Participation 94
3.4.3 Restructuring of Government Role 94
3.4.4 Conservational Approach 95
3.5 Water Conservation Practices in Kerala 96
3.5.1 Traditional Techniques in Water Conservation 97
3.5.2 Contemporary Water Conservation Practices 104
4. LSG Institutions in Kozhikode District: An Introduction 119-155
4.1 Defining the Concept of Local Self-Government 119
4.2 Evolution of Local Self Government System in India 121
4.2.1 Colonial period 122
4.2.2 Post–Colonial Period 123

4.2.2.1 Belwant Ray Mehta Committee 124
4.2.2.2 Ashok Mehta Committee 125
4.2.2.3 G.V. K. Rao Committee 126
4.2.2.4 L.M. Singhvi Committee 127
4.2.2.5 73rd Constitutional Amendment Act of India 128
4.2.2.6 74th Constitutional Amendment Act of India 129
4.3 The institutional framework of the LSG system in Kerala 131
4.3.1 The Kerala Panchayat Raj Act (KPRA), 1994 133
4.3.1.1 Grama Sabha 134
4.3.1.2 Village Panchayat 135
4.3.1.3 Block Panchayat 136
4.3.1.4 District Panchayat 137
4.3.2 The Kerala Municipality Act (KMA), 1994 138
4.3.2.1 Functions in the public amenities sector 139
4.3.2.2 Functions in the public assets maintenance sector 140
4.3.2.3 Regulatory functions 140
4.3.2.4 Functions in the public health sector 140
4.3.3 People's Campaign for Decentralized Planning 141
4.4 LSG system in Kozhikode District 142
4.4.1 The genesis of LSG in Kozhikode: A historical survey 143
4.4.2 Institutional profile of LSG system of Kozhikode District 144
4.3.2.1 The Urban LSG System of Kozhikode District 145
4.3.2.2 The Rural LSG System of Kozhikode District 146
5. Water Conservation Initiatives in Kozhikode District 157-208
5.1 Introduction 157
5.2 Physiography 158
5.2.1 Kozhikode Coast 158
5.2.2 Nadapuram-Mavoor Undulating Plain 158
5.2.3 Kozhikode Forested Hills 158
5.3 Soil system 159

5.3.1 Alluvial soil 159
5.3.2 Lateritic soil 159
5.3.3 Forest Loam 159
5.4 Forest 159
5.5 Rainfall 160
5.6 Wetlands 160
5.7 River System 161
5.7.1 Chaliyar (Beypore) River 161
5.7.2 Kuttiyadi (Murat) River 161
5.7.3 Korapuzha 161
5.7.4 Kadalundy River 162
5.7.5 Kallayi River 162
5.7.6 Mahe River (*Mayyazhi puzha*) 162
5.8 Ground Water System 163
5.9 Major Water Consumption Sectors in the District 163
5.9.1 Agriculture sector 163
5.9.2 Domestic sector 164
5.9.3 Industrial sector 164
5.9.4 Energy production sector 165
5.10 Major Issues in the Water Sector of Kozhikode District 166
5.10.1 Water Contamination 166
5.10.2 Groundwater depletion 168
5.10.3 Salinity Intrusion 170
5.10.4 Water Scarcity 171
5.11 Challenges for Water Conservation in the District of Kozhikode 175
5.11.1 Water conservational challenges 175
5.11.2 Challenges of water consumption and contamination 177
5. 11.3 Water governance challenges 179
5.12 Water Conservation Measures in the Kozhikode District 182
5.12.1 Watershed Development Initiatives 183
5.12.2 Initiatives under Haritha Keralam Mission 186
5.12.3 Operations at Village Panchayats 197
5.12.4 Operations at Block Panchayats 198

5.12.5 Operations at District Panchayat 198
5.12.6 Operations at Municipalities 199
5.12.7 Long term strategies 199
5.12.8 Short term strategies 200
5.13 Water Saving Practices in the District 200
6. The Question of LSG Participation in Water Conservation 209-248
6.1 Analysing the role of LSGs in water conservation initiatives 210
6.1.1 Operation Canoly Canal 211
6.1.2 Revival of *Peruvanmadu Thodu* (canal) 219
6.1.3 *Mampuzha* Restoration Project 225
6.1.4 Formation of Biodiversity Block 233
6.1.5 Rejuvenation of Vanimel River 240
7. Findings and Conclusions 249-259
8. Recommendations 261-263
Bibliography 265-281

LIST OF TABLES

Sl. No.	*Name of the Table*	*Page No.*
1	Urban LSGs in Kozhikode District	146
2	Rural LSGs in Kozhikode District	148
3	Basic information on village panchayats in Kozhikode District	149
4	District wise data on waterborne diseases in Kerala	168
5	Drought susceptibility of villages (without perennial water bodies) in Kozhikode District	172
6	Drought susceptibility of villages (with perennial water bodies) in Kozhikode District	173
7	Rejuvenated drains in the Kozhikode District by “Eni njan ozhukatte” campaign	192

CONTENT

		Page No.
1.	**Introduction**	**1-29**
1.1	Statement of the Problem	4
1.2	Brief Profile of the Study	5
1.3	Theoretical Framework	8
1.4	Review of Literature	10
1.5	Research Objectives	19
1.6	Research Questions	19
1.7	Research Hypothesis	20
1.8	Chapter Scheme	20
1.9	Research Methodology	20
1.10	Findings of the Study	22
2.	**Decentralized Governance and Water Conservation: A Conceptual Framework**	**31-71**
2.1	Major Concepts used in the study	31
2.1.1	Decentralization	31
2.1.2	Political Decentralization	32
2.1.3	Fiscal Decentralization	32
2.1.4	Administrative Decentralization	33
2.1.5	De-concentration	33
2.1.6	Devolution	33
2.1.7	Delegation	34
2.1.8	Dis investment	34
2.1.9	Decentralized Governance	35
2.1.10	Local Self-Government Institutions	35
2.1.11	Water Conservation	36
2.1.12	Integrated Water Conservation	37
2.1.13	Water Harvesting	37
2.1.14	Watershed Management	38
2.1.15	Water Efficiency	38

Renjith Kumar O. S. Local self government institutions and water conservation in Kerala A study of kozhikode district. Department of political science University of Calicut.

2.1.16 Water Budgeting 39
2.1.17 Water Prizing 39
2.1.18 Virtual Water 39
2.2 Theoretical Framework 40
2.2.1 New Institutionalism Framework 42
2.2.2 Behaviourist Framework 46
2.2.3 Sustainability Framework 53
3. Water Conservation in Kerala: Policies and Practices 73-117
3.1 Introduction 73
3.2 Major Policy Developments on Water Conservation in India 76
3.2.1 Colonial Period 76
3.2.2 Post – Independence Period 78
3.2.3 National Water Policy 1987 80
3.2.4 National Water Policy – 2002 81
3.2.5 National Environmental Policy – 2006 82
3.2.6 National Water Mission (NWM) – 2008 83
3.2.7 National Water Policy – 2012 84
3.2.8 The Draft of National Water Framework Bill – 2016 85
3.3 Water Policy Developments in Kerala 86
3.3.1 State Water Policy of Kerala – 1992 88
3.3.2 State Water Policy of Kerala – 2008 90
3.4 Major Reforms in the Water Policy Framework of Kerala 92
3.4.1 Water is a vital natural resource with economic value 93
3.4.2 Decentralization and Community Participation 94
3.4.3 Restructuring of Government Role 94
3.4.4 Conservational Approach 95
3.5 Water Conservation Practices in Kerala 96
3.5.1 Traditional Techniques in Water Conservation 97
3.5.2 Contemporary Water Conservation Practices 104
4. LSG Institutions in Kozhikode District: An Introduction 119-155
4.1 Defining the Concept of Local Self-Government 119
4.2 Evolution of Local Self Government System in India 121
4.2.1 Colonial period 122
4.2.2 Post–Colonial Period 123

4.2.2.1 Belwant Ray Mehta Committee 124
4.2.2.2 Ashok Mehta Committee 125
4.2.2.3 G.V. K. Rao Committee 126
4.2.2.4 L.M. Singhvi Committee 127
4.2.2.5 73rd Constitutional Amendment Act of India 128
4.2.2.6 74th Constitutional Amendment Act of India 129
4.3 The institutional framework of the LSG system in Kerala 131
4.3.1 The Kerala Panchayat Raj Act (KPRA), 1994 133
4.3.1.1 Grama Sabha 134
4.3.1.2 Village Panchayat 135
4.3.1.3 Block Panchayat 136
4.3.1.4 District Panchayat 137
4.3.2 The Kerala Municipality Act (KMA), 1994 138
4.3.2.1 Functions in the public amenities sector 139
4.3.2.2 Functions in the public assets maintenance sector 140
4.3.2.3 Regulatory functions 140
4.3.2.4 Functions in the public health sector 140
4.3.3 People's Campaign for Decentralized Planning 141
4.4 LSG system in Kozhikode District 142
4.4.1 The genesis of LSG in Kozhikode: A historical survey 143
4.4.2 Institutional profile of LSG system of Kozhikode District 144
4.3.2.1 The Urban LSG System of Kozhikode District 145
4.3.2.2 The Rural LSG System of Kozhikode District 146
5. Water Conservation Initiatives in Kozhikode District 157-208
5.1 Introduction 157
5.2 Physiography 158
5.2.1 Kozhikode Coast 158
5.2.2 Nadapuram-Mavoor Undulating Plain 158
5.2.3 Kozhikode Forested Hills 158
5.3 Soil system 159

5.3.1 Alluvial soil 159
5.3.2 Lateritic soil 159
5.3.3 Forest Loam 159
5.4 Forest 159
5.5 Rainfall 160
5.6 Wetlands 160
5.7 River System 161
5.7.1 Chaliyar (Beypore) River 161
5.7.2 Kuttiyadi (Murat) River 161
5.7.3 Korapuzha 161
5.7.4 Kadalundy River 162
5.7.5 Kallayi River 162
5.7.6 Mahe River (*Mayyazhi puzha*) 162
5.8 Ground Water System 163
5.9 Major Water Consumption Sectors in the District 163
5.9.1 Agriculture sector 163
5.9.2 Domestic sector 164
5.9.3 Industrial sector 164
5.9.4 Energy production sector 165
5.10 Major Issues in the Water Sector of Kozhikode District 166
5.10.1 Water Contamination 166
5.10.2 Groundwater depletion 168
5.10.3 Salinity Intrusion 170
5.10.4 Water Scarcity 171
5.11 Challenges for Water Conservation in the District of Kozhikode 175
5.11.1 Water conservational challenges 175
5.11.2 Challenges of water consumption and contamination 177
5. 11.3 Water governance challenges 179
5.12 Water Conservation Measures in the Kozhikode District 182
5.12.1 Watershed Development Initiatives 183
5.12.2 Initiatives under Haritha Keralam Mission 186
5.12.3 Operations at Village Panchayats 197
5.12.4 Operations at Block Panchayats 198

5.12.5 Operations at District Panchayat 198
5.12.6 Operations at Municipalities 199
5.12.7 Long term strategies 199
5.12.8 Short term strategies 200
5.13 Water Saving Practices in the District 200
6. The Question of LSG Participation in Water Conservation 209-248
6.1 Analysing the role of LSGs in water conservation initiatives 210
6.1.1 Operation Canoly Canal 211
6.1.2 Revival of *Peruvanmadu Thodu* (canal) 219
6.1.3 *Mampuzha* Restoration Project 225
6.1.4 Formation of Biodiversity Block 233
6.1.5 Rejuvenation of Vanimel River 240
7. Findings and Conclusions 249-259
8. Recommendations 261-263
Bibliography 265-281

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CHAPTER 1
INTRODUCTION

"Think Global and Act Local", the slogan raised by the United Nations Environment Programme (UNEP) held at Rio de Janeiro in 1992 explicitly reveals the institutional role of Local Self-Governments (LSGs) in the natural resource management. It indicates, that today, LSGs have appropriate institutional machinery to facilitate the management of essential natural resources like water as the problems and solutions being addressed by the resource management have their roots in local interventions. LSGs establish social, economic, and environmental infrastructure, oversee local planning processes, articulate local environmental policies and regulations, and even to co-work in executing national and sub-national environmental policies. Hence, the level of government closest to the people and natural resources enjoys a significant institutional fit and capacities in mobilizing and educating the local communities to promote sustainable conservation of essential natural resources like water. Many recent surveys and studies of United Nations agencies and other global environmental institutions reveal that despite innumerable number of global and local water conservational and remedial initiatives, the water crisis across the world is still worse than ever. Similarly, in 2015, the Global Risk Report of the World Economic Forum reminded the global society that around one billion people in the world facing severe freshwater scarcity. In this alarming context too, recent global summits and conventions on the environment unanimously concluded that the use of institutional resources and interventions of LSGs must be adopted as a global strategy in addressing the various water sectoral issues across the world.

In India, intensifying population pressure and urbanization coupled with rampant industrialization and development have resulted from the

subversion of sustainable and balanced use of natural resources like land, water, forestry, etc. In addition, policies, programmes, and other statutory measures made to regulate the use of natural resources which lacked social acceptance and political will often become inactive or nominal. The higher institutional priorities paid to the developmental initiatives by all the stakeholders' right from the national to local level made the environmental laws and water use regulations voluntary. Gradually, such institutional lapses led to the rise of many serious water sector issues like freshwater scarcity, groundwater depletion, salinity intrusion, and demolition and contamination of freshwater systems in India too.

World Bank report in 2018 alarmed the Indian society too by reporting that above 600 million Indians suffering from moderate to extreme freshwater crisis and which results in the death of around two lack people annually. In addition, according to the NITI Aayog study, the demand for fresh water will outstrip the supply by 2030. The Composite Water Management Index-2018 prepared by the NITI Aayog denotes that 70% of the freshwater resources in India are being contaminated (NITI Aayog, 2018). In this context, in line with the global vision and mission of water governance, India reinforced the approach of decentralized governance in its water sector also. Initially, the new approach adopted to manage the consumption and conservation of freshwater resources have not paid adequate priority to the institutional role of local planning and local governance by LSG institutions. It led to the sustenance of the aforementioned water sectoral issues resulting from the gradual development of water insecurity in the country. Therefore, the recent national water policies of India and subsequent state-level policies suggested a strong institutional framework for decentralized water governance to ensure sustainable and participatory water conservation by LSGs. Besides, it facilitated the authorities to appropriate the local knowledge and resources

along with the possibilities of local planning and governance for water conservation (State Planning Board, 2017).

Kerala is generally said to be a water-rich state among Indian states. But the situation has changed over the last couple of decades due to the intensive population growth, urbanization, industrialization, and other human interventions, which resulted in the degeneration of the entire freshwater resource system of the state. The policymakers generally conclude that the water crisis in Kerala is more often a governance issue than the issues of freshwater resources (surface and ground) and the source (rainfall). Such water sectoral issues often resulted from the inefficiency of institutional types of machinery to enforce the environmental regulations and water conservational measures effectively. In addition, most of such water conservational measures and environmental regulations often framed by the priorities of political economy were not sufficient and suitable at local level realities. Such institutional lapses are automatically reflected in the coordination, communication, and education among the stakeholders of freshwater conservation initiatives of the state with societal support. In this context, in line with global and national strategic reforms on water conservation missions, Kerala also adopted the policy framework for decentralized water conservation by LSGs (State Planning Board, 2017). Though subsequent legislative measures and appropriate institutional frameworks were implemented in the state, various water sectoral issues resulting in water insecurity are still active in Kerala. So, it is relevant to make a timely and closure analysis of the institutional programmes and operations in the decentralized water conservation mission of the state. Therefore, the present study intended to analyse the institutional fit and capacities of LSG institutions in their formal water conservational initiatives.

1.1 Statement of the Problem

Kerala is one of the rare states of India endowed with an abundance of rivers, lakes, diverse wetland formations, and high average annual rainfall (3,055 mm). However, despite the abundance of such surface and groundwater resources in sufficient quantities, the state is being experienced constant water scarcity issues during the last decades. This is partly due to the topographic features of Kerala such as the undulating structure of the land and the low water storage capacity of hard crystalline rocks which underlie nearly 88% area of the state (Central Ground Water Board, 2012). In addition, along with irrational human interventions like intensive transmutation of wetland areas, destruction of water bodies, rampant sand mining, water contamination, etc., preference for homestead human settlement pattern in the state resulting heavy pressure on the remaining forest and wetland areas for want of habitable land plots also intensified water scarcity in Kerala. Consequently, such factors create multiplier impacts on the freshwater reserve of the state resulting in severe drought in various parts of Kerala during the recent history.

In line with the state water policy framework-2008, Kerala adopted decentralized governance as a strategic approach in its water conservation mission. Subsequently, the LSG institutions in the state have been entrusted with some institutional powers and financial resources to do needy steps for freshwater conservation with community participation at the local level. The activities like cleaning rivers and ponds, building miner earthen check dams, building water harvesting structures, preventing deterioration of water bodies and other wetland formations, etc. were termed as the water conservational measures of LSGs. Besides, along with such statutory measures, various timely institutional and legislative reforms were introduced in Kerala to accelerate the decentralized water conservation mission by LSG institutions.

Though such statutory institutional reforms toward decentralized water conservation were introduced in the state, major water sectoral issues such as water scarcity, groundwater depletion, water contamination, and salinity intrusion still threaten the various regions in the state. In this context, the present study concentrates to understand the actual institutional capacity of LSG institutions in the various aspects of its formal water conservational measures and programmes. Therefore, this study intended the closure analysis of various water conservational programmes of the LSG institutions in Kozhikode District which is one of the worst affected districts in Kerala experiencing the aforementioned water sectoral issues intensively.

1.2 Brief Profile of the Study

Water is one of the essential components of human survival and development. Therefore, freshwater availability has always been a vital factor in ensuring socio-economic growth and food security of the growing population. The freshwater availability has been confirmed through sustainable water conservation techniques, climatic-oriented farming and crop patterns and water-sustainable life pattern, etc. However, in the last few decades, the environmental consequences of growing population pressure, intensive urbanization and subsequent industrialization, and aggressive development process and associated consumerist culture have adversely affected the natural hydrological cycle of rainfall, soil moisture, groundwater, surface water, and water storage of all sizes. Such multifarious human intervention has led to overuse, abuse, and contamination of limited freshwater resources and has disturbed the quantity, quality, and natural cleansing capacity of water available. Therefore, the sustainable conservation of our freshwater resources became essential to ensure the water security of our growing population. It was also becoming an essential institutional responsibility to avoid the growing conflicts and the possibility of social

unrest in the society in the future due to freshwater scarcity. Consequently, national and state-level governments in India adopted a policy framework of decentralized water governance to ensure sustainable conservation of local water resources through decentralized operations with the active participation of local authorities and communities (State Planning Board, 2017).

73rd and 74th Amendments in Indian Constitution empowered the LSGs in the country with a strong statutory framework to discharge functions regarding the conservation of essential natural resources including water. This cast a constitutional imperative on all the state-level governments to come up with a decentralized institutional framework of policies and programmes on freshwater conservation. In Kerala, the state enactments of the Panchayat Raj and Municipality Acts in 1994 have constitutionally equipped the LSGs in Kerala for such decentralized initiatives on freshwater conservation. It placed a strong institutional base for LSG institutions and local communities to come together for water conservational measures at the grass-rout level. Therefore, along with subsequent state water policy reforms, several statutory measures of the state also placed the LSG institutions as the central point of its water conservational initiatives in Kerala. Such institutional experience of decentralized governance is easily sensitized by Kerala as it is already experienced with its unique 'Peoples Planning Campaign'.

Even though such decentralized water conservation measures by LSG units are reinforced through many strategic and institutional reforms by the state, water scarcity issues are still disturbing the state frequently due to various institutional or infrastructural limitations in the governance of water conservation. Along with such institutional factors, topographic features of the land determine the frequency of such water sectoral issues in each district of the state. Consequently, most of the villages in each district of the state

being suffered from moderate drought, and few of them are under the threat of drought (Kerala State Drought Monitoring Cell, 2016).

Therefore, the present study aimed at the assessment of the existing institutional framework of various water conservation measures carried out by LSGs to enhance the institutional fit and capacity of LSG institutions in Kerala to maximize the efficiency of their institutional mechanism of decentralized water conservation. Thereby, this study concentrates on understanding the institutional role of LSG institutions in various aspects of the formal freshwater conservation programmes with special reference to Kozhikode District; one of the districts worst affected by water scarcity in Kerala. As per the report of Kerala State Drought Monitoring Cell (2016), seven villages in Kozhikode District come under the category of drought and 110 villages experience the drought moderately. This district is situated on the southwest coast of India sharing borders on the north by Kannur, on the east by Wayanad, on the south by Malappuram, and on the west by the Arabian Sea. There are mainly three distinct regions - the sandy coastal belt, the rocky highlands found by the hilly portions of the Western Ghats, and the lateritic midland. Of the total area of 2344 Sq. Km, the sandy coastal belt is 362.85 Sq. Km, lateritic midlands are 1343.50 Sq. Kms and rocky highlands are 637.65 Sq. Km (Central Ground Water Board, 2013). The LSG system of the district is spread over these three regions and consists of 1 Municipal Corporation, 7 municipalities, 1 District Panchayat, 12 Block Panchayats, and 70 Village Panchayats. The study is mainly proposed in the context of the alarming level of water scarcity in the Kozhikode District (Information Kerala Mission, 2021).

1.3 Theoretical Framework

Since the International Conference on Water and the Environment-1992 held in Dublin various United Nations agencies and other international institutions of environmental development recognized decentralization as an essential strategy for sustainable water conservation. Subsequently, many theoretical and practical types of research and case studies by researchers and academic or governmental institutions on decentralized water governance emerged during the last few decades. It led to the development of a wide range of theoretical perspectives and frameworks on decentralized institutional reforms, especially on the decentralized governance of essential natural resources like water. As a result, a lot of diverse theoretical approaches and perspectives developed in this sector regarding the institutional role and impact of different actors and factors in the decentralized water conservation initiatives. While analysing some of such theoretical observations on the various aspects of water conservation governance, it was found that the New Institutionalism Theory and integrated assessment of some sustainability and behaviourist theoretical observations are relevant to the present study.

Recently, the majority of countries across the world are implementing decentralization reforms in different versions such as 'top-down' and 'bottom-up' patterns of decentralized governance in the management of essential natural resources, especially water. But institutional experiences from the global level often reflect that the outcomes of such 'top-down' and 'bottom-up' patterns of decentralized governance are mixed and partial, and the 'community participation' still waiting for equity and efficiency in natural resource governance (Ribot, 2004). Thereby, the 'New Institutionalism' framework developed with a theoretical observation that "decentralization is a complex adaptive process that involves a combination of natural and political

intervention by institutional actors and agencies to draw on existing structures to negotiate and renegotiate the existing unequal power relations to manage water, and it connate to the spatial distinction of being 'top-down' or 'bottom-up', but a messy integration of these" (Saravanan, 2009).

The "Four Dublin Principles"-1992, the United Nations declaration-2005 on the period of 2005 to 2015 as the "Decade of Education for Sustainable Development" and similar global initiatives established the vital role of water-relevant behaviour of user community in the decentralized and sustainable water conservation approaches (Sarabia-Sanchez et al, 2014). In this context too, many theoretical observations like 'ecological behaviour', 'water conservation behaviour', 'water conflict behaviour', 'environmentally significant behaviour', etc. developed across the world to determine the impact of water conservational behaviour of user communities on water conservation. But such behaviourist theoretical perspectives in particular may not explain the impact of overall aspects of water conservational behaviour on water, therefore, the present study described the fundamental observations of some relevant behavioural theories on water conservational behaviours of user communities. Besides, it is added with an integrated assessment of the various features of such theoretical perspectives on water-relevant behaviour patterns of user communities as it helps identify and prioritize behavioural changes that result in a better impact on consumption and conservation of water (Valizadeh et al, 2019). However, still, there is no single theoretical framework that can determine the impacts of external and internal factors and their multi-dimensional role in stimulating the water conservational behavioural pattern of users since they belong to different socio-economic and geographical contexts.

Frequent administrative reforms and their segregated operations in the water sector often subverted the sustainability principles resulting in the

contradictory and undesirable impacts on the global water resource system and the water conservational efforts at the global to the local level. Therefore, United Nations raised the slogan of sustainable development through its global programme Agenda 21 (1992). Consequently, many global and local theoretical perspectives are being formulated on the sustainable development and sustainability of water governance too. Some sustainability principles or approaches such as participatory approach, future-oriented approach, integrative/holistic approach, polluter pays approach, precautionary approach, and rational approach were identified as common in many theoretical perspectives or frameworks. However, most of the relevant theoretical frameworks that emerged on sustainable water governance were based on some selected context-specific sustainability principles. But such operational frameworks individually may not address the holistic features of desired sustainable water governance. Therefore, the present study analysed some relevant theoretical perspectives and observations on sustainable water conservation initiatives.

1.4 Review of Literature

The review of literature on the existing research, study reports, policy documents, and statutory frameworks regarding the institutional aspects of water conservation by the LSG institutions has been conducted with a specific focus on characterizing the present scenario of decentralized water conservation by LSGs in the state.

The term Local Self Government is defined as the base unit of government which constituted of locally elected community representatives and government-recruited officials (Smith. S, & Butterworth,2005). To him, an ideal LSG is structured with a legislative forum of public representatives and an executive body of officials to discharge the statutory authorities and

responsibilities decentralized from the central unit of government. The studies of Venkatarangiaya (1969) already observed that such statutory local units of governments are essential for the effective governance of local matters and sustainable development at the grass-route level by ensuring active participation of communities, because, it works on the principle that the local demands and issues can be resolved by the local authorities better than by the central authority of the government.

The UNDP (1996) observed that institutional practices such as local planning and local governance in decentralized governance can be an accelerating factor in developing civil society politically vigilant. In 1997, UNDP elaborated the concept of decentralized governance as an effective institutional method to realize the goals of its sustainable human development mission of maximization of the participatory governance and better experience of public services regarding the public life and habitat. The report of UNDP (1998) explained the term decentralized governance as an institutional mechanism of systematic and harmonious instructions resulting from balanced decentralization of statutory authorities and responsibilities among central and local governments and non-government agencies, and the institutional capacity of local governments to implement their statutory functions on a participatory manner.

Glossary of Environmental Statistics (1997) framed the term water conservation as the institutional policies and programmes prepared to manage the preservation and development of the freshwater system as an essential natural resource to maintain the sustainability of the water resource system and to satisfy the human demand on freshwater. Amy Vickers (2001) observed water conservation as the “beneficial reduction in the use, loss, and wastage of water". To him, this process includes all the formal and informal measures which can maximize the water efficiency of use and users.

Therefore, Amy Vickers emphasized the programmes such as reduction of evaporation, irrigation and runoff losses of freshwater, promotion of reuse and recycling of water, and the prevention of wastage and contamination of freshwater available as the water conservation practices.

The Global Water Partnership (2005) emphasized integrated water conservation as a method of inter-sectoral management of freshwater and water-dependent natural resource system to realize sustainable preservation and development of freshwater resource systems and the reduction of its contamination. Global Water Partnership promoted this method as a strategic shift in the institutional measures of water conservation from the sectoral and sub-sectoral approach to a holistic method of water conservation in a sustainable manner. The Dublin Statement (1992) emphasized decentralized water governance as a global strategy to ensure institutional cooperation and user community participation in water governance, especially in water conservation. It shifted the role of central governments from water service providers to a facilitator in the decentralized water governance by the planning and implementation of the consumption, conservation, and development of water at the local government level.

Traditionally, all the freshwater resources have been maintained as a public and sacred natural resource by culture in India. But, during the British reign, such traditional climatic-oriented water consumption patterns in the agro-social life of India began to change (D' Souza. R, 2006). This study added that the colonial reign in India introduced the concept of government control or ownership over all the freshwater resources of the country. The studies of Agnihotri (1996) already observed that during the colonial period, the colonial irrigation reforms and water technologies developed for the commercialized pastoral economy subverted the water-friendly agro-social life patterns of traditional India. By the provisions of the Bengal Irrigation

Act (1876) and Bombay Irrigation Act (1879), the customary rights and powers of local communities to access their natural and traditional freshwater sources were demolished to establish the concept of government ownership of all the water resources. Apart from these reforms led by 'colonial monitory logic', the Madras Rivers Conservancy Act (1884) introduced the new concept of 'compulsive river conservation' in colonial India. It empowered the colonial authorities to restrict farming and other constructions in the riverbed areas.

During the post-colonial period, the Draft Constitution of India (1950) restored the traditional status of water as 'public property' and established its policy on the water to ensure free access to water as the fundamental right of citizens. The concept of 'compulsive water conservation' initiated by the old Madras Rivers Conservancy Act extended through the state-level enactments such as 'The Orissa River Pollution Prevention Act-1954, *Uttar Pradesh Bhoomi Evam Jal Sanrakshan Adhiniyam*-1963, and Maharashtra Prevention of Water Pollution Act-1969. The Water (Prevention and Control of Pollution) Act (1974), one of the first legislative measures of India to ensure the national level water conservation by preventing the water contamination and the restoring of freshwater resources substantiated the constitutional concern of India on water. The provisions of the 42nd Amendment of the Indian Constitution (1976) reinforced this constitutional policy by upholding the conservation of all essential natural resources like water as the fundamental duty of the citizens of India.

The first National Water Policy (1987) of India emphasized the implementation of a national policy framework for water governance to overcome the contradictions in various regional water policies which are influenced by the priorities of their regional political economy. The major provisions of this policy framework focus on addressing the emerging water sector issues such as decreasing per capita water availability, irrational

extraction and consumption of water, and intensifying deterioration and contamination of water resources by various institutional reforms like comprehensive resource planning for hydrological units, integrated policies on land use and water use, watershed management, etc. The revised National Water Policy (2002) of India recognized the water resource as a component of a larger ecosystem and focused more on the water conservational aspects of water governance by adopting the innovative concepts like water resource planning, institutional mechanism, information system, private partnership, water quality, and efficiency, etc. Along with the traditional water harvesting methods, this document promoted many scientific techniques of water conservation like artificial water recharging, water treatment, precision methods, polluter-pays principle, etc. cost-effectively.

The National Environmental Policy (2006) of India reinforced the integrated approach in the development of the freshwater resource system as a whole which includes surface water, groundwater, and related wetland formations because each of them has characteristic features and interdependence to another natural resource system. Similarly, The Comprehensive Mission Document of the National Water Mission (2008) suggested the adoption of an integrated and scientific approach to water conservation measures at the basin level to address the threat of growing environmental degradation. The recent National Water Policy (2012) of India discussed the strategic relevance of recognizing water as an economic good and privatizing the major water services wherever it is feasible to increase the efficiency of water conservation and consumption by the measures of water recycling, water pricing, water harvesting, desalination, etc. The study report of the Central Water Commission (2017) discusses such scientific and innovative water conservation techniques which are feasible as modern water conservation measures in line with the national policy framework. Along with

adopting modern scientific measures, the use of traditional indigenous water conservation techniques is also reinforced by this policy as a sustainable method.

The study report of Agarwal and Narain (2005) which is exploring the various traditional water conservation techniques of India stated that the basic concept behind all the eco-friendly traditional water conservation practices of India is that "being a source of water, rainwater shall be saved whenever and wherever it falls". The studies of P. Vasudevan (2015) on the water management strategies in Kerala reveal various topographic-based traditional water conservation techniques still prevail in practice. The major provisions of the Draft of the National Water Framework Bill (2016) combine all the water conservational policies and practices in the water sector being implemented by the central, state, and local governments into a single legal framework to clear the contradictions in the national water conservation mission. Therefore, the report of the Central Water Commission in 2017 explains that, though state-level governments are allowed to frame their water policies and programmes, the Central Government is responsible to regulate them under the national law framework.

The State Water Policy (1992) of Kerala combined all the policies and programmes of various sectoral and sub-sectoral departments of state and local governments into a single framework prepared in line with the national policy framework. The major provisions of this first individual water policy of Kerala are mainly based on the aquatic, topographic, and climatic features of Kerala. The recent State Water Policy (2008) of Kerala emphasized the institutional restructuring of the water governing mechanism in the state by redefining the operational role of all the formal and informal stakeholders in the water governance at the micro-watershed level. It is seriously suggested that the water conservational and developmental operations of the state shall

be decentralized among the State Government, Local Governments, and community institutions to facilitate the decentralized water conservation based on sustainable and participatory principles. By the reforms of the 73rd and 74th Constitutional Amendment Act in 1992, the LSG system of India already experienced adequate structural changes to adopt the decentralized governance of essential natural resources like water by urban and rural LSGs.

In line with such reforms of the 73rd and 74th Amendment of the Constitution, the Kerala Panchayat Raj Act and Kerala Municipality Act-1994 restructured the institutional framework of urban and rural local bodies with sufficient statutory powers to reinforce the measures of decentralized governance. Isaac and Franke (2000) observed that the experience of the People's Plan Campaign in Kerala facilitated the institutionalization of democratic decentralization at the grass-route level resulting in community-oriented and resource-oriented local governance. This book states that the People's Plan enabled Kerala to become the first state in the country to have a successful set of watershed master plans for sustainable development. The case study report of Vijayananth (2009) observes the experience of decentralized governance in Kerala as a home-grown practice organically evolving from the socio-political and administrative context of Kerala. Subsequently, Kerala has developed its legislative framework and institutional network to facilitate decentralized water conservation missions by LSGs. As per the Handbook of Haritha Keralam Mission (2017), Kerala introduced a special purpose vehicle known as Haritha Keralam Mission to facilitate the planning and practicing of various water conservational programmes by LSGs in an integrated and decentralized manner. This document added that this mission addresses the matters of social acceptance, economic viability, technical feasibility, and community participation by

facilitating bottom-up and top-down approaches in the water conservation mission by LSGs.

The theoretical observations of Saravanan (2009) developed a theoretical framework known as 'New Institutionalism' to maintain a balanced integration of such 'top-down and bottom-up approaches in the decentralized water governance practices. To him, the actors with discursive capacities in the decentralization process transmute themselves as human institutions to reinforce the existing system by the integration among stakeholders in decentralized water governance. According to the theoretical perspective of Valizadeh (2019), an integrated analysis of distinct theoretical approaches to water-relevant behaviour of user communities will be useful in determining and prioritizing relevant behavioural changes resulting in better governance towards water conservation. The theoretical assessment made by Maynen W and Doornbos M (2004) viewed that interventions of government and non-government agencies with multiple and contradictory interests in water conservation often result in conflict and negotiation on the sustainability of water conservation practices. They observed that such undesirable impacts will be prevented by a stable LSG mechanism with sufficient judicial and financial powers to execute their sustainable models of water conservation.

The water management report of the State Planning Board (2017) the quantity and quality of freshwater resources in Kerala facing serious threats such as water contamination, groundwater depletion, salinity intrusion, and severe drought. This document again alarms that the water conservational intervention of the state is being challenged by distinct and interrelated constraints regarding the natural water resources, water pollution/deterioration, water governance, and topography of the land. The Environmental Assessment Report (2010) explains the experience of Kerala regarding the widespread initiatives of each district for the preparation of the

Block Panchayat level master plan of watershed development aimed at integrated water conservation. The studies of M. Firoz and H. Banerjee (2014) found that such watershed-based programmes are facilitating distinct water conservational measures appropriate to the geo-hydrological features of the plan area resulting in better water conservation. The environmental analysis report of KRWSSA (2000) also observed that the freshwater available in the land is the output of the interaction between the rainfall and geo-hydrological components of each watershed area.

The joint study of Central and State Groundwater Boards (2020) alerts the state about the falling tendency of groundwater table in Kerala and it reveals the various Block Panchayats come under the category of critical zone and partial critical zone. The report of the National Green Tribunal of India (2019) declared that most of the rivers in Kerala facing contamination, especially the three major rivers of Kozhikode District come under the category of severe contamination. Similarly, the study carried out by CWRDM (2019) reveals that most of the surface water sources and open wells in the urban and semi-urban areas of Kozhikode District are contaminated with a heavy load of coliform and suffering fluctuations in pH values. As per the study report of Kerala State Drought Monitoring Cell (2016), seven villages in Kozhikode District come under the category of drought and 110 villages experience the drought moderately. Therefore, all such alarming situations demand the state for more comprehensive institutional measures to restore its water resource system.

Therefore, the brief literature review indicates that there is a need to analyse the question how best the institutional mechanism of LSGs to effectively intervene in the decentralized water conservation mission of the state. The current research study will be a pioneering attempt in this direction.

1.5 Research Objectives

The purpose of the present study is to contribute to a close understanding of the actual and potential institutional role the LSG mechanism plays in the decentralized water conservation mission of Kerala.

- To analyze the nature of the LSG system in Kerala.
- To analyze the formal institutional arrangements of LSGs that exists towards decentralized water conservation in Kerala.
- To determine the institutional capacity of LSG institutions in the freshwater conservation of Kozhikode District in Kerala.
- To develop a framework of suggestions for future research and to develop a more effective institutional mechanism of water conservation by LSG institutions.

1.6 Research Questions

1. How does the LSG system function in Kerala in connection with water conservation?
2. What are the specific policies and programmes for decentralized water conservation in the state of Kerala?
3. How can LSG institutions contribute to the decentralized water conservation in Kozhikode District?
4. What are the ways to strengthen the institutional role of LSGs in decentralized water conservation?

1.7 Research Hypothesis

1. The LSG institutions in Kerala have become one of the important agents for decentralized water conservation.

2. Even though the LSG institutions in the district of Kozhikode are active in the work of water conservation, water scarcity continues to exist in the area.

3. The level of LSG participation in planning and implementation seems to be a decisive factor in the success of water conservation projects in the district of Kozhikode.

1.8 Chapter Scheme

Chapter 1: Introduction

Chapter 2: Decentralized Governance and Water Conservation: A Conceptual Framework

Chapter 3: Water Conservation in Kerala: Policies and Practices

Chapter 4: LSG Institutions in Kozhikode District: An Introduction

Chapter 5: Water Conservation Initiatives in Kozhikode District

Chapter 6: The Question of LSG Participation in Water Conservation

Chapter 7: Findings and Conclusions

Chapter 8: Recommendations

1.9 Research Methodology

The present study, both historical and analytical, is intended to analyse the institutional capacity of LSG institutions and the extent of the actual

institutional role played in decentralized water conservation. The historical approach is used to make a proper understanding of the relevance of decentralized water governance as it provides an opportunity to trace the overall developmental stages of local governance and water governance in Kerala. The analytical approach as it provides the closure analysis of the legislative and policy frameworks, institutional settings, and operational roles of LSGs in the decentralized water conservation which would develop a close picture as regards the actual level of institutional fit and capacities of LSG institutions for decentralized water conservation mission.

The present research has followed a combination of doctrinal and non-doctrinal methods of study to capture data from policy documents, statutory frameworks, books, legislation, regulations, projects, and various sectoral institutions as regards decentralized water conservation by LSGs. The doctrinal method of research includes the studies in research centers, libraries, archives, and related sectoral institutions of local governance and water governance to seek the support of institutional documents and study reports for the research. The non-doctrinal method consists of field visits to project areas of various water conservation initiatives led by LSG institutions in Kozhikode District and meetings/interactions with officials, resource persons, and residents to understand their operational roles in such local water conservation initiatives.

In addition, the case study method is used in this study to capture the actual operational role of LSG institutions carried out in the various water conservation initiatives. The selection of case study projects was made based on the purposeful sampling method. The individual projects opted for a case study selected from formal water conservation initiatives of various urban and rural LSG institutions of Kozhikode District which are representing diverse topographic features of the land such as high-land, mid-land, low-land, and coastal land. The selection of such studied LSG institutions was also made

based on a purposeful sampling method to ensure the representation of all the institutional/structural variants of urban and rural LSG systems in Kerala.

This study is empirical. Primary data was obtained from selected LSG institutions in Kozhikode District such as Kozhikode District Panchayat, Kozhikode Block Panchayat, Vanimel Village Panchayat, Kozhikode Municipal Corporation, and Feroke Municipality, and their selected water conservational initiatives. Besides, many relevant collected from the officials, residents, and resource persons of some sectoral institutions like Haritha Keralam Mission, CWRDM, etc. as the other institutional stakeholders in the decentralized water conservation initiatives in the district. Various policy documents, Acts, statutory regulations, study reports, and work reports of State Government and its agencies are also used to collect primary data regarding the water sector and its governance. Relevant information from books, journals, articles, and newspapers was used as secondary data.

The primary and secondary data were obtained by applying qualitative methods of data collection. To collect primary data qualitatively, the researcher has carried out intensive field visits to selected LSG institutions and their project areas and conducted individual meetings or interactions with institutional stakeholders and other community stakeholders as regards the decentralized water conservation initiatives. Apart from these, the researcher has analysed various legislative and policy documents, statutory regulations, and study reports prepared by government agencies. The researcher obtained secondary data through an intensive analysis of the information from various books, articles, and newspapers regarding the decentralized water conservation measures by the LSG institutions.

1.10 Findings of the Study

The institutional fit and capacities that have been experienced in the closure analysis on the institutional operations of LSG initiatives for local water conservation are following;

- As an institutional agency of effective community participation, the LSGs opened an institutional platform both for planning authorities and local communities to work together on water conservation at the local level.

- As a convenient mechanism of multi-institutional convergence, the LSG institutions are becoming institutionally able to appropriate the interdepartmental resources and expert services of central and state government agencies and institutional resources of other water conservational projects which are required local water conservation.

- As a local statutory mechanism, the LSG institutions have functioned as the grass-route level statutory agencies of the government for the implementation of many long-term and short-term measures of the state toward sustainable water conservation.

- As an agency of local resource mobilization, the institutional settings of LSGs have enjoyed an institutional fit in mobilizing the user community and civil society resources towards low-cost and sustainable water conservation at the local level.

- As a central point of watershed development programmes in the state, LSG institutions accelerated the method of integrated water conservation through more resource-based and user-based watershed initiatives at the grass-route level, especially in agriculture and allied sectors.

Institutional gaps or limitations have been revealed in the present analysis of various water conservation initiatives carried out by LSG institutions are following;

- Due to the proliferation of LSGs, the limited territorial jurisdiction of LSGs is not favorable to back up the macro initiatives for water

conservation by LSG institutions, especially the conservation of flowing water bodies like rivers, canals, streams, etc.

- Distinct institutional priorities of the various departments in the government which is involved in the macro water conservation programmes often constrained the water conservational efforts of LSGs.
- Local community resistance against some innovative water conservation techniques regarding the possible impact of such initiatives upon them often undermined many sustainable water conservation strategies that LSGs are trying to implement.
- Private ownership and illegal occupations on deteriorating water bodies and related eco-systems are constraining several LSG interventions for sustainable conservation of such local water resources.

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CHAPTER TWO

DECENTRALIZED GOVERNANCE AND WATER CONSERVATION: CONCEPTUAL FRAMEWORK

The present chapter contains an exclusive analysis of various terms and concepts used in this study and a comprehensive discussion of relevant theoretical observations on decentralization and decentralized water conservation. The first section of the chapter conceptualizes major terms and concepts used in this study and the second section is a theoretical framework that covers the existing trends, techniques, and impacts of decentralized water conservation initiatives.

2.1 Major Concepts used in the study

2.1.1 Decentralization

Lexicographically, the concept of decentralization denotes the territorial dispersion of administrative powers from a central unit of government to its local government institutions. Such a generalized version of decentralization is concerned with the extent to which authority and responsibility are distributed across the territorial hierarchy of the government, and the agencies and processes through which such devolution works (B.C. Smith, 1985). Even though, it is difficult to express the multidimensional meaning of the dynamic concept of decentralization with a single set of definitions. However, to develop a framework on the impact of decentralized governance on water conservation, it is necessary to define a common definition; hence we define the relevant terms on decentralized governance and water conservation as below.

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Decentralization is a process based on state policy reforms targeted at "the distribution of institutional authorities of Government among its various organs of defined geographic or functional competence according to permanent constitutional or legislative provisions" (Encyclopaedia Americana, 1992). In this process, the power center is expanded from a micro-unit to a macro unit of a larger number of stakeholders as well as from a central unit to a local unit (Pollit, 2005). Generally, decentralization reforms are categorized into three channels political, administrative, and fiscal - depending on the mode of power devolved (Gupta D.N, 2004).

2.1.2 Political Decentralization

Political Decentralization refers to the set of constitutional reforms and governmental policies implemented to ensure the representation of local polities in the state political system (USAID, 2009). It is the devolution of electoral capacities to local actors to strengthen the political autonomy of local government institutions. So, political decentralization is the process of transferring political authority from the central unit of government to local units. It presupposes that local governments to which responsibilities are devolved must be administered by local actors elected from local polities. Such a variant of decentralization is often referred to as devolution (Conyers, 1983).

2.1.3 Fiscal Decentralization

Fiscal Decentralization transfers fiscal accountability through assigning authorities on expenditures (capital and revenue) and revenues (grants, taxes, borrowings, etc.) of public services from the national government to local government institutions at the regional level (Litvack et.al, 1998, 10, 26-27). So, it is the process of de-concentrating the budgetary and revenue-generating powers and fiscal resources from the central unit of

government to local government units (United Nations (DDSMS and UNDP), 1996).

2.1.4 Administrative Decentralization

Administrative Decentralization is a set of governmental policy reforms to distribute the authority of governance and public services (health, education, community development, etc.) among the local government institutions of central government (Manor, 1999). Administrative decentralization allows the devolution of decision-making, planning, and administrative authorities from the central unit of government to its local government institutions. So, it provides an integrated system for collaborating with a lower, peer, and higher units of government and even with non-governmental actors in the state (Rondinelli D, Nellis. J, 1986 and USAID, 2009).

Therefore, lots of organizational varieties are allowed to exist in the complex and liberal system of administrative decentralization and such organizational varieties are functioning even within the same government system or State. So, based on their distinct purposes, such operational varieties in administrative decentralization are also defined below.

2.1.5 De-concentration

It is the process of transferring the responsibilities of a central administrative unit to its local units within the system. Such dispersion of functions includes planning and governance of particular areas like education, health, rural development, etc. (UNDP, 1999).

2.1.6 Devolution

It is the transfer of decision-making authority from the central unit of government to local government institutions. So, devolution is considered one

of the genuine variants of administrative decentralization because it transfers a specific volume of autonomy and legitimacy to local self-government institutions (UNDP, 1999).

2.1.7 Delegation

Subnational units or local agencies of government such as rural development Corporations, Housing Boards, and Community Development Corporations execute some specific responsibilities on behalf of the central or state government. Such administrative arrangements in decentralization are termed a delegation (UNDP, 1999).

2.1.8 Dis investment

It is the transfer of functions or responsibilities of government mechanisms to non-government organizations or private communities. Such transferring of responsibilities may be in the forms of ' privatization' or 'private-public partnerships' or 'contracting out (UNDP, 1997). Defining the term disinvestment as a variant of decentralization is a controversial issue. Some writers like James Manor separate the concept of privatization or disinvestment from the dimensions of decentralization. Manor substantiates his arguments based on two reasons. Firstly, privatization or disinvestment in administrative decentralization includes transferring government responsibilities to the outside parties of the government mechanism. Secondly, the non-governmental organizations or private groups involved in the disinvestment process are often highly centralized or macro, so such disinvestment often results from a shift of authority and resources from one centralized system to another one (Manor, I999).

2.1.9 Decentralized Governance

The term governance refers to the process by which government policies and programs are formulated and executed in the state. Governance is the total output of relationships and interactions among the various stakeholders from the government, non-government, private, and civil society sectors of the state. Such interactions among different stakeholders of the state determine how public services are offered (UNDP, 2000). Decentralized governance is defined as the mechanism of systematic and harmonious interactions resulting from balanced devolution of authorities and responsibilities among a central unit of government and local government institutions and non-governmental sectors, and the capability of local government institutions to execute their devolved functions by a participatory approach (UNDP, 1998). Practices of local administration, local planning, and local legislation in decentralized governance can be vital factors in making civil society politically active and vigilant (UNDP, 1996). So, the process of decentralizing governance will be an effective mechanism to realize the fundamental goals of sustainable human development mission of better access to public services and maximum community participation in the policy formations of matters regarding their life and habitat (UNDP, 1997).

2.1.10 Local Self-Government Institutions

The term Local Government Institutions or Local Self-Government (LSG) institutions denotes that base level unit of government which constituted of locally elected members and government-appointed civil servants. A typical LSG institution is structured with a legislative unit of regionally elected representatives, and an executive unit of government-appointed officials to discharge the authorities and responsibilities devolved from the central unit of government (Smith. S and Butterworth 2005). It is globally admitted that the LSG institutions are the essential and effective

administrative mechanism of regional matters and sustainable development of the state by ensuring community participation, because, it functions on the principle that the local demands can be resolved by the local units better than by central units of government. Though LSG institutions practice regional autonomy of governance, it is subjected to constitutional interventions and supports from the central government (Venkatarangiaya. M, Pattabhiram. M, 1969).

The aforementioned varieties of decentralization reflect different extents of devolution from central government to LSG institutions on the one hand and the other hand, it reflects the institutional wide and capacity of LSG institutions to ensure community participation, accountability, and government responsiveness in the decentralized authorities and responsibilities. Therefore, the objectives, mode, and sequence of practices and institutional structures in the decentralization process can differ from state to state based on the guiding political ideologies and institutional will of the implementing states.

2.1.11 Water Conservation

Water conservation refers to the policies and programs formulated to manage the preservation and development of freshwater on the surface and ground as an essential natural resource to protect a sustainable water system and to satisfy present and future human demand for water (Glossary of Environmental Statistics, 1997). According to Amy Vickers, water conservation is the "beneficial reduction in the use, loss, and wastage of water". So, it covers all the efforts which can maximize the water efficiency of users. As a crucial part of water resource management, the process of water conservation is committed to three important tasks; beneficial deduction in use, loss, and wastage of water, maintenance of water quality, and preservation and development of water sources (Vickers. A, 2001). Therefore,

the major water conservation strategies include reduction of evaporation, irrigation, and runoff losses of freshwater, prevention of water wastage and contamination of natural sources of fresh water, and promotion of safe reuse and recycling of water.

2.1.12 Integrated Water Conservation

Integrated water conservation is a method of inter-sectoral management of water and water-dependent natural resource systems to ensure sustainable preservation and development of freshwater on the surface and ground and the reduction of its pollution to meet the water demands of generations in an equitable manner (GWP, 2000). The method of integrated water conservation is a strategy shift in water conservation measures from a sectoral or sub-sectoral approach to an integrated or holistic method of surface and groundwater conservation based on sustainability, equity, and efficiency principles.

2.1.13 Water Harvesting

Water harvesting is one of the generally recognized traditional techniques of water conservation which includes the processes of capturing and storing rainwater for current direct consumption or the recharging of groundwater systems (Glendening and Vervoort, 2010). Precipitation is the source of fresh water in the hydrological cycle and lakes, rivers, and other surface and groundwater bodies are secondary. So, freshwater harvesting can be done through the capturing of water flows from rooftops, local catchment areas, seasonal floodwater from local rivers, and through watershed management to reduce rainwater runoff and prevent groundwater contamination from the intrusion of saline water by raising the groundwater table (Glendening and Van Ogtrop, 2012).

2.1.14 Watershed Management

Conceptually, a watershed means "a drainage basin or an area above a given point of a waterway, which contributes rainwater or runoff to flow through that point" (Ghosh, et al, 2008). Such drainage units are constituted of physical and hydrological natural resources and human resources also. So, the process of watershed management refers to the planned and integrated utilization of land, water, and another related natural resource system in the water basin to provide desired goods and services without any damage to the watershed (Sonowal and Satapathy, 2012). It ensures rational and sustainable usage of the watershed by considering the interdependence of soil, water, and uphill and downstream areas of land in the drainage unit or water basin (Sonowal and Satapathy, 2012).

2.1.15 Water Efficiency

The term water efficiency refers to the rational practice or capacity to reduce the volume of water consumption in the production of a commodity or the completion of service (Vickers, 2001). Water efficiency determines the actual volume of water needed for a particular purpose to minimize the consumption or wastage of water, especially in well-engineered productions and constructions. So, it's an economically viable exercise to save freshwater by maximizing the beneficial reduction in the usage of water (AWA, 2012). At the same time, the United States Environmental Protection Agency (USEPA) explains water efficiency as the application of innovative techniques and technologies to provide sustainable and better water services with minimal volume of water by ensuring zero wastage of water to conserve freshwater resources for future (Centre for Science and Environment,2017).

2.1.16 Water Budgeting

Water budgeting refers to the "process of scientific evaluation of the occurrence and movement of water through the natural environment" (IWM Water Budget Overview). It's a scientific technique to measure the balance of freshwater demand versus freshwater availability by understanding the hydrological cycle of the land (Mitra, et.al, 2015). The concept of water budgeting is formulated on the principle of water mass conservation, so water budgeting is a scientific technique that is helpful to improve the volume of efficiency, quality and saving of freshwater, and managing the demand and supply of water in the country rationally (Niveditha, 2019).

2.1.17 Water Prizing

Water pricing is one of the economic techniques in water conservation practices "which can minimize excessive water consumption and consequent pollution as well as ensure the sustainability of water treatment programs" (Bernstein, 1997). Water pricing is a process to assign a price to freshwater to maximize water use efficiency and water quality by forcing large-scale water consumers and providers to adopt water-saving techniques and technologies like water reuse, water recycling, virtual water assessment, etc. (Foster, 1992). The 'polluter – pays - principle adopted by Organization for Economic Cooperation and Development (OECD) in 1972 is the basic drive behind the concept of water pricing which led to the introduction of cost-effective and economic measures in the water sector of the European Union nations (OECD, 1994).

2.1.18 Virtual Water

The term virtual water refers to the "volume of water embedded in goods and services". It means the total amount of water used or polluted during the overall production chain of a product or the discharge of a service

(Allan, 2011). The policy relevance of virtual water and its analysis is widely recognized as a scientific technique to maximize water saving and sustainability of global freshwater consumption by identifying the hot spots of unsustainable water consumption and conservation practices (Global Water Partnership, 2017, Roth and Warner, 2008). Virtual water is generally categorized into three major components; Bluewater (freshwater on the surface and ground), Green water (freshwater stored in the soil or vegetation), and Greywater (amount of water polluted and the amount of water required to dilute the contaminated water (Hoekstra, et.al, 2011, Hoekstra and Chapagin, 2008). Recently, virtual water and its movements are being analysed and applied in the centralized and decentralized water conservation planning as a scientific strategy to ensure the sustainability of freshwater consumption and conservation practices by determining the geographical diversities and imbalances in the production of green, blue, and grey water in the country (Warner and Johnson, 2007).

2.2 Theoretical Framework

The complex and diverse institutional dynamics of decentralization cannot be addressed with a single theoretical framework. To a political scientist, the concept of decentralization is a policy matter regarding the distribution of institutional powers in the state, to the sociologist; it is one of the effective mechanisms of formal and informal people participation, and a sustainable developmental applying decentralization as an institutional technique for sustainable development (Camille, et.al, 1997). Recently, especially after the Dublin conference on water and environment held in 1992 various United Nations agencies and other international institutions of environmental development recognized decentralization as an essential strategy for sustainable water conservation.

As a result, a lot of theoretical and practical research, case studies, and evaluation reports by academicians and academic or governmental institutions on decentralized governance emerged during this period. In the initial stage of the promotion of United Nations development agencies, the concept of decentralization was studied and debated concerning general issues like poverty alleviation, development, and service efficiency of government institutions (Cheema and Rondinelli, 1983). At the next level, the concept of decentralization of governance developed into its political dynamics, in which, it is used as an institutional means of good governance, people participation, and political stability by resolving sub-national conflicts regarding ethnic, linguistic, and regional identities (Cohen and Peterson, 1999). The focus of the global debates on decentralization reforms gradually, transformed into the kind of sustainable technique of development and environmental management.

Many global multi-lateral institutions including U N development agencies are very active in the promotion for the adoption of such decentralization reforms in the development and natural resource management of various countries. It led to the emergence of a wide range of decentralized institutional reforms among the nations in recent decades. Most nations have adopted decentralized natural resource management as a sustainable method, especially in the water sector. Such decentralized institutional mechanisms for water management and conservation allowed LSG institutions, national and international non-government institutions, and local communities to participate in water development initiatives. As a result, a lot of different theoretical and analytical approaches and perspectives developed in this sector regarding the role and impact of different actors and factors in the decentralized water conservation initiatives. Therefore, this section of the present chapter discusses relevant theoretical frameworks of different approaches and perspectives in decentralized water conservation practices.

2.2.1 New Institutionalism Framework

Recently, most of the developing countries are implementing decentralization reforms in different variants as a panacea to overcome the dichotomy between development and natural resource conservation, a significant challenge facing the world today (World Resource Institution, 2003). Such decentralization reforms are implemented worldwide, including the 'top-down' and 'bottom-up' versions of decentralized governance of natural resources, especially in the water sector. Unfortunately, various empirical responses from the global level reveal that the reactions to both 'top-down' and 'bottom-up' models of decentralization reforms are mixed, partial, and contradictory, and the 'local community' participation is still waiting for equity and efficiency in natural resource governance (Ribot, 2004). Meanwhile, a 'New Institutionalism' framework developed with an argument that "decentralization is a complex adaptive process that involves a combination of natural and political. It endeavours by actors and agents to draw on existing structures to negotiate and renegotiate the existing unequal power relations to manage water. It connects to the spatial distinction of being 'top-down' or 'bottom-up', but a messy integration of these" (Saravanan, 2009).

The New Institutionalism framework developed from ecological and social sciences draws a theoretical explanation of the institutional process of decentralized water governance by analysing the role (as opportunities or constraints) of rules, actors, and bio-physical resources in decentralized water resource governance (Saravanan, 2009). Sharing a thought that the impact or role of institutions and actors in the formulation or evolution of social action (Hall and Taylor, 1996), historical Institutionalism, Rational Choice Institutionalism, Organizational/ Sociological Institutionalism, and Ecological Institutionalism constitute and describe 'New institutionalism' theory.

The framework of Historical and Rational Choice Institutionalism developed on the role or impact of institutions in determining or maximizing the instrumental behaviour or actions of actors in decentralization reforms, where Historical Institutionalism stands for a 'calculus-based approach' to the behaviour and actions of actors who participated in the decentralization is determined by the institution. In contrast, Rational Choice Institutionalism states that actors behave strategically and contextually in response to the extent of decentralization implemented (Ostrem, 1998 Campbell, 1997). Even though the normative and unrealistic approach of Historical and Rational Choice Institutionalism was subjected to some criticism by Organizational Institutionalists, this institutionalism significantly contributed to the 'theory of constraints' by exploring the historic and strategic role of institutions in determining the activities and capabilities of actors and agents in making socialization regarding decentralized water resource management (Campbell, 1997).

Organizational Institutionalism develops an organizational theory of action' by establishing the subjective and proactive intervention of institutions based on the 'logic of appropriateness' in decentralized water governance from a social realist perspective to mitigate dilemmas by integrating normative and cognitive frameworks concerned (Compbell, 1997, Powell and Dimaggio 1991). According to Organizational Institutionalism, actors refer to the individuals "who process information, strategies, and actions on powers in their actions with various stakeholders within and outside institutions based on their empirical knowledge and capability" (Long, 2001). Some actors enjoy discursive capacities to be transformed into social actors or Giddens's concept of 'human agents' of social construction (Long, 1992; Giddens, 1984). According to Giddens (1984), human agents and structures are not separate entities but different means to facilitate or realize the same social construction in the Organizational Institutionalism perspective, while it does

not explain the operational or instrumental details of what transmutes an actor to human agent or agency (Hitlin and Elder, 2007; Campbell, 2009).

Ecological Institutionalism, rooted in ecology and geography, forwards a 'theory of integration' by embracing or integrating changes in policies and programs in legislation, administration, and other separated sectors in decentralized governance (Dorcey, 1986). According to Gunderson (1995), "such changes in each sector of decentralization reflect an adaptive cycle that has the properties of growth (exploitation) and accumulation (conservation) on the one hand, and novelty (release) and renewal (reorganization) on the other hand". It works in the decentralized water governance as Past provisions facilitated the exploitation of water and favoured the powerful. Still, it led to a situation that forced the vulnerable section to participate in water management and search for novel mechanisms and programs like decentralized water conservation, which authorities recognized to reorganize the existing framework (Saravanan, 2009). According to Ecological Institutionalism, "the adaptive cycle will be repeated at different periods and versions but occurs in different nested arenas of panarchy" (Holling, 2000) to make decentralization 'complex and adaptive.

The New Institutionalism framework developed through the institutional integration approach by applying the normative historical and rational choice institutionalism to explore the historic and strategic stake of structures in determining the capacity of actors and agents, and ecological institutionalism to substantiate the analytical phases of negotiation among agents for restructuring and renewal of the system, in the decentralized water governance (Saravanan, 2009). The New Institutionalism perspective on decentralized water governance formulates the interactive role of three situational variables: actors, rules, and bio-physical resources (Saravanan, 2009). V. S. Saravanan (2009) explains that the actors in the decentralization

process act or react to the limitations of resources and institutions in different forms. Still, some actors with discursive capacities direct their actions into a focused 'project' and transform themselves into human agencies with empirical knowledge and discursive capacities to reinforce or restructure the existing structures (collective of actors, rules, and biophysical resources) by interacting with different decision-making arenas of panarchy in decentralized water resource management.

Panarchy is the "hierarchical structure in which systems of nature, human and socio-ecological system are interlinked in never-ending adaptive cycles of growth, accumulation, restructuring, and renewal" (Holling, 2001). Such interactions of actors or agencies with the panarchy of decentralization, including contextual variables like climate, physiography, geological disturbances, etc., bring reforms in the structures of decentralized water governance (Saravanan, 2009). So, the New Institutionalism framework of decentralized water governance represents "a complex adaptive process which consists a package of the natural and institutional initiative of actors and human agents to reinforce or restructure the prevailing structures to negotiate and renegotiate the prevailing unbalanced and inadequate power relations in the water governance", instead of contemporary 'top-down' or 'bottom-up' model of reform package of dispersion of power among the stakeholders in water management (Saravanan, 2009).

From the social and ecological perspective, New Institutionalism frames a comprehensive and integrated statement of the decentralized governance of water as an institutional process by determining the decisive stake of rules and resources, especially the discursive capacity of actors/agents in transposing global, national, and subnational agendas to their local interest of water governance with equity and efficiency (Saravanan, 2009). According to V.S Saravanan (2009), the case studies on the application

of New Institutionalism in the decentralization of water governance suggest a capacity-building approach, which facilitates the empowering of statuary structures and the development of platforms for actors/ agents to debate and share heterogeneous information to make collective and effective decisions and actions for ensuring efficiency, equity, adaptively and sustainability in decentralized water governance.

2.2.2 Behaviourist Framework

According to Amy Vickers (2001), water conservation is the "beneficial reduction in the use, loss, and wastage of water", combining behavioural, educational, and technological measures to maximize the water efficiency of users and minimize the volume of water consumption. So, conservational behaviour of water users is vital in integrated and decentralized water conservation initiatives. The "Four Dublin Principles", one of the significant outcomes of the International Conference on Water and the Environment held in Dublin in 1992, established the discursive role and relevance of water users or communities and their conservational behaviour and attitudes in the sustainable and decentralized water conservation mission of the world (United Nations, 1992). In addition, the United Nations (2005) declaration on the period of 2005 to 2015 as the "Decade of Education for Sustainable Development" substantiated the vital role of water users and their water-relevant behaviour in sustainable water conservation efforts (Sarabia-Sanchez et al., 2014).

In the context of such globally accepted observations on the water-relevant behaviour of people, several theoretical and scientific approaches and frameworks are being developed to identify and determine the impact of water conservational behaviour on individuals and communities. Such theoretical attempts include 'ecological behaviour', 'water conservation behaviour' (Lam, 1999), 'water conflict behaviour' (Bijani and Hayathi,

2013; Bijani et al., 2017) ‘, environmentally significant behaviour’ (Stern, 2000), etc. Such behavioural theories, in particular, may not explain the overall impact of people’s conservational and behavioural consumption patterns on the water. Therefore, the present behavioural framework describes the fundamental observations and outputs of some major behavioural theories and perspectives on water conservational behaviours of water users. In addition, such an integrated assessment of the various features of different theoretical approaches to water-relevant behaviours of users will help identify and prioritize behavioural changes that result in a better impact on the consumption and conservation of water (Valizadeh et al., 2019).

The rational Human Approach or Traditional Economic Approach and Moral Approach are the two major approaches prevailing in the people’s environmental and conservational water behaviour. These approaches have their theoretical framework to justify their point of view (Schultz, 2000). The Rational Human Approach justifies their interpretations with “Planned Behaviour Theory”, which treats human behaviour as “a situation of rational choice” (Ajzen, 1991). While, the “Norm Activation Theory” (Schwartz, 1997) and “Value – Belief – Norm Theory” (Stern, 2000) justify the arguments of the moral approach by substantiating the human behaviour as a moral positioning to denote that the formation of water conservational behaviour among the users is strictly based on the “feeling of moral obligation”, not in regard of personally beneficial and other external drives as observed in Rational Human Approach on water - relevant behaviours (Valizadeh et al., 2019).

The Norm Activation Theory of Schwartz (1977), one of the first fundamental works in social psychology, observes that some environmental and conservational water actions by people can occur as altruistic behaviours based on the “feeling of moral obligations” for others' well-being. Schwartz

states that "the altruistic values lie in value orientations referred to as self-expectations", which a personal norm is constituted with social characteristics and attitudes, and behavioural obligations and intentions internalized social interactions and socialization (Schwartz, 1970). So, the Norm Activation Theory observes that, with the activation of altruistic attitude or behavioural change which comes from the personal norm, the water users will be guided to feel a sense of moral obligation towards others' water availability and to water conservational behaviour and actions conserved (Valizadeh et al., 2019). Such actions will occur based on the "awareness about the impacts of that action on others as well as the ascription of responsibility to the action" (Marquart - Pyatt, 2004).

By the assumptions of Value – Belief – Norm Theory, the personal norms behind the conservational water behaviour will be activated when the user is aware of the consequences of water scarcity and the users feel responsible for adopting water conservational activities to reduce water scarcity (Stern, 2000). Value – Belief – Norm Theory extends the scope of Norm Activation Theory (Stern, 2000) by analysing the Norm Activation Theory under different value orientations such as biospheric, altruistic, and egoistic (Stern, 2000). Being an integrated version of Norm Activation Theory, the New – Environmental Paradigm, and the Theory of Personal Values (Stern, 2000; Phipps et al, 2013), Value – Belief – Norm Theory observes that the egoistic, biosphere, and altruistic values will be an active ground which can frame various water conservational behaviour among the people (Raymond et al, 2011; Stern, 2000).

Value-Belief-Norm Theory (Stern, 2000) assumes that an egoistic water user adopts his water-relevant behaviour cost-effectively. So, the user may dissent on water conservation activities/water-relevant behaviour if it is costly to them (Bijani and Hayati, 2013). At the same time, the generous

water users set and adopt their water conservational behaviour/actions based on the sense of moral obligation toward the well-being of humanity irrespective of cost and benefit to them. Likewise, people with biospheric values adapt their water-relevant behaviour based on its price and use for the ecosystem (Valizadeh et al., 2019).

According to the principles of the Rational Approach, individual actions are the ultimate result of rational and logical thinking on the available information, not a natural outcome of unconscious motives or super–instinctual desires (Ajzen and Fishbein, 1980). So, theories in the Rational Approach evaluate the water conservational behaviour change among the users as an outcome of the "situations of rational choice", in which water users make a cost-benefit analysis and opt for which is more beneficial to them (Harland, P et al., 2007). By the principles of Rational Action Theory, first used by Ajzen and Fishbein (1980), individuals are "rational and reasoned creatures that systematically can use and process available information".

"By analysing the interrelationship between the following variables like 'water conservation intention' and 'water conservation behaviour'; 'attitude towards water conservation and 'water conservation intention'; 'subjective norms of water conservation and 'water conservation intention'; a person's beliefs towards consequences of his/her action' and 'attitude towards water conservation; and a person's beliefs towards failure to perform a specification action concerning the thoughts of individuals of a particular group' and 'subjective norms of water conservation, the Rational Action Theory concludes that individuals water conservational behaviour is the outcome of the belief that underlies this behaviour" (Hsu, 2003).

However, the Rational Action Theory failed somewhere in distinguishing personal attitudes on water conservation from social attitudes

and norms on the same and identifying the other internal or external and direct or indirect drivers in setting water conservational behaviour of the people (Valizadeh et al., 2019). Naturally, further studies on such a knowledge gap led to Planned Behaviour Theory, another primary theory that belongs to the rational perspective on water conservation behaviour (Marquart - Pyatt, 2004). Unlike Reasoned Action Theory, Planned Behaviour Theory focuses on 'intention' to behave or behavioural control factors (Marquart - Pyatt, 2004).

Planned Behaviour Theory observes that the 'intention' of an individual, as a psychological construct, towards a behavioural change or action leads to perfect behavioural change or activity, which they indented; however, other factors like resources and opportunities also can control/constrain that link between 'intention' and 'behaviour' (Ajzen, 1991). Planned Behaviour Theory perceives the controlling or restraining factors on the water conservational behaviour of individuals and distinguishes the impacts of "perceived behavioural control" on water-relevant behaviours from two different perspectives; "firstly, the impact on water conservational behaviour by its impacts on intentions of the individuals and secondly, the direct impact on water conservational behaviour" (Marquart - Pyatt, 2004; Mak and Lee, 2013).

Apart from the "perceived behavioural control", the 'intention' of the individual to conserve water can be influenced by the individual attitude ("rationality or irrationality of water users on water conservation") on water conservation and subjective norms ("social perceptions and pressure on water conservation") of water conservation (Valizadeh et al., 2019). Although the Rational Approach has succeeded in comprehensively analysing factors of water conservational behaviour change, it has some limitations in some respects, especially regarding "the water user's cognition and behaviour

cannot always be the reflection of the user's water conservational behaviour" (Valizadeh et al., 2019). So, the Planned Behaviour Theory ultimately concludes that their advantages for them drive an individual's behaviour action; likewise, it overlooks value bases behind the intention of an individual on water conservational behaviour, however, and altruistic values also can be enjoying a stake in their behaviour (Valizadeh et al., 2019).

The observations above of various theories in Rational and moral theories explore the multi-dimensional factors that formulate water conservational behaviour changes among the people. The basic principle of the Rational Approach is that individual behaves in an autonomic line based on their rational and personal choice; so, Rational Approach theories like Planned Behaviour Theory develop a helpful framework that describes the individual's private sphere behavioural changes regarding the conservation of water resources (Trumbo and O' Keefe, 2005; Valizadeh et al., 2019). Likewise, the Moral Approach is based on the assumption that individuals behave on a moral ground based on the "feeling of moral obligation for others' well-being" therefore, the Rational Approach theories like Value – Belief – Norm Theory and Norm Activation Theory develop a comprehensive framework on the deterministic factors of the public-sphere behavioural patterns regarding participatory and collective initiatives for water conservation (Anderson et al., 2005; Valizadeh et al., 2019).

The assessments above and observations on the factors of water conservational behaviour changes are limited to analysing attitudes, intentions, beliefs, norms, and social perceptions from theoretical perspectives mainly based on environmental and social psychology and its academic branches. Moreover, there are differing opinions on how such theoretical frameworks, which have evolved primarily in western living conditions and outlooks in developed countries, can accurately define the water

conservational behaviour changes of options people in water-scarce regions of developing and underdeveloped countries. Various case studies from underdeveloped countries substantiate the above opinions by concluding that "as a general concept or global issue, the conservation of natural resources including water is not a foremost or relevant concern of the people in countries with underdeveloped economies". In contrast, contextual factors like concern for local water resources, incremental water conservation information, and attitude toward frugality impact their water-relevant behaviour (Chang, 2013). Such studies brief that beyond general concern on environmental conservation, water-specific beliefs and matter on local water availability have an evident impact on water appropriate behaviour of the people on residential water conservation, and such people with an integrated perspective on local water maintain sustainability and efficiency in water consumption than those who have a household model or view (Chang, 2013).

Such empirical studies often argue that the declared norms, values, and beliefs which are intended to stimulate water conservation are not culminating in water conservational behaviour change of people due to a lack of required material capacities or facilities among people to adopt water-saving techniques or technologies (Dolnicar and Hurlimann, 2010). So, not only the various values, beliefs, and attitudes and their different dimensions but also the external factors like socio-economic elements must be attributed to the set of variables that will be studied to determine conservational water behaviour changes (Hassell et al., 2007). Recently, a lot of new theoretical frameworks like the "Human Interdependence Paradigm" are being developed to address the impacts of both socio-economic (external) factors and personal feelings (internal factors) on water conservational behaviour changes (Corral et al., 2008). However, there is still no single theoretical framework that can determine the impacts of external and internal factors and their multi-

dimensional role in stimulating the water conservational behaviour changes of people from different socio-economic and geographical contexts.

2.2.3 Sustainability Framework

In recent decades, especially after the declaration of "Four Dublin Principles", which derived from the "International Conference on Water and Environment" met in Dublin in 1992, the world witnessed several institutional reforms and administrative rearrangements based on 'decentralization principles' regarding the conservation of essential natural resources including water of the nations concerned. Intentionally or unintentionally, such institutional reforms and related policy formulations were highly encouraged and often influenced by international finance Institutions, funding agencies, market forces, non-governmental organizations, and various government agencies. In most countries, such decentralized institutional and administrative devolutions followed by "privatizations" and "market deregulations" often led to the infiltration of various non-government 'forms' or 'forces' into the "governance" or "co-governance" of essential natural resources like water.

Such multifaceted administrative decentralization and its segregated operations on water conservation often subvert the participatory and sustainability principles resulting in contradictory and undesirable impacts on the water resource table and the water conservation mission of the world. In such a global context, too, the "United Nations Conference on Environment and Development" held in Rio de Janeiro in 1992 declared its primary outcome 'Agenda 21' to ensure a sustainable approach among nations regarding their conservational and developmental activities of natural resources. As a reflection of the global practice of sustainable development raised by Agenda 21, several international and local approaches and

theoretical perspectives are being formulated on the sustainable development and conservation practices of natural resources, especially in the water sector.

In addition to the United Nations declaration to observe the period 2005-2015 as a "decade of Education for Sustainable Development", the "Sustainable Development Summit" of the United Nations to develop "Millennium Development Goals" in 2015 adopted the water sector as one of the seventeen new "sustainable development goals" to ensure sustainable water governance (Josefina, 2015). So, applying sustainability principles led to several theoretical and operational approaches and theoretical frameworks on institutionalized planning, policies, and practices regarding sustainable water governance.

Being a hot topic of global debate, the concept of sustainable development is being defined, interpreted, and practiced differently in different sectors. At the same time, some common principles or approaches can be seen as the normative basis of operational and analytical frameworks of such sustainable practices. Some relevant literature surveys in this field identified common sustainability principles or approaches as participatory approach, integrative/holistic approach, future-oriented approach, precautionary approach, polluter pays approach, rational approach in the use of resources based on the capacity of nature, and equity-based distribution of resources. But, applying all such principles and approaches to sustainability into a single theoretical or operational framework is often not necessary or practical.

Therefore, most of the prevailing theoretical or operational frameworks regarding sustainable water governance in this sector are based solely on some selected context-specific sustainability principles. Individual theoretical frameworks may not fundamentally address sustainable water governance's holistic features. So, the present framework addresses the major

theoretical perspectives and observations of some relevant, sustainable water conservation initiatives to identify and prioritize better theoretical frameworks on sustainable water conservation.

Although the sustainable reforms in institutional setup led to hot debates on theoretical and operational perspectives regarding the role of government, private and community participation in water governance, there is a consensus on the critical role of institutional planning in water governance by determining the extent and limit of institutional and public access and operations on water resource (Maynen and Doornbos, 2004). Beatrice Hedeline (2008) put forward such a theoretical framework on institutional planning for sustainable water governance, in which she transmuted two major sustainable principles of 'Integration and Participation' into a theoretical framework of a set of deductive criteria or deductive approach to integrating sustainable principles and knowledge into the planning for sustainable water management.

According to Beatrice Hedeline (2008), an integrated approach is essential in planning sustainable water governance to understand the deterministic and dependent factors of the planning context and their interactions, which are necessary to identify the real supporting and constraining factors in sustainable water governance. Because the planning of sustainable water management constitutes an integrated system of general and context-specific elements, in which government and non-government institutions with different civic and institutional cultures, stakes, and legal status act and interact with considerable impact on the planning process and its impact on sustainable water management (Hedeline, 2008). Here, Hedecline (2008) developed an analytical framework for planning with deductive criteria based on the integration principle of sustainable water management.

The existing literature indicates that the participatory approach in the planning of sustainable water governance is dominated by the inductive method of studies which just describes "what the specific actors of that specific process say about which factors are important for what it is they define as a process for sustainable water governance". In this context, Hedeline (2008) applies a deductive framework by using theoretical and empirical literature and knowledge and "connecting it to a particular process for understanding how that process should be changed or adjusted to lead to sustainable water management". To Hedeline (2008), 'participation' is a necessary means of making and legitimizing informed decisions in the planning for sustainable water management but not a sufficient means, so she widened the scope of the participatory method in her deductive framework of planning by synthesizing the insights of proponents and opponents and multidisciplinary knowledge by identifying and integrating the relationship between context-relevant parts of expertise.

Even though, Hedeline's (2008) deductive criteria framework on planning for sustainable water development lacks its organizational aspects, which come under the realm of the 'Integration Principle' (Jepson, 2001), more over its conceptual base of sustainability criteria is limited to 'Integration and Participation' principals of sustainable water development.

Some of the analytical studies in the sector argue that water-specific institutional incentives and regulations played a considerable stake in promoting sustainable water consumption and conservation patterns, especially in water-scarce regions. D. Garrick et al. (2020) established an incentive-based framework based on intersectional analysis of incentive-based approaches and theory of change approaches for incentivizing sustainable water management and for strategic development and impact evaluation in sustainable water conservation. By which they "identify where

and when to develop various incentives for sustainable water consumption and conservation, formulating and testing different varieties of incentives in relation with institutional reforms and infrastructural development regarding sustainable water management, and evaluating the impact of various incentives in water conservation by applying different data sources, techniques and criteria" (Garrick et al. 2020).

D. Garrick et al. (2020) developed their observations on incentive-based approaches by analysing 'water markets' and 'public investments in irrigation efficiency'; two interdependent models of incentive-based methods are being followed by the majority of government and non-government institutions to enable sustainable water management. 'Water market' and 'public investment in irrigation efficiency' are interdependent incentives because the increasing market value of water promotes quality and conservation of water as a means to additional profit. At the same time, as a commodity with trade value, water can attract public and private investments to ensure irrigation efficiency and avoid economic loss of water loss. Both ways meet in the sustainable water saving.

However, being an economically stimulated incentive, it is also necessary to identify the positive and negative impacts of such incentive-based approaches and how they react to different times and spaces, where the theory of change approaches is becoming relevant and helpful. So, the observations of D. Garrick et al. (2020) on incentive-based frameworks for water conservation are substantiated by an analysis of existing literature and field experiences regarding theories of change approach to development and impact evaluations on such sustainable water management experiences by identifying various shortcuts in institutional reforms to fulfil the sustainable goals.

Applying major concepts in Theories of Change Approaches to the analysis of some incentive-based institutional reforms for sustainable water management, D. Garrick et al. (2020) developed an analytical framework of the Theory of Change Approach to formulate improved incentives for sustainable water conservation and to identify the factors of positive and negative impacts on short-term and long-term sustainable goals of the reforms and related knowledge gap. D. Garrick et al. (2020) determine and define the possible activities and challenges in sustainable water management and clarify the desired sustainable goals of incentive-based institutional reforms for water conservation as the primary step in framing a theory of change. The next level identifies the strategy, techniques, and infrastructural developments in the incentive-based institutional reform for sustainable water conservation. Finally, it establishes an analytical link between the applied method and the intended results of incentive-based reforms for sustainable water conservation to make a reliable and comprehensive evaluation of interventions and impacts (Garrick et al., 2020).

Even though incentives are being considered as one of the significant factors in the sustainable water conservation mission of the world, there is no universal formula in the selection and application of incentives for sustainable water conservation, as time and space apply to it, in this context, specific theories of charge framework will be needed to lead the development, implementation, and evaluation of such incentive-based institutional reforms for sustainable water management by distinct socio-economic and environmental contexts (Garrick et al. 2020).

Although sustainable methods like decentralization and community participation have been recognized globally since the 1990s for the conservation of essential natural resources, especially water, countries have had diverse experiences regarding the mode and volume of institutional

decentralization and the role of stakeholders in water conservation initiatives. Most decentralized institutional reforms implemented for sustainable water conservation reflect ideological and theoretical differences driven by each country's political and economic interests. For example, since the 1990s, powerful neo-liberal forces driven by market interests are influencing the state policy frameworks to minimize the role of government institutions in maximizing the private partnership in decentralized water conservation initiatives with a claim to improve the service efficiency of sustainable water conservation practices (Banmann, 2000).

The overlapping of such public choice and neo-liberal agendas in decentralized institutional reforms for sustainable water conservation often results in contradictory and undesirable impacts on sustainable water management. Based on some Indian experiences, Maynen and Doornbos (2004) developed a framework of critical observations on such contradictory and unwanted effects of decentralized institutional reforms for the sustainable management of natural resources, including water. Maynen and Doornbos (2004) observed that the diverse, multiple, and interrelated interventions of formal and informal institutions of Government and private agencies with conflicting and numerous interests in natural resource conservation made the decentralized and sustainable water conservation sector a center of conflicts and negotiations, in which local social inequalities and sustainability principles often being neglected or compromised.

Inconsistencies in the policies of governments on decentralized natural resource management due to the pressures from global financial forces for the adoption of neo-liberal techniques of privatization and market deregulations often led to contradictory impacts on participatory and equity-based sustainable water management (Maynen and Doornbos, 2004). Such external interventions with market interest are often subverting many sustainable

principles in the State initiatives for decentralized water conservation by constraining free access of the public to their traditional water sources, implementing water pricing for the public, including socially and economically vulnerable sections, and ignoring the voice and customary claims of indigenous people in the private or private – government partnership projects for water management (Maynen and Doornbos, 2004).

In addition, the multi-layered institutional mechanism of local government institutions and newly introduced different sectoral institutions within the same regional limits for decentralized water resource management in India lacks complementarity and constructive institutional interactions in the water conservation mission, it is often leading to functional and interest conflicts among various stakeholders in the resource management where the interests of weaker sections and sustainability principles are constantly subverting (Maynen and Doornbos, 2004).

According to Maynen and Doornbos (2004), the aforementioned contradictory effects of several decentralized institutional reforms in India on its sustainable water conservation mission could be defended by a solid and stable Local Self Government system with adequate financial and judicial powers to implement its plans and to settle conflicts of interests among different stakeholders in the resource management, further, it should be equipped with a well- empowered institutional mechanism to prevent the tendencies of subverting the sustainability principles of water and genuine interests of weaker indigenous sections of society due to the pressures from a national or international market interest in the water resource management.

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CHAPTER 3

WATER CONSERVATION IN KERALA: POLICIES AND PRACTICES

The present chapter examines the water policy reforms and water conservation practices in India and Kerala comprehensively. The chapter is arranged its discussion into two parts. The first part of the chapter discusses the development of water policy frameworks and other relevant legislative initiatives for water conservation in India and Kerala. The second part covers a detailed discussion of traditional and modern water conservation practices.

3.1 Introduction

In the last few decades lot of scientific studies from global to local levels are being alarmed the global society regarding the growing threat of water scarcity. Environmental degradation due to pressures from uncontrolled population growth, rampant urbanization, and industrialization, and irrational use of science and technology in the exploitation of essential natural resources intensified the threat to global water security (National Environment Policy, 2006). The recent surveys and studies of United Nations agencies and other environmental institutions reveal that despite numerous global and local water conservational and remedial initiatives, the water crisis is still worse than ever. In 2015, the Global Risk Report of the World Economic Forum reminded the global society that around one billion people in the world facing severe freshwater scarcity. Similarly, the World Bank report in 2018 alarmed the Indian society by reporting that above 600 million Indians suffering from moderate to extreme freshwater crisis and which results in the death of around two lack people annually. It substantiates that water scarcity is one of the top-order national threats in India also.

The latest studies of NITI Aayog (2018) also observe that most of the states in the Indian Union will be failed to satisfy the essential freshwater needs by 2030. Environmental issues such as climate change, global warming, depletion of vegetable cover and water eco-system, and soil erosion are the root causes behind the water crisis in India as well as around the world. The civilizational changes in the agro-industrial and developmental outlooks that deviated from the traditional eco-friendly styles led to the aforementioned environmental degradation which accelerates the current freshwater crisis by draining and polluting the water we drink (Das, 1994). The water eco-systems are a fragilely interdependent and balanced system of environmental checks and balances which needs proper environmental sustainability to survive (Linden, 1987). Therefore, in India, historically evolved traditional practices in agricultural-industrial and developmental sectors formulated by topographic and climatic specifications of the region by local people with local techniques did not cause much degradation of the water eco-system. But today India is one of the major states in the world suffering the socio-economic and environmental costs of water insecurity by experiencing heavy depletion and pollution of the freshwater resource system (Desarda. H M, 2019).

Decades have passed since India realized that the major cause of the water crisis in India, which receives higher annual precipitation (around 1, 200 mm) than the global average (about 1,000 mm) (India Meteorological Dept., 2019), is the absence of sustainable water consumption and conservation patterns. But the plethora of distinct concepts, strategies, and policies followed by state governments and central governments in the Indian Union regarding the water sector in that period subverted the possibilities of a comprehensive and coordinated approach to the water conservation mission. In addition, the spatial and temporal differences in precipitation and water

availability that existed in the states of India often justified the divergent approaches and policies of state governments on water conservation.

Consequently, to ensure comprehensive and united initiatives for water security in the coming decades, India began formulating national policy frameworks on water in the late 1980s. Therefore, many states in India, including Kerala, have subsequently formulated state water policies in line with the principles of the national water policy framework and brought about a policy approach to water governance at the national and state level.

As one of the major Indian states suffering severe water shortage and higher water demand, at the same time Kerala also formulated its state water policies in recent decades and its water policies are being updated in affiliation with national water policies. In the case of Kerala, various studies already found that failures in preventing the rapid runoff of rainwater are one of the major causes of the water crisis in Kerala which has a high annual average of precipitation (3,055 mm) compared to other states in India which are experiencing moderate and extreme water scarcity (India Meteorological Department, 2019). In addition, the deterioration of surface water sources and decline in the groundwater level also threaten the water security of Kerala. Therefore, most of the water conservation policies and strategies of Kerala which are governed by tropical monsoonal climate are aimed to enhance groundwater levels by storing maximum runoff water in the land and preserving its major surface water sources such as rivers, lakes, ponds, wells, and another water-intensive ecosystem. In recent decades, Kerala has been pursuing a policy approach to water conservation missions by adopting several legal, technical, and vegetative methods by the policy updates at the global and national levels.

3.2 Major Policy Developments on Water Conservation in India

Traditionally, water has been treated as a sacred natural resource by culture in India. Therefore, the consumption and conservation of water were efficiently managed as a cultural practice and moral duty to the traditional lifestyle of Indians. Traditionally evolved natural and local techniques and local community involvement have played a major role in the integrated local water resource conservation practices of the period. But, the climatic, topographic, and geologic-oriented traditional water consumption patterns and crop patterns in the agro-social life of India began to subvert during the British colonial period (D'Souza, R, 2006).

3.2.1 Colonial Period

In the colonial period, the water-friendly agro-social life patterns of India overlaid or co-existed by the colonial water technologies such as canals, dams, weirs, and barrages which constituted an irrigation network for the commercialized pastoral economy (Agnihotri, 1996). Such commercially formulated colonial irrigation reforms and their revenues not only subverted the ecological bond between land and water but also led to the emergence of economically motivated approaches and reforms in the water-intensive sectors of India (D'Souza, R, 2006). Consequently, the British reign in India laid the foundation for the concept of government control over water resources of the country to exploit maximum surface water sources for revenue-driven schemes like irrigation, canal, etc.

Such colonial reforms were the by-product of 'colonial monitory logic' for maximizing the profit from the agrarian economy and capturing the control of ferries in India for fast shipping. Therefore, the colonial government in India confiscated the private ferries and declared them public ferries under the government by the enactment of Bengal Regulation VI of

1819. In addition, the Northern India Ferries Act in 1878 and subsequent ferry legislations empowered the colonial government to implement a toll system on ferrying to restrict unauthorized ferrying (Proceedings of Govt. Of India, 1878). After the first major colonial intervention in the water sector of India by the Bengal Regulation VI of 1819, the private embankments in India were also brought under the control of the colonial government by reforming the Embankment Law by the Act of 1882 which defined all dams, walls, banks, and dykes used to exclude or retain water in any land as embankments irrespective of size (Bengal Embankment Act, 1882).

The Bengal Irrigation Act, 1876, and Bombay Irrigation Act. 1879 introduced the expansion of the existing irrigation and canal system to serve the colonial interest in the agrarian economy of India, subverted the customary rights and privileges of indigenous communities for the customary access to their traditional and natural water sources by empowering government officials with the discretion to make decisions on such traditional water sources (Bengal Irrigation Act, 1876, Bombay Irrigation Act, 1879). Moreover, the private parties were limited to enjoying a virtual right to use unlimited water on their property by the Indian Easement Act of 1882 which is still relevant. Thus, during the colonial period, the status of water was transmuted to 'government property' from 'common property' (Legislative Department, 1866).

Some water conservational interventions were also seen among the aforementioned exploitative reforms introduced by the colonial government in the water sector of India. For example, the Madras Rivers Conservancy Act (1884), activated the concept of compulsive river conservation by authorizing the colonial government to restrict constructions and cultivations in the land areas of the riverbed. Despite the several current water laws in India bearing the aforementioned colonial biases, the post-colonial reforms by the

Constitution of India based on social welfare principles restored the pre-colonial status of water as 'common property.

3.2.2 Post – Independence Period

During the post – Independence period India has experienced both formal and informal reforms in the policy frameworks on water conservation initiatives. Such legal reforms in the water sector of India were formulated mainly in response to the socio-economic and political policies on the water of the period. A new era of water legislation began in post-independent India with the emergence of constitutional reforms based on social and welfare principles. It restored the pre-colonial status of water as 'public property' by abolishing the exploitative and interventional water policies of the colonial government which were formulated based on colonial economic logic. Part III of the Indian Constitution established its general policy on water by incorporating constitutional provisions to ensure free access and use of water as a fundamental right of citizens (The Draft Constitution of India, 1950). The Protection of Civil Rights Act (1955) substantiated the aforesaid constitutional policy on water by ensuring equal access and use of water to all the vulnerable sections of society. In addition, the 42nd Amendment of the Indian Constitution (1976) reinforced its constitutional concern on environmental resources by incorporating Article 51 A to the Indian Constitution with the provisions for the preservation of natural resources including water as the fundamental duty of the Indian citizens.

The United Nations Conference on the Human Environment held in Stockholm in 1972 led to national-level initiatives in India on environmental conservation, especially regarding the water sector which belongs to the State List of the Indian Constitution. Being a signatory of the Stockholm Declaration, which is well known as the 'Magna Carta' on the human environment, India started to make legislation on water conservation at the

national level. The Water (Prevention and Control of Pollution) Act (1974) under Article 252 of the Indian Constitution was one of the first legislations formulated at the national level for the conservation of water by preventing or controlling the contamination of water by domestic and industrial effluents and restoring the wholesomeness of water resource. Consequently, in response to the Stockholm Declaration, India introduced Environment Protection Act -1986 as per Article 253 of the Indian Constitution for the protection and improvement of the environment. It empowered the Central Government of India to make water conservational interventions by legislation on water governance which comes under State Subject. Because, the definition of the term 'environment' in the Environment Protection Act includes water resources also (Environment Protection Act, 1986).

The "Water (Prevention and Control of Pollution) Act" in 1974 and the "Environment Protection Act" in 1986 are the major initial steps toward the government water conservational movements at the national level in post-independent India. Till then the water conservational aspect of water governance in India was limited to some state or regional level enactments such as the "Orissa River Pollution Prevention Act" in 1953 and "*Uttar Pradesh Bhoomi Evam Jal Sanrakshan Adhiniyam*, 1963. In 1953, Orissa State Government enacted the "Orissa River Pollution Prevention Act" as an extension of the old "Madras Rivers Conservancy Act", 1884 to keep the cleanliness and natural course of rivers by constituting a "State River Board" (Orissa River Pollution Prevention Act, 1953). Uttar Pradesh State Government passed the *Uttar Pradesh Bhoomi Evam Jal Sanrakshan Adhiniyam* for the conservation of soil through the preservation and development of water and its sources by activating District and Panchayat Committees under the guidance of soil and water conservation Boards in the state (Uttar Pradesh Bhoomi Evam Jal Sanrakshan Adhiniyam, 1963). Maharashtra State Government also followed this model of the Uttar Pradesh

Government by passing the Maharashtra Prevention of Water Pollution Act (1969).

However, there are not many legal and policy initiatives on water conservation taken by the then Central and State Governments during this time beyond the constitutional demands on water conservation. Because the water governance policies of Central and State Governments are often influenced by the priorities of their political economy. Such productivity and economic principles of political economy which reflected the colonial pattern often subverted the environmental concern of the Constitution on the water sector of India. Consequently, the socially and economically vulnerable sections of the country began to suffer from water-related issues like freshwater scarcity, water contamination, etc.

3.2.3 National Water Policy - 1987

India's water governance system was constituted by different policies and programs formulated and operated by central, state, and local governing bodies by their vision and mission on the water resource system. Such multi-level policies and operations led to various issues of contradictions and overlap in the water sector of India. In this context too, National Water Resource Council (NWRC) adopted India's first National Water Policy (NWP) in 1987. NWRC formulated a national policy framework for water governance to address emerging challenges such as decreasing per capita availability of freshwater, unhealthy competition for control and exploitation of water sources, and increasing contamination of water resources in the water sector of India at the national level. Because the major water sources and water destinations of India (precipitation and rivers) are inter-state in nature they cannot be conserved and developed with a master plan prepared by an individual state. Besides these domestic concerns, international reforms and

initiatives in the water sector also forced India to make a national policy framework for water governance with a special focus on water conservation.

Primarily, NWP (1987) recognized water as one of the prime natural resources and essential human requirement and the planning and governance of its development should be based on a national perspective. In this regard, the NWP-1987 suggested many reforms and views on water governance with a prime focus on drinking water security to Central and State governments for implementation. Resource planning for hydrological units like drainage basins and their sub-basins planned multi-purpose projects for water resource development with prime concern on drinking water, regulations on surface and groundwater extraction to keep its consumption up to rechargeable limits, fixing of water allocation priorities, and water zoning of the country by integrating water use and land use policies and a master plan for flood and watershed management by soil conservation, forest conservation, catchment area treatment, and check dams are some of the major water conservational suggestions of NWP-I987 (NWP, 1987).

3.2.4 National Water Policy - 2002

Newly evolved threats to the water security of India led to the foundation of its existing national water policy framework. Consequently, NWRC revised its prevailing national water policy with upcoming concepts and concerns regarding water resource development in 2002. NWP - 2002 of India started to recognize water as part of a larger ecosystem and modified the existing water policy framework with more focus on water conservational aspects and modern concepts in water governance such as institutional mechanism, information system, water resource planning, private partnership and water quality (NWP, 2002).

Promotion of non-conventional water conservation techniques such as artificial recharging of groundwater, inter-basin transfer, desalination of seawater along with the conventional technique of rainwater harvesting, promotion of scientific water consumption and farm practices like sprinkler and drip methods of irrigation to optimize water efficiency, promotion of multi-sectoral and participatory approach on the governance of water sector, promotion of the scientific and cost-effective techniques to reactivate the salinated water systems and land and promotion of 'polluter pay principle in governance of polluted water and promotion of private sector partnership in the water resource management are some of the major suggestions of NWP - 2002 (NWP, 2002).

3.2.5 National Environmental Policy - 2006

National Environment Policy (NEP) - 2006 is a national policy initiative of India to establish its environmental concerns on developmental activities in all sectors. Although India has various sectoral policies aimed at the conservation and development of different sectors of the environment like water, air, and forest, the NEP - 2006 aims to integrate the common interests among the existing sectoral environmental conservation strategies by adopting new empirical knowledge, scientific and economic principles to maximize the scope and sustainable impact of environmental policies in India (NEP, 2006).

The fundamental concept of NEP - 2006 is that "while conservation of natural resources is necessary to secure livelihood and well-being of all, the most secure basis for conservation is to ensure that people dependent on specific natural resources achieve better livelihoods from the fact of natural resources conservation than from degradation of the natural resources" (NEP, 2006). Regarding the water resource system, NEP - 2006 initiates an integrated approach to the development and conservation of freshwater resource system which consists of rivers, groundwater, and wetlands because

each of these water sources has characteristic rode and interdependence to other environmental resources (NEP, 2006).

Integration of conservational practices and consumption practices of wetlands into river basin management to save hydrological regime and related biodiversity, reduction of subsidies on electricity tariff and diesel price to farmers to maintain the groundwater table at rechargeable limits by efficient water consumption techniques (sprinklers /drip irrigation and water sustainable changes in crop pattern) in the irrigation sector, and establishment of the effective legal regulatory system for wetlands to prevent the conversion of wetlands for agriculture, industries, and human settlements and to defend the threat from pollution and degradation of wetlands are the some of the major strategies initiated by NEP - 2006 regarding water conservation (NEP, 2006).

3.2.6 National Water Mission (NWM) - 2008

"Comprehensive Mission Document of NWM" is one of the eight missions of the "National Action Plan for Climate Change" declared by the Prime Minister of India in 2008 to address the threat of climate change and related environmental degradation. Policy and institutional framework, groundwater management, surface water management, management of domestic and industrial water consumption, water consumption efficiency, and basin level planning & management were the major areas of research by the "High-level Steering Committee" of the NWM (NWM, 2008).

Therefore, concerning the aforementioned research areas, the "Comprehensive Mission Document of NWM" recommended several strategies and effective measures of "(1) promotion of public and government initiatives for conservation, augmentation, and preservation of water, (2) formation of comprehensive water database in the public domain and regular

assessment on the climate change impact on water sources, (3) exclusive water conservational initiatives for water scarce and over-exploited regions, (4) promotion of efficient water consumption techniques to enhance water consumption efficiency by 20 % by 2017, and (5) adoption of basin level integrated water management" (NWM, 2008).

Periodical reviews on prevailing national water policies and their impacts are also accepted as one of the effective strategies of NWM to enhance the water sustainability of India. Consequently, the Government of India started to review its prevailing National Water Policy - 2002 with a new vision and mission (NWM, 2008).

3.2.7 National Water Policy - 2012

NWRC of India revised the existing water policy framework with NWP - 2012 to formulate a legal and institutional framework with a plan of unified operations for water resource development at the national level. To realize aforesaid water conservational and developmental goals, the NWP - 2012 recommends the strategies of (a) national law framework for water, (b) adaptation to climate change, (c) enhancement of the availability of usable water resources, (d) efficient water consumption techniques and water demand management, (e) water pricing to manage water consumption, (f) conservation of water bodies, river corridors, and water infrastructure system, and (g) legal institutional mechanism to deal with various issues in the water sector at national and regional level (NWP, 2012).

In addition, NWP - 2012 seriously discusses the relevance of considering water as an economic good and privatization of water services as strategic measures to enhance the efficiency of water consumption and conservation (NWP, 2012). Therefore, it recommends the modern techniques of water pricing, desalination, recycling of grey water, watershed

management, and rainwater harvesting to enhance the level of water use efficiency and water conservation in agricultural, industrial, and urban sectors (NWP, 2012). According to the conditions of NWP - 2012, the State Governments are instructed to revise their regional water policies with the provisions of the national water policy framework and there should be a plan of action proposed by the National Water Board to implement the recommendations of NWP - 2012 (NWP, 2012).

3.2.8 The Draft of National Water Framework Bill – 2016

The Draft of National Water Framework (DNWF) Bill was formulated and suggested by an expert committee constituted under the direction of the Ministry of Water Resources in 2015 to formulate a legal framework for the governance of consumption, preservation, and conservation of water system at national perspective (DNWF Bill, 2016). So, DNWF Bill is an umbrella statement of environmental and policy principles behind the national legal framework on the water to lead the Central, State, and LSG institutions in the governance of water as a ‘common heritage' and stressed essential natural resource.

The concept of National Water Law combines all the developmental and conservational aspects of water governance and divergent policies and practices in the water sector being followed by the central, state, and local bodies into a single legal framework to avoid overlaps and contradictions in the water conservation mission (DNWF Bill, 2016). The relevance of National Water Law is increasing as long as none of the previous national water policies formulated to make national consensus in water governance have legal status. Because, the National Water Law is "intended to be justiciable in the sense that the laws passed and its execution by the Central, State and LSG institutions will have to conform to the general principles and

priorities laid down in the National Water Law, and that deviations can be challenged in a Court of Law" (DNWF Bill, 2016).

Even though the current water policies of India promote economic measures like water pricing and marketing as water conservational techniques, the DNWF Bill strictly instructs that such economic measures should be practiced based on the interests of social justice, equity, and water conservation. So, it suggests a “water pricing order based on a differential pricing mechanism in recognition of the right to water for life and its multiple roles about religion, culture, and history" (DNWF Bill, 2016).

Unlike most of the other water-sensitive countries in the world, India does not have a specific conservational and consumption policy framework for the management of surface water, groundwater, and pollution of water. Instead, the legal frameworks on the aforesaid aspects of water governance are formulated across the Central, State, and LSG by the provisions of NWP. Because such national perspectives of water policy developments in the Indian water sector are the output of the combination of diverse needs and efforts of various regulatory authorities and sectoral institutions and their initiatives. In that concept, the National Development Council of India decided to set up NWRC as an apex forum to formulate water policies, plans, and regular reviews from a national perspective. Therefore, in India, though State Governments are constitutionally permitted to formulate water policies and plans at the state level, the Central Government is regulating such regional initiatives by the provisions of its national water policies (National Water Academy, 2017).

3.3 Water Policy Developments in Kerala

The water governance of Kerala is the combined exercise of various policies and schemes like national water policies, state water policies, and

policies and programmes of rural and urban LSG institutions. In recent decades, the freshwater sector of Kerala is undergoing many structural and strategic shifts in its policy perspectives regarding the conservational and consumption aspects of water governance due to the global, national, and domestic discourses and concerns over the water crisis. Water policy developments of Kerala in general combined with legal and policy shifts along with institutional mechanisms and strategic programs for water resource development. As a State that once had rich freshwater sources, Kerala has its unique water conservational and consumption strategies and plans, but with the introduction of NWP to address the emerging challenges in the water sector across the country, state-level water governance and its strategies and priorities have been adjusted in line with the perspectives of NWP.

The water governance practices of Kerala in general combined with the legal and policy framework along with the government's institutional system and its plans and strategies regarding consumption, conservation, and development of water resources. The water conservational initiatives of Kerala are mainly formulated with various traditional, modern, and conventional methods. But such plethoric water conservational techniques that existed in Kerala led to the formation of serious confusion regarding the context-specific conservation techniques, appropriate mode of implementation, and role of various stakeholders in the water conservation initiatives of Kerala. In addition, during the last few decades, Kerala is suffering from serious threats of increasing water scarcity, water demand, and degradation of water sources. In this context, Kerala started to develop its policy framework and holistic approach in its water sector.

In Kerala, the Water Resource Department of the State Government develops all major policy frameworks and institutional frameworks for the state water sector. In this mission, the Water Resource Department is

supported by its various subordinate sections like Kerala Water Authority, Ground Water Department, Irrigation Department, Command Area Development Authority, and *Jalanidhi* (Rural Water Supply and Sanitation), Kerala Irrigation Infrastructure Development Corporation, etc. Recently, Kerala initiated a ‘special purpose vehicle known as "Haritha Keralam Mission" as an umbrella mission to ensure the revival of traditional water sources, preservation of freshwater resource system, and prevention of the pollution of water sources along with the measures to redeem the hygiene, sanitation and water abundance of the state sustainably (Dept. Of Finance & Planning, 2017). With the formation of the State Water Policy (SWP), all the plans and programs of aforesaid sectoral and sub-sectoral institutions of the State Government and LSG system in the water sector of Kerala begins to formulate by the prevailing water policy of the state.

In 1992, Kerala formulated its own first state-level water policy which was the first individual state water policy framework set up in India in line with the provisions and parameters of then NWP. Because, unlike most of the other states in India, due to its unique environmental features "Kerala is being suffered from steep topography, extremely uneven rainfall, lack of snow-fed rivers, high population density, and diminishing per capita water availability" (SWP of Kerala, 1992). In addition, the" indigenous pattern of cropping and water consumption and nearly 3/4th of the state rivers without any inter-state connections" raised the relevance and need for an individual water policy for Kerala (SWP of Kerala, 1992). Therefore, the aforementioned "hydrologically landlocked" features of Kerala forced and facilitated the Kerala initiatives for an individual water policy framework at the state level.

3.3.1 State Water Policy of Kerala – 1992

Given the crucial role of water in human and animal life and the maintenance of ecological balance, Kerala formulated its water policy

framework in 1992 as a comprehensive document of policy parameters and strategic programs regarding the state initiatives on the consumption, conservation, and development of freshwater resources of the state (SWP of Kerala, 1992). In line with the provisions of NWP - 1992, SWP of Kerala (1992) also suggested various water conservational and developmental initiatives like;

- Preparation of a detailed database of the water system in Kerala with regular monitoring, recording, processing, and assessment of hydro meteorological data (rainfall, water discharging, groundwater level, humidity, temperature, evaporation, and salinity intrusion) of the state;
- River basin development by scientific planning at river basin and its sub-basins in terms of its capacity regarding current use and future use;
- Planning for integrated basin development and scientific watershed management at the micro level in terms of its socio-economic and environmental impacts;
- Maximization of water availability to reduce drought impact by preventing immediate runoff of rainwater and storing the maximum rainwater through various long-term and short-term water conservation techniques like contour trenching, check dams, afforestation, preservation of conventional and non-conventional water bodies, etc.;
- Train the stakeholders in water management to adopt appropriate scientific and technological measures in the conservation and development of water and related natural resource systems.

In addition, Kerala Water Policy-1992 suggested an institutional framework to materialize its objectives and strategies for water developmental and conservational initiatives in Kerala. Formation of a Water Resources

Control Board, Centralized Hydrological Data Bank and Data Processing Centre, and Special Cell in the Irrigation Department to manage non - conventional water resource systems (ponds, tanks, springs, lakes, and *thurangams*) are the major institutional and administrative reforms suggested by the SWP of Kerala - 1992 (SWP of Kerala, 1992).

3.3.2 State Water Policy of Kerala – 2008

The policy parameters and operational plans for water resource management in the first state water policy framework of Kerala were revised in 2008 with new concepts and strategies to address the newly evolving challenges in the water sector of Kerala. The major reforms in the SWP of Kerala - 2008 were formulated based on some new principles and concepts like state ownership of water, water access is a human right, water is a common heritage with economic value, micro-watershed should be the basic unit in the management of water conservation and development, the decentralized institutional framework will be the appropriate mechanism for the sustainable, equitable and user-based water management, etc. (SWP of Kerala, 2008).

SWP-2008 of Kerala seriously focused on the restructuring of the institutional framework of state water governing mechanism to redefine the operational roles of authorities, consumers, and other actors in the water sector to make them capable stakeholders for sustainable, equitable, and efficient water management at the river basin and micro – watershed level. Promotion of a comprehensive approach to water conservation by proper planning in watershed conservation, water quality governance, long-term and short-term operations in the river basin and its sub-basins, and preservation of the state water resource system is one of the major features of this policy reforms (SWP of Kerala, 2008).

To ensure sustainability in the water consumption sector by integrating environmental, social, and physical concerns of the state, the SWP of Kerala-2008 prioritized the water allocation of the state in the following order domestic consumption, agricultural consumption, power generation consumption, agro-based industrial consumption, industrial – commercial consumption and others. Moreover, SWP-2008 suggested that the powers and responsibilities of planning and its execution regarding the water conservational and developmental initiatives of the state shall be decentralized among State Government, LSGs, and Community institutions to ensure sustainability, equity, community participation, and integrity of ecosystem in the management of the freshwater system (SWP of Kerala, 2008).

Since the emergence of state-level water policy frameworks in Kerala, the major legislations and regulations on planning, implementation, and management of the water conservational and developmental initiatives especially on the environmental viability, economic efficiency, and technical and institutional feasibility of water sector reforms in Kerala are formulated in accordance of the provisions and guidelines of prevailing SWP (State Water Policy of Kerala, 2008, 1992). Kerala is one of the leading states of India in the legislative initiatives for the conservation of freshwater resource systems. Therefore, along with the national legislative and policy frameworks for the water sector, Kerala has developed its legislative framework with the following direct and indirect enactments on water conservation;

- The Kerala Protection of River Banks and Regulation of Removal of Sand Act, 2001.
- The Kerala Ground Water Control Regulation Act, 2002.
- Bio-Diversity Act, 2002.

- The Kerala Irrigation and Water Conservation Act, 2003.
- The Kerala Forest (Vesting and Management of Ecologically Fragile Lands) Act, 2003.
- The Kerala Municipality Building (Amendment) Rules for Rainwater Harvesting, 2004.
- The Kerala Land Reforms (Amendment) Act, 2005.
- The Kerala Ground Water (Control and Regulation) (Amendment) Act, 2005.
- The Kerala Tourism (Conservation and Preservation of Areas) Act, 2005.
- The Kerala Irrigation and Water Conservation (Amendment) Act, 2006.
- The Kerala Conservation of Paddy Land and Wet Land Act, 2008.
- The Wetlands Conservation and Management Rules, 2010.
- The Kerala Forest (Amendment) Act, 2010.
- The Kerala Irrigation and Water Conservation (Amendment) Act, 2018.

3.4 Major Reforms in the Water Policy Framework of Kerala

Due to intensifying water crisis regarding diminishing per capita water availability, degradation of water sources and water contamination, Kerala began to formulate and revise its water policy and legal frameworks. Along with various global and national initiatives for water security by sustainable water consumption and conservation, development of water resource system, and prevent water contamination, Kerala also adopted many serious

reformative steps in its water policy frameworks during the last few decades. Therefore, along with the domestic requirements of state, global and national factors and principles also influenced the policy shifts and reforms in the water sector of Kerala. Such reforms and policy shifts in the water governance of Kerala are mainly based on the following principles like water is a vital natural resource with economic value, decentralization and user participation, restructuring of government role, and conservational approach.

3.4.1 Water is a vital natural resource with economic value - It is one of the major principles which led to the recent water governance strategy of Kerala. Along with the "Dublin Statement on Water and Sustainable Development" (1992), a globally accepted assumption evolved among the countries that the lack of economic perspective in the consumption and management of water in the past resulted in the current stage of unsustainable and irrational use of water. Thus, most of the water-scarce nations around the world including India adopted an economic perspective on water management policies and initiatives. So, NWP (2002) of India clearly stated such a policy and institutional framework with an economic perspective.

In line with NWP (2002), Kerala also followed an economic perspective in its water policy shifts with a due role for economic parameters and the private sector in water governance. Such reforms in Kerala characterized water as an economic good or commodity and it resulted in a crucial shift or reversal from a constitutional perspective in terms of the rights of control over and access to water (Kumar, 2020). In addition, due to such a policy shift in the water sector, economic techniques like cost-recovery, privatization, and water pricing are widely recognized as efficient and effective measures of water consumption and conservation as proposed by some international financial institutions like World Bank, Asian Development Bank (Asian Development Bank, 2003). Consequently, most of the free and

public water taps and similar water sources in Kerala began to disappear, and paid and piped water supply networks began to become widespread instead.

3.4.2 Decentralization and Community Participation - In line with global and national reforms Kerala adopted the principle of decentralization and community-based water management into its water policy framework as strategic reform in water governance. Govt. Of Kerala adopted such a reform to decentralize its institutional role in water management among the local government, non-government, and user community institutions to resolve the institutional limitations of government mechanism in water management, especially in water conservation (SWP of Kerala, 2008). Most of the recent water sector initiatives (distribution and conservation) in Kerala were implemented and managed with the active participation of LSGs, non-government and user community institutions.

The concept of 'decentralized water governance' actually means the decentralization of the planning, implementation, and management of water services (consumption, conservation, and development) among all stakeholders including user groups. A decentralized institutional framework in water governance is a globally accepted strategy to ensure essential cooperation and participation of local authorities and user groups in water conservation initiatives (Dublin Statement, 1992). Thus, the role of government institutions shifted from water service providers to a facilitator or regulators in the services of distribution, consumption, conservation, and development of the freshwater resource.

3.4.3 Restructuring of Government Role - Reforms in the water policies of Kerala restructured the institutional framework in water governance by redefining the role of institutional actors in water management especially the role of government institutions. With the implementation of decentralized water governance in Kerala, the State Government transferred its several

prerogatives to non-government, private, and user groups in the water sector. By redefining the role of government institutions in state water management, such policy reforms shared the institutional responsibilities of the government among the aforesaid informal stakeholders in water conservational and developmental initiatives to create a sense of ownership among them (SWP of Kerala, 2008).

In addition to existing conventional government and non-government institutions in the water sector, several new sectoral and inter-sectoral institutions were also created at the state and local levels of Kerala by these policy reforms. With the recent reforms in the water policy framework of Kerala, State Government strengthening its water conservational and regulatory legislations, simultaneously, it minimizing its institutional role in the water sector as incentives to private sector involvement in the water conservational and developmental measures of the State (SWP of Kerala, 2008).

3.4.4 Conservational Approach - Along with the global and national concern on increasing water scarcity, Kerala also realized that existing legal and institutional frameworks are insufficient to ensure its freshwater security by appropriate water conservational measures (SWP of Kerala, 1992). So, the recent water policy reforms in Kerala mainly focused on the adoption of various water conservational measures to address the threats of diminishing per capita freshwater availability, degradation of water sources, water contamination, etc (SWP of Kerala, 2008). Water conservational reforms in the water policies of Kerala led to several legislative enactments regarding the protection of groundwater and surface water, preservation of water bodies and wetlands, prevention of water contamination, and development of a water resource system. In addition, such conservational reforms in the water policies suggested several sustainable and scientific techniques like watershed

management, river basin management, water harvesting, etc (SWP of Kerala, 2008, 1992). Therefore, the conservational aspects of water governance became a major policy parameter of the recent water management initiatives in Kerala. Consequently, many state-wide water conservational programs regarding the revival of traditional freshwater sources like rivers, streams, ponds, etc. are being implemented by LSGs in Kerala.

3.5 Water Conservation Practices in Kerala

Increasing population pressure and consequent demand for water in the agricultural, industrial and domestic sectors of Kerala raised the importance of water conservational aspects in the water management of the State. The state water policies of Kerala also recognized the need for more water conservational initiatives and suggested various measures to address the issues in the water sector because, water conservation is a crucial and essential component of any initiative that aims to resolve water scarcity (NWP, 2002). In line with National Water Policy, the SWP of Kerala (2008) perceived that water conservation is a multi-sectoral practice covering environmental, social, economic, legal, and technological concerns. So, the planning and practicing of water conservation in Kerala are being followed in an integrated manner to address the issues like environmental sustainability, social acceptance, economic viability, and technical feasibility of the various water conservation initiatives (Haritha Keralam Mission, 2016).

Therefore, along with the Central Government of India, the government of Kerala also practices several plans and programs based on traditional and modern techniques in its water conservation mission. as per the provisions of NWP-2002, the Central and State governments in India practice the combination of traditional and modern techniques as its water conservational strategy.

3.5.1 Traditional Techniques in Water Conservation

In India, throughout the generations, water resource has been recognized as sacred one. Since that time, India suffers from either flood or drought due to its uneven rainfall and topographical features. Even though, the country managed such situations naturally by indigenous water conservational and management techniques reflecting its topographical and cultural features. The basic concept behind all such traditional techniques is that "being a source of water, rainwater shall be saved whenever and wherever it falls" to use in the dry season (Agarwal and Narain, 2003). Each of the existing traditional water conservation techniques in India is formulated by the ecological and topographical features of different regions in India. Therefore, an ecological region-wise discussion on some traditional water conservation techniques still prevalent in various parts of India is given below:

a - Trans – Himalayan Region: The Trans-Himalayan region of India especially the Ladakh area developed an indigenous technique of water conservation and management known as '*zing*', it's a small tank that collects water from melting glaciers by a network of guiding channels from the glaciers. By the evening, the collected water in the '*zings*' or tanks is utilized for irrigation in dry areas (Central Water Commission, 2017).

b - Western Himalayan Region: Similar to '*zing*', the Western Himalayan region like Himachal Pradesh and Uttarakhand formulated its regional technique of water conservation known as *'Kuhl'* is a surface water canal or channel built by people or rulers to carry water directly from snow-fed rivers to dry agricultural fields in the region. Such surface water channels or *'Khuls'* divert the glacial water from *'Khuds'* or natural streams to irrigate higher elevation fields than the *'Khuds'*. In addition, some headwalls built across the streams help with the storage of water, inter-field flow of water, and the flow

back of surplus water to the streams or *'Khuds'* (Central Water Commission, 2017).

c - Eastern Himalayan Region: *'Apatani'* tribes of Ziro in the Eastern Himalayan region of India are practicing a multi-purpose technique of water conservation and management named *'Apatani* system'. This indigenous technique of Arunachal Pradesh integrates land, water, and cropping patterns by preserving soil and conserving water for irrigation and paddy-cum-fish farming. *'Apatani* system' is capable to harvest both surface and groundwater for the farming system. In this system "valleys are terraced into various blocks or plots with inlet and outlet on opposite sides and the blocks are separated with earthen dams also". A network of deeper channels interconnects the inlet point and outlet point of the plots and to the farming fields also (Central Water Commission, 2017).

d - North Eastern Hill Region: '*Zabo*' is one of the major traditional water harvesting techniques in Nagaland in the North Eastern Hill Region of India. This system of freshwater conservation combined with agriculture, forestry, and animal care, collecting rainwater from forested hilltops by a network of channels and storing that runoff water in the artificial ponds built on the terraced hillsides. The run-off water in the network of water channels flows through the cattle yards by collecting dung and urine of animals for the paddy fields at the foot of hills. In addition, varieties of the bamboo technique for water harvesting and irrigation are also commonly practiced in this region (Central Water Commission, 2017).

e - Brahmaputra Valley Region: '*Dong'* is a traditional freshwater harvesting technique of Bodo tribal groups of Assam in the Brahmaputra valley region. '*Dongs'* are constructed at the structures of ponds to collect and store rainwater by preventing run-off water in the region. '*Dongs*' are

constructed and maintained by individuals for their irrigational purpose (Central Water Commission, 2017).

f - Indo – Gangetic Plains Region: *'Ahar Pyne'* is an indigenous water conservation technique of South Bihar commonly practiced in the Indo-Gangetic Plains region. It is a traditional flood water harvesting mechanism for irrigation in a dry time. *'Ahar'* is a water reservoir constructed with embankments at its three sides set up at the end of *'Pyne'*. *'Pyne'* is an artificial stream built for collecting water from rivers to *'Ahar'*. Similar to *'Ahar Pyne'* structures, the 'Inundation Channel' of West Bengal also performs as a traditional flood irrigation technique (Central Water Commission, 2017).

g - Thar Desert Region: *'Taanka'*, *'Kund'*, and *'Nadi'* are the major indigenous rainwater harvesting techniques of Rajasthan being practiced in the *Thar* Desert region. *'Taankas'* are cylindrical-shaped underground pits constructed by the households to collect rainwater from the courtyard, rooftop, and artificial catchment areas around the house. The run-off water collected in the *'Taankas'* can be used in the dry time. *'Kunds'* are saucer structured catchment areas sloped into the central circular underground well. The rainwater harvesting technique is mainly used to meet drinking water purposes. *'Nadi'* is a village pond with a high water storage facility to collect rainwater from natural catchment areas in the surroundings of the village. To prevent siltation in *'Nadi'*, afforestation in its drainage basins and the construction of silt traps and spillways are also practiced in this water harvesting system (Central Water Commission, 2017).

h - Central Highland Region: *'Talab'* is one of the major traditional water conservation techniques in the central highland region of India. It’s an artificial or natural water reservoir with high storage capacity. The stored water in the *'Talabs’* is mainly used for drinking and domestic purposes. The

medium-sized 'Talab' is known as '*Bandhi'* and the large sized known as 'Sagar' (Central Water Commission, 2017).

i - Eastern Highland Region: *'Kattas'* are the main traditional irrigation source in the states of *Odisha* and Madhya Pradesh in the eastern highland region of India. *'Katta'* is a temporary check dam or embankment built across the natural drainage lines under a community initiative to store water for use in dry periods. Generally, the construction of *'Kattas'* is north to south or east to west with a slight curve in both ends to facilitate the natural flow of water. The small-sized *'Kattas'* known as 'Munds' and four-sided tanks built under the *'Kattas'* to absorb water known as 'Bandha' (Borthakur, S, 2009).

j - Deccan Plateau Region: *'Ramtek'* model of water harvesting in Maharashtra is one of the major traditional water conservation techniques in the Deccan Plateau region of India. In this interconnected network of surface and groundwater bodies, water tanks interconnected by surface and underground channels formulate a water drainage system from foothills to plain fields. Once the water tank on the hilltop is filled with runoff water, it will flow down to fill the successive tanks in the network (Central Water Commission, 2017).

k - Western Ghats Region: Most of the land in the Western Ghats is experiencing a high amount of discharge in rivers during the monsoon period and lesser discharge during the dry time. Therefore, people in this region practiced a unique water harvesting technique named *'Surangam'* or *'Thurangam'*. ' *Surangams'* are horizontal wells constructed in rock fields to collect seepage on downhill slopes and seep water in the *'Surangam'* flows out of the tunnel to an open pit built outside the *'Surangam'* for collecting water. The long *'Surangams'* are having several vertical airshafts to ensure atmospheric pressure in the tunnel (*Pillai*. V, 2015).

The *Kuruma* tribal community residing at Wayanad in the Western Ghats region practices an indigenous technique of water conservation named ' *Panam Keni'*. It is a wooden cylinder built with an outer layer of toddy palms. Such *'Panam Kenis'* immersed in groundwater springs located in the field and forest can maintain abundant fresh water even in dry periods (Central Water Commission, 2017).

l - Western Coastal Plains: The West Coastal regions of India mainly practice *'Virdas'* as a rainwater harvesting technique developed by the nomadic *Maldharis* of Gujarat. *'Virda'* is a shallow well-constructed in low depression or tanks to collect rainwater in the coastal region. The structural features of each *'Virda'* can keep collected freshwater separated from salty groundwater with a middle layer of brackish water (Central Water Commission, 2017).

m - Eastern Ghats Region: One of the important traditional water conservation techniques of the Eastern Ghats region is *'Korambu'*. It's an artificial check dam constructed across the mouth of water channels like canals and streams to enhance the water level in the channels to lead the water flow in water required directions. This system of temporary dams was built twice a year constructed with horizontally fixed wooden beams connecting both sides of the water channel and a chain of vertically fixed wooden beams with appropriate height and touching the ground level of the channel. The height of the *Korumbus* can be adjusted according to the required amount of water flow into the various farm fields (Pillai. V, 2005).

n - Eastern Coastal Plains: *'Eris'* or 'Tanks' are the common traditional water conservation mechanism in South Indian regions, especially in Tamil Nadu. '*Eris'* is huge artificial earthen water reservoirs or tanks. Sometimes it is maintained as an interconnected *'Eri* system' with access to a chain of water channels to divert any river water and balance the water level in the era

system. As an eco-friendly method, *'Eris'* is still in practice to recharge the groundwater system and prevent runoff of rainwater, soil erosion, and flood. The small and single tank or '*Eri*' constructed to irrigate isolated fields with a limited amount of water collected from rainfall known as *'Oorani'* is also commonly practiced in this region (Pillai. V, 2005).

o - The Island Region: Most of the Islands in India practice the 'Jack well' system as their prominent indigenous technique of water harvesting and conservation. Mainly, the *Shomben* tribal community residing on the rugged land of Nicobar Island practices a chain of 'Jack Well' for rainwater harvesting. 'Jack Well' is a man-made shallow pit surrounded by dams built with strong logs. In a 'Jack Well System', some full–length longitudinally slithered bamboos placing under the trees with slight slop to 'Jack Well'. Such bamboo channels are collecting runoff water from trees to fill the 'Jack Well'. In an interconnected Jack Well system, the overflow from the first Jack Well flows to successive Jack Wells in the network by interconnected bamboo channels (Pillai. V, 2005).

Being a state with experience of both flood and drought, Kerala has constituted its traditional water conservation system by rainwater harvesting, groundwater recharging, and natural irrigation and drainage measures. The science and structures of such traditional water conservation measures are evolved in terms of the topographical and climatic features of this region and its centuries of experience in this sector.

Among the aforementioned region-wise traditional water conservation techniques in India, *Katta, Surangam* or *Thurangam, Eri* or *Tank, Oorani*, *Korambu* or *Chira, Panam Keni*, Ponds, and Wells are the prominent traditional water conservation techniques practiced in the different terrains of Kerala. Being a State with a strong affiliation to the Western Ghats region, all such traditional water conservation strategies have evolved as an exclusive

response to the ecological diversities of the Western Ghats and related cultural backgrounds.

Kattas and their different variants like 'Bandhs' and '*Mundas*' are some of the traditional water conservation techniques of Kerala mainly practiced in the Kasaragod district to collect and store river water for groundwater recharging and the enhancement of river percolation (Samuel, 2003). Such traditional water conservation strategies have been practiced under community initiatives for dry time irrigation with conserved water. *Korambu* or *Chira* is another traditional water conservation technique commonly practiced in the various parts of Kerala, especially in the Thrissur and Kasaragod districts. It's a temporarily made wooden dam to adjust the water level in the channels to divert the water flows for the water required fields (Pillai. V, 2005).

Surangam or *Thurangam* is an exclusive traditional technique of water conservation in the northern region of Kerala with low discharge in rivers during the non-monsoon period. Still, it's a major practice of water harvesting in the Kasaragod district to collect groundwater by horizontally constructing well in rock formations (Pillai. V, 2005). *Panam Keni* is an indigenous technique of tribal communities in the elevated forest region of Kerala. It's a wooden cylindrical formation mainly practiced by *Kuruma* tribal community in Wayanad to collect and store water for the dry period. The traditional techniques like *Eris* and *Ooranis* are also practiced in a few parts of Southernmost Kerala which borders Tamil Nadu. Above all, natural and artificial ponds related to farm fields and temples, household and public wells, mulched coconut and aeronaut basins, and coconut husk trenches also constitute the major portion of the traditional water conservation system of Kerala (Pillai. V, 2005).

3.5.2 Contemporary Water Conservation Practices

The intensifying pressure of centralization in water governance, multi-sectoral demand for water from the sectors of agricultural, industrial, power generation, etc, and the constant occurrence of drought and flood led to the emergence of modern strategies and techniques of water conservation as a global solution to address the issues in the water sector at the macro level. Therefore, the modern water conservation techniques with socio-economic and environmental concerns are centralized, macro, and universal. To address the newly emerged threats of spatial and temporal differences in the availability of monsoon, intensifying multi-sectoral water demand, inefficiency in water consumption, diminishing per capita freshwater availability, and water contamination and degradation of surface and groundwater resource system in the current water sector of India, the country adopted a three - dimensional strategy of water conservation (Central Water Commission, 2017) as follows:

A - Water resource conservation by preserving available water, water sources, water quality, and water eco-system;

B - Water use conservation by preventing misuse, overuse, and wastage of water;

C - Efficiency in water consumption by implementing water-saving technologies, cropping patterns and economic parameters, etc.

Based on the aforementioned multi-dimensional strategy of contemporary water conservation system, a discussion on major contemporary water conservation practices that are prevalent in India and relevant in Kerala is following:

a - River Basin and Watershed Development: The recent national water policies of India often focused on the river basin and watershed development as an integrated strategy for the conservation of water and related natural resource systems. The river basin development in the course of actions (conservation and rejuvenation of rivers, lakes, ponds, wetlands, and other water-related eco-system) for the conservation and development of the total land area which includes the area drained by the rivers and the network of its tributaries and related aquifers and the catchment areas of precipitation or run-off leading to the river or its tributary or related aquifers. Being a micro-unit in the river basin system, the development of watershed by check dam, a chain of contour trench, sub-surface dyke, and seepage wells also embedded in the integrated river basin development based on the principle of water mass conservation of the country (DNWF Bill, 2016).

b - Canal Lining: It's a method of lining or covering the canals or natural water channels with geo-membranes or plastic or concrete canvases to speed up the water movements in the channels. It enables a sufficient supply of water to tail-end farm fields without any type of water loss or wastage like seepage (Central Water Commission, 2017).

c - Laser Land levelling and Management: It's a contemporary practice of integrated water conservation by removing the unevenness of the soil surface as a technique having an impact on the soil - water conservation, germination, the yield of the crop, rainwater harvesting, recycling of agricultural wastewater, reduction of runoff water, soil moisture and water storage (Central Water Commission, 2017).

d - Piped and Pressurised Irrigation: In this system, a chain of pipes carries water from a water destination to a distant outlet with the support of gravity pressure or pumping pressure, or both. This pressurized pipe channel enables the water conveyance without any water loss by evaporation, seepage, and

friction. In addition, the pressure pipe supply of water facilitates the sprinkler and drip irrigation methods on the farms (Central Water Commission, 2007).

e - Micro Irrigation Techniques: Micro irrigation method is a popular irrigation technique with high water use efficiency. Because contemporary micro-irrigation techniques such as sprinkler and drip irrigation are free from water lost by evaporation and seepage. The sprinkler is an irrigation technique of spraying water like natural rainfall in a controlled manner on the crops or farm fields with the help of nozzles fixed in the network of pressure pipes. Drip irrigation is a more water-efficient technique than the sprinkler. Because it is the technique of slow and direct dripping of water into the root zone of plants "either from above the surface or below the surface soil". In this technique, the dripping can be regulated in the required manner to avoid water loss by evaporation and percolation (Central Water Commission, 2017).

f - Moisture Conservation Pit: It's a micro pit dug in the fields or groves to capture runoff water for the recharging of the ground water system during the rainy period (Dept: Of Soil Survey and Soil Conservation, 2016).

g - Rainwater Syringe: It’s a cost-effective rainwater harvesting method with salination resistance practiced in the coastal regions of Kerala. In this technique, a network of PVC pipes carrying rainwater from the rooftops of houses to a pressure tank is constructed in the ground. The tank allows the deepening of stored water underground at below sea level. The deepened water stored below sea level can be recollected by a piston pump or motor through a tube well built in the adjacent areas (Dept: Of Soil Survey and Soil Conservation, 2016).

h - Reuse of Agricultural Water by Drainage Management: It’s a method of collecting the access irrigated water in the farm fields by the chain of perforated pipes buried under the farm fields and redirecting the collected

water mixed with nutrients in the pipelines to irrigate other farm fields. This water-saving technique avoids the wastage of water simultaneously it prevents eutrophication of adjacent water destinations by the runoff from farm fields (Central Water Commission, 2017).

i - Contour Trench: It's an artificial trench built across the hill slopes and barren tracts to intercept the quick surface runoff by breaking the land slopes, especially in the high land regions. This technique is mainly meant to maintain soil moisture for a long period of lean period by storing rainwater both on hill slopes and degraded terrains. The continuous contour trenches with trapezoidal shapes are built in both low and high rainfall conditions of the region (Dept. Of Soil Survey & Soil Conservation, 2016).

j - Sub-Surface Dyke: It is an artificial dam constructed entirely at the sub-surface or under the ground level of the stream bed to balance the level of groundwater table upstream of the dyke by intercepting the quick flow of streams. In addition, it can raise the volume of water storage and recharge of ground in the stream course without any water loss by contamination or evaporation. Such dykes are harvesting water during the monsoon for the water needs in the lean period. The high flow over the dyke is recharging the aquifer downstream (Dept. Of Soil Survey & Soil Conservation, 2016).

k - Percolation Tank: It's an artificial groundwater recharging mechanism. Such tanks or ponds are built across various water course areas to enhance the water availability in the wells and ponds in the surrounding terrains, especially during the dry season. It is one of the minor water harvesting structures being practiced by the farmers for their irrigation and domestic requirements. Such artificial structures across the natural streams enhance the volume of percolation and soil moisture by reducing the velocity of quick runoff during the monsoon period (Dept. Of Soil Survey & Soil Conservation, 2016).

l - Gully Plug: It is an earthen embankment built across the gullies to prevent active gully erosion. Usually, such structures are built with locally available materials like mud, loose rocks, brushwood, woven wire, etc. There is no standard design or principle followed in the construction of such structures (Dept. of Soil Survey & Soil Conservation, 2016).

m - Check Dam: Check dams are artificial structures of water conservation built across narrow streams with high banks to reduce the volume of quick runoff and active erosion in the streams. Usually, such dam structures are constructed with stone, clay, wood, concrete, etc. in line with the local availability of such raw materials. The flow of the dammed stream can be regulated by the spillways or sluices set up in the dam structure. The active percolation and soil moisture by stored water in the dam result in the proper recharging of the aquifers in the adjoining areas of the dam (Dept. of Soil Survey & Soil Conservation, 2016).

n - Water Pricing: The recent national water policies of India adopted water pricing as an economic technique in water conservation strategy to reduce overuse, misuse, and wastage of water. Economic techniques like water pricing and the "polluter–pays - principle" maximize the water use efficiency by rational use, reuse, and recycling of water (National Water Policy, 2002, 2012).

o - Water Budgeting: It’s a scientific assessment of the per capita freshwater availability, multi-sectoral water demand, water consumption pattern, roots of water losses, and the hydrological cycle of the country. So, water budgeting is a scientific technique based on the principle of water mass conservation to enhance the volume of Sustainability, efficiency, and quality of water and its consumption (Niveditha, 2019).

p - Water Auditing: Recent water policies of India demanded the serious practice of water auditing in this sector as an effective tool to identify the real issues in the water conservation system. In addition, it can suggest appropriate interventions on water use and loss by the documentation of what is happening to the water movement system from its source point to the end-user point (Central Water Commission, 2017).

q - Virtual Water Assessment: It's a scientific technique to measure the total amount of water consumed or polluted during the entire production process of any good or service. Being a water-scarce country with regional variations in water availability, India also started to practice virtual water assessment in terms of space and time to measure the efficiency and sustainability of water use and water (virtual) flows in its major water consumption sectors especially agriculture and industrial sectors. In the light of virtual water analysis based on the principle of water mass conservation, the country adopting various water-saving reforms and re-arrangements on its crop pattern and water consumption pattern in terms of water sustainability and efficiency to ensure sustainable virtual water flow (Central Water Commission, 2017).

Along with the aforementioned modern techniques and strategies, various types of rainwater harvesting are also practiced across the country as a mass technique. Unlike traditional patterns, contemporary water harvesting techniques are macro and mass projects using natural and artificial catchment areas, large reservoirs or tanks, and household storage formations for direct consumption purposes and artificial recharging of the groundwater system (Central Water Commission, 2017).

With the emergence of national water policies, the adoption and implementation of all the contemporary water conservational strategies and practices in India and its regional units are determined by the provisions and

guidelines of its prevailing national water policy framework. Therefore, being a regional unit responsible for the provisions and suggestions of the national water policy framework of India, Kerala is practicing most of the aforesaid contemporary water conservation techniques in terms of its potential.

During the post-independence period, the water governance of India became more centralized in terms of its political-economy principles. The pressure of centralization and intensifying multi-sectoral demand for water led to the emergence of macro-projects and modern techniques and replaced the then traditional and micro-approaches in the water sector of India. Even though, the intensifying water crisis around the world in the last few decades led to many strategic shifts in the global perspective on the policies and practices of water resource management, especially for the decentralization of water consumption and conservation management (Dublin, 1992). Consequently, in line with such global policy shifts, India also revised its recent water policy frameworks with exclusive provisions and suggestions towards the decentralized water management system with an adequate role of LSG institutions and local communities along with their traditional techniques of water conservation (National Water Policy, 2002, 2012). Therefore, as a state with a strong and stable LSG system, the rural and urban LSG institutions of Kerala have a legal and institutional stake in the water conservation initiatives in Kerala.

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CHAPTER- 4

LSG INSTITUTIONS IN KOZHIKODE DISTRICT: AN INTRODUCTION

The present chapter covers a detailed discussion on the evolution and practice of LSG institutions in India. The chapter is arranged its discussion into three parts. The first part of the chapter examines the evolutionary process of the LSG system in India. The second part deals with the institutional framework of the LSG system in Kerala. The third part of the chapter is an exclusive examination of the urban and rural LSG institutions in the Kozhikode District of Kerala.

4.1 Defining the Concept of Local Self-Government

As a multi-dimensional concept, the term Local Government or Local Self–Government has been defined from different angles concerning specific features of the concept of local self–government. D. Lockard defined local government as “a public organization, authorized to decide and administer a limited range of public policies within a relatively small territory which is a subdivision of a regional or national government". In the point of view of V. Venkata Rao LSG is the “part of government which deals mainly with local matters, administered by authorities subordinate to the state government but elected independently of the state authority by the qualified residents" (Rao Venkata, 1965).

Another eminent political thinker Clarke explained the term local government as “part of the national or state government which deals mainly with the affairs of inhabitants of the particular district or places, together with those affairs which parliament has deemed it desirable should be administered by local bodies, subordinate to the central government" (Clarke, 1948). According to Maheshwari, the local self–governments are constituted with

some essential features like statutory status, community participation in decision making and administration, general purpose bodies, and power to raise taxation and act independently within its jurisdiction (Maheshwari, S.R, 1984).

An assessment of the aforementioned multi-angled definitions of the concept of LSG reflects that the idea of 'decentralization' is the foundation principle of such LSG institutions. Decentralization is a dynamic term highly celebrated around the world over the last few decades. The ambiguous concept of decentralization is generally recognized as a " state reform practice composed by a set of public policies to transfer authorities, responsibilities, and resources of government from higher to lower-level units in the context of a specific type of state" (Cheema and Rondinelli, 1983). By such reform of decentralizing the authorities, responsibilities, and resources of the central unit of government, decentralization has a fundamental objective to equip and enable the local units of government to plan and implement their policies and programs in terms of the requirement and priorities of local communities by active people participation.

In addition, the UNDP (2000) widened the scope of decentralization as a “comprehensive institutional reform practice to address the issues like poverty, environmental crisis, gender inequality, health issues, access to education and technology, etc. in association with participation of local communities, private institutions and international institutional and citizen aids". Therefore, along with the developed countries, the United Nations development agencies and other international multi-lateral aid institutions also significantly promoted this concept as an administrative mechanism of high community participation, government responsiveness, and accountability in governance.

Besides, the domestic factors like political demand for democratic self-rule in the nations that experienced colonial rule, and movements for political devolution in the nations with regional and ethnic diversities forced many countries to be receptive to the concept of decentralization. Consequently, during the last few decades, a large number of developing countries around the world adopted the concept of decentralization as an institutional reform by conceiving LSGs to address the issues in social, political, economic, and environmental sectors. India is one of the major states among them and the studies on decentralization reforms of such countries conducted by the World Bank ranked India as one of the best performs in this sector (World Bank, 2000).

4.2 Evolution of Local Self Government System in India

If we analyse the evolutionary process of the LSG system and decentralized governance in India, we can identify the significant role of its own historical experience since the Vedic period regarding various indigenous models of the village and town self–government formations (H.F. Alderfor, 1969). Such village governments are formed and performed differently by the regional and cultural diversities of India. Most of such village committee formations are the output of the agrarian economy system of pre-colonial India. Such centers of local administration, economic force, social life, and social unity existed in the pre-colonial period and exercised the role of LSG (Islam Nasrul, 2007).

Joint families are the base unit of some of the village community formations that emerged during this period, in which, members of such joint families unite and associate themselves as a political and administrative unit of the village with social recognition (Pillai. V, 1940). All such traditional local government structures led by the elders in joint families or castes and chieftains of villages functioned in a feudal order and as an intermediary

between higher authorities and local people (Reghunandan, 2012). Therefore, such local government experiences different extent of roles and forms commonly practiced in the various parts of pre-colonial India.

4.2.1 Colonial period

During the colonial period, India began to exercise the modern institutionalized versions of local government structures. Since the establishment of Calcutta, Bombay, and Madras presidency towns in India by the Royal Charter Act of 1793, some local government structures in the elusive manner introduced by the Town Improvement Act of 1850 with authorizing LSGs in mofussil towns to offer civic amenities in its jurisdiction (Argal, 1960). In 1870, Lord Mayo's Resolution raised the desirability of including natives in local administration for strengthening the municipal institutions. Subsequently, the Town Improvement Act of 1871 expanded the devolution of power to such local government structures to maintain sanitation, education, public work, and medical relief sectors with the representation of elected native people (Nigam, 1968).

Lord Ripon's Resolution, 1882 led to the next level in the development of local government structures as a network of LSG institutions and means of political and popular education. To him, local government should be constituted with elected and non-governmental members from the locality to reduce the central control over such local government units. This resolution recommended empowering the local governments to levy taxes to be financially independent (Govt. of India, 1882). Subsequently, the Bengal Local Self–Government Act also came to effect in 1885, which led to the formation of district local boards in colonial India.

Resolution of Royal Commission on decentralization - 1909 seriously suggested that in addition to the existing municipality system, each village

must have a panchayat and it must be considered as the basic unit of LSG structures. Besides, it recommended more budgetary and taxation powers and representation of elected natives in the LSG system (Report of Royal Commission, I909). Govt. of India-1919 issued a resolution repeating the major suggestions of the Resolution of Royal Commission as its provisions to take a new step in the evolution of the LSG system in India.

In 1935, the Govt. of India Act empowered the provincial executive to determine the territorial jurisdictions, the number of elected seats, and the mode of seat allotment in municipalities, village panchayats, and district boards in its jurisdiction. In addition, Provincial Governments enjoyed the general power to dissolve and reconstitute the local governments, and cancel or suspend the resolutions policies of local bodies (Govt. of India, 1935). Although several popularly elected LSGs came into existence as an impact of the Govt. of India Act, 1935, no changes were happened in the fundamental legal framework controlling the various urban and rural self - governments accordingly.

4.2.2 Post–Colonial Period

Constitutional reforms of India led to many significant developments in the evolution of the LSG system in the post-independent period. The factors like global and national perception of decentralization, Gandhian thought of gram *swaraj*, five-year plans, and community development movements of India constituted the features of constitutional reforms in India towards the development of the LSG system. Article 40, article 171, and State List in the Seventh Schedule of the Indian Constitution are the limited references in the original Constitution of India regarding the concept of its LSG system.

Article 40 of the Indian Constitution which offers one of the DPSP states that "the state shall take steps to organize village panchayats and endow them with such powers and authority as may be necessary to enable them to function as units of self-government" (Constitution of India,1949). State List in the Seventh Schedule of the Indian Constitution contains that "Local government, that is to say, the constitution of powers of the municipal corporation, improvement trust, district board, mining settlement authorities and other local authorities for self–government or village administration", whereas the Seventh Schedule of the Indian Constitution bestowed the LSG system under state governments (Constitution of India, 1949).

Along with the constitutional perspective on the LSG system, India initiated the Community Development Programme in 1950 to speed up the country's development through the community-based administration centred around the LSG bodies. The First Five Year Plan of India also highlighted the relevance of rural development through the people-centred administration of LSG institutions and funded a lot of Community Development Programme. Unfortunately, in the field, Community Development Programme lacked proper community participation and it centred on the bureaucratic authorities (Govt. of India, 1958).

Over time, the constitutional provisions of the LSG system were further modified and elaborated in terms of suggestions of the studies conducted by the various committees and commissions appointed by the Union Government of India. Following committees significantly contributed to the evolution of India’s LSG system to its present form.

4.2.2.1 Belwant Ray Mehta Committee: National Development Council of India appointed Belwant Ray Mehta Committee in 1957 to examine all the issues in the LSG system of India based on the Community Development Programme experience. The major recommendations of the Belwant Ray

Mehta committee stressed the necessity of democratic decentralization of local governance with panchayats at the district, block, and village levels to ensure the people's participation in the decision-making process. In addition, it strongly recommended the formation of statutory elective local governing bodies of decentralized governance with adequate powers, resources, and authority to initiate grass root level development (Govt. of India, 1957).

By recognizing the major suggestions of this committee as the basis of the proposed LSG system, India launched its Panchayat Raj system in 1959. Even though, the factors like political and bureaucratic reluctance to power sharing in the states, domination of money, and caste over the inefficiency and absence of elected representatives led to stagnation in the process of the desired amount of democratic decentralization (Thankappan, 2000).

4.2.2.2 Ashok Mehta Committee: An evident stagnation in the LSG sector led the Govt. Of India appointed a new team under the leadership of Ashok Mehta in 1977 to examine the stagnating factors in the democratic decentralization process by the on-going Panchayat Raj system. Team Ashok Mehta observed that the absence of institutional clarity and efficiency in democratic decentralization and grass-root development practices itself stagnated the entire network of Panchayat Raj institutions. So, Ashok Mehta raised the necessity of Constitutional intervention in the institutional framework of the Panchayat Raj system (Govt. of India, 1978). In 1978, Ashok Mehta Committee submitted its conclusions highlighting the more comprehensive role of the LSG mechanism with the following suggestions:

- Two tired LSG systems constituted by direct or indirect election with reservation for scheduled caste and scheduled tribe, and women,
- Provision for a strong institutional framework at two tiers of Panchayat Raj institutions with adequate powers, and financial and bureaucratic

resources devolved from the state government to adopt developmental initiatives at the grass-root level,

- A political vision for more community participation in the planning and implementation practices of LSG institutions with essential powers and resources,
- Formation of *Mandal Panchayat* by interconnecting various villages to form a combined platform of similar and interrelated developmental schemes in and around various LSG units (Govt. of India, 1978).

4.2.2.3 G.V. K. Rao Committee: In 1985, Union Govt. of India appointed G. V. K. Rao committee to make a comprehensive study on all possible measures to activate the LSG institutions and local initiatives for development and Social Justice at the grass-root level of the country. So, the studies of the Rao committee had conducted in a sector-wise manner by different groups. After examining the institutional limitations of on-going rural developmental and " poverty eradication" schemes, the first group of team Rao observed that planning and implementation of such programs at each level (village, block, and district) should be practiced strictly in terms of a formula prepared by the experts and recognized by State Legislative Assemblies concerned (Dept. of Rural Development, 1985).

The group studied the organizational and functional structure of Panchayat Raj institutions and observed that the existing decentralized governance and its institutional machinery lack institutional and functional uniformity. Therefore, the committee suggested the states keep plans and projects well prepared by the experts in terms of specific objective norms and conditions and let the LSG units adopt such plans with necessary modifications based on local requirements. To bring attitudinal reform and professional expertise to the functionaries of the LSG system, the Rao

committee recommended more refreshers, orientation, and professional training programs among them. In addition, Rao and his team recognized District Panchayat as the principal authority in the management of developmental programs and the district as the basic unit of policy making and its implementation to ensure the necessary institutional role of all LSG units in the local development initiatives and functional harmony with higher authorities (Dept: of Rural Development, 1985).

4.2.2.4 L.M. Singhvi Committee: The appointment of the Singhvi Committee is another attempt of the Union Government of India to strengthen the conceptual and functional aspects of its LSG institutions towards democratic decentralization. At the initial stage of the study, the team Singhvi observed that the absence of a political will, national priority, and conceptual clarity are the major limitations of the existing local governing system. Therefore, the committee considered *Grama Sabha* and villages as the "republican base" of the Indian democratic system and recognized *Grama Sabha* as the embodiment of its direct democracy and Panchayat Raj as means of its democratic decentralization (Ministry of Rural Development, 1985). As an effective means to develop the social habit of self-governance, the Singhvi committee recommended the idea of *Nyaya* Panchayat for a cluster of village units constituted with appropriately expert and trained members and functionaries. To integrate the planning and implementation practices of various sectoral departments in the state with District Panchayat, the Singhvi committee suggested the posting of a District Panchayat (Ministry of Rural Development, 1985). Above all, team Singhvi strongly recommended the Constitutional status of Panchayat Raj institutions by declaring them as the third tier of government to ensure uniformity and clarity in its structure and functions.

Most of the committees and commissions assigned by the Union Government of India repeatedly indicated that the absence of uniformity in the structural and functional aspects of the LSG system and political and bureaucratic reluctance to power-sharing with people are the major constraints of India's decentralized governance. Therefore, the administrative leadership of India also realized the necessity of Constitutional intervention to address such institutional defects and bias in the local governance sector. After making a consensus among the political leaderships of the country on constitutionalizing of proposed provisions regarding mandatory setting up of LSG institutions with periodical elections, reservation for vulnerable sections, and regular accounts auditing, the Union Govt. India implemented 73rd and 74th Constitutional Amendments in 1992 (Chandrasekhar, 2012).

4.2.2.5 73rd Constitutional Amendment Act of India

73rd Amendment of the Indian Constitution introduced a strong legal framework for a three-tiered system of rural self–governments to ensure decentralized governance at the sub-state level of India. Along with this village, block, and district level LSG network, *'Grama Sabha'* has been introduced as the fourth tier of direct democracy. In addition, the 73rd Constitutional Amendment made State Governments constitutionally responsible to set up Panchayat Raj (PR) institutions in a uniform manner with the jurisdiction of 29 subject areas under the state (Government of India, 1993). Thus, the Constitutionalised PR system of rural self-government came to effect in India on April 24, 1993, with the following mandatory provisions:

- Formation of PR institutions every five years by direct and compulsory elections for all the seats in the three tiers of the PR system,
- Proportionate reservation of seats for scheduled castes and tribes in all PR institutions at the village, block, and district level is mandatory,

- Women reservation of seats in one - third of all seats in the three tired PR units,
- Indirectly elected chairpersons at all the district and intermediate bodies of the PR system,
- Reservation in proportion to the population of scheduled caste and tribe is mandatory in the posts of chairperson also,
- One–third of all chairperson posts in the PR units are reserved for women,
- Appointment of an independent election commission to conduct fair elections to the LSG units,
- Appointment of a State Finance Commission every five years to observe the financial status of LSG units and to make suggestions (Government of India, 1993).

4.2.2.6 74th Constitutional Amendment Act of India

74th Constitutional Amendment (1993) added Part IX A into the Constitution of India which contains the mandatory provisions on urban LSG institutions such as Municipal Corporations (in the larger urban region), Municipal Councils (in the smaller urban region), and Nagar Panchayats (a region in transition from rural to urban features). The 74th Constitutional Amendment Act for urban governance by LSG units came into effect in India on 1st June 1993 with the following constitutional provisions:

- Formation of three types of urban self–governments (Municipal Corporation, Municipal Councils, and Nagar Panchayat) in terms of the demographic density and urban features of the region,

- Three types of Municipalities should be constituted every five years with directly elected members, nominated members with expertise in municipal administration, and representatives from State Legislature,
- Formation of Ward Committees in all types of municipalities in the region with a population of three lakhs or above,
- Reservation of seats for scheduled caste and tribe in all urban self–governments in proportion to their population in the region,
- Women reservation in not less than one–third of the total seats in municipal institutions,
- Appointment of a Finance Commission to observe the financial status of urban and rural LSG institutions and report to the Governor of State,
- Formation of District Planning Committee to consolidate development plans of urban and rural LSG units in the district,
- Formation of a Metropolitan Planning Committee in urban areas with a population of ten lakhs or above to prepare a master plan of development for that metropolitan area as a whole (Government of India, 1993).

73rd and 74th Constitutional Amendments of India constitutionalized the authority of urban and rural LSG systems with uniformity and clarity in their structural and functional aspects. The 73rd Amendment brings 29 subjects of function to the authority of PR institutions and 74th Amendment provides 18 subjects to the Municipalities under the urban LSG system. Even though, as a subject in State List of Seventh Schedule in the Indian Constitution, any structural and functional reforms in urban and rural self–government system has to be implemented by the state governments. Unfortunately, implementation of such constitutional reforms proposed by the 73rd and 74th

Amendments at the state level is being practiced differently by various states due to their reluctance to power sharing. But Kerala is one of the major states successful in the implementation of democratic decentralization in the various aspects of state governance through LSG institutions.

4.3 The institutional framework of the LSG system in Kerala

Being a regional unit of India, Kerala also has similarly experienced some decentralized governance models since the ancient period. Travancore, Cochin, and Malabar regions of Kerala practiced various models of LSG during this time. Though the history of comparatively modern LSG formations in these regions goes back to the various administrative reforms that emerged during the colonial period, the experience of democratic decentralization by the modern LSG structures started with the formation of the first elected government of Kerala in 1957. This government started Kerala's decentralization reforms by constituting an Administrative Reform Committee (ARC) under the chairmanship of E.M.S. Namboodirippad, the then Chief Minister of the State to strengthen the existing LSG system by the principle of democratic decentralization.

The ARC realized that the existing LSG system with a colonial legacy centred around a few powerful social sections and it should be replaced with a new LSG framework in terms of decentralized governance, reorientation of bureaucracy, larger public participation, and grass root level development (Namboodirippad, 2009).In response to suggestions of ARC, the State Government presented the District Council Bill and Kerala Panchayat Bill in the Kerala Legislative Assembly but not enacted as the then State Government was dismissed and its legislature was dissolved (Oommen, 2009). Even though, the State of Kerala enacted the "Kerala Panchayat Raj Act" and “Kerala Municipality Act" in 1960 to strengthen the existing LSG types of machinery in the Travancore, Cochin, and Malabar regions of Kerala

with an enlarged uniform legal and functional framework (Ramachandran, 1988).

Along with the reforms in national perspectives on the institutional and functional framework of the LSG system, Kerala also adopted many reformative steps in its legal framework of the LSG system during the pre-Constitutional Amendment period. The legislative initiatives in Kerala towards the formation of 'District Council' (1991) is one of such enthusiastic efforts adopted to ensure decentralized governance in the grass-root level development (Isaac and Franke, 2000). In 1988, the Govt. of Kerala appointed V. Ramachandran as Special Advisor to study the scope of democratic decentralization at the district level by the formation of District Councils.

The report of Ramachandran strongly recommended for the formation of a District Council by redefining the institutional role of heads of the departments of state and districts on grass-root level development concerned, and deployment of an adequate number of functionaries with professional expertise to District Councils with the service and status as government staffs (Ramachandran, 1988). The then government also felt that his recommendations are relevant and appropriate to the concept of District Council and established the institution of 'District Development Council' as a center of decentralized administration at district and lower levels by the enactment of Kerala District Administration (Amendment) Act, 1990. Thus, District Councils came into effect in Kerala in February 1991 by the elections conducted on the eve of 1990.

To coordinate the development administration of the district and lower levels in line with state sector schemes based on the guidelines of the State Planning Board, the authorities and functionaries at the district level are rearranged by the state government (Isaac and Franke, 2000). Along with adequate devolution and bureaucratic resources, District Councils in the state

are financially supported by the Eighth Five-year Plan and Annual Plan (1991-92) of the state. But, most of the District Councils in the state failed to come up with the desired results. Unfortunately, along with the inefficiency of deployed officials and fluctuations in the political interests of the District Councils, the implementation of the 73rd and 74th Constitutional Amendments on the legal framework of the nationwide LSG system weakened the relevance of democratic district governance by District Councils (Isaac and Franke, 2000).

The enactment of the 73rd and 74th Amendments of the Indian Constitution launched a new era in the development of decentralized governance by constitutionalizing the urban and rural LSG system with a uniform legal and institutional framework at the national level. It made all the states in India Constitutionally responsible to establish a three-tiered PR system for rural areas and a *Nagarapalika* system for urban areas within one year from the date that the Acts came into effect. Therefore, in 1944, the State of Kerala also enacted its State Panchayat Raj Act and Municipality Act in line with the mandatory provisions of the 73rd and 74th Constitutional Amendment Acts of India to establish an institutional framework for rural and urban LSG institutions in the state. So, the current "Kerala Panchayat Raj Act" and the "Kerala Municipality Act" in 1994 repealed the Kerala Panchayats Act and Municipality Act in 1960.

4.3.1 The Kerala Panchayat Raj Act (KPRA), 1994

The State Legislature of Kerala enacted the KPRA on 23rd April 1994. It established a legal framework of a three-tiered PR system by constituting panchayats at Village, Block, and District levels in the rural limits of Kerala. Subject to the provisions of the 73rd Constitutional Amendment, it provides an institutional framework of three-tiered panchayats with adequate powers,

offices, and resources to make them an effective means of decentralized governance and grass-root level development.

Though, along with the three-tiered LSG system, Panchayat Raj Act, 1994 provides mandatory provisions for the formation of *Grama Sabha* in each village to serve as the base unit of the rural LSG system. Therefore, the KPRA (1994) enacted by the State Legislature of Kerala in line with the 73rd Constitutional Amendment of India, provides the legal framework for the composition and mission of *Grama Sabha*, Village Panchayat, Block Panchayat, and District Panchayat in the rural LSG network of the state.

4.3.1.1 *Grama Sabha*

As per the provisions of KPRA (1994), *Grama Sabha* is one of the institutional units of the PR system consisting of "all persons whose names are included in the electoral rolls relating to a village comprised within the area of a Village Panchayat shall be deemed to be constituted as *Grama Sabha* of such village". Being one and the only permanent body comprising all voters in the PR system, *Grama Sabha* acts as the foundation unit of direct democracy in the same. The mandatory provisions of KPRA (1994) instruct that each *Grama Sabhas* of village panchayat "shall meet at least once in three months and to such meetings, the convener of the village panchayat shall compulsorily invite the members of the Block Panchayat, District Panchayat and the Legislative Assembly representing the area of *Grama Sabha*". Besides, along with necessary powers and functions, the KPRA entrusted the *Grama Sabha* to perform the following responsibilities:

- Responsible for campaigning news and views on the information of development and welfare practices,
- Participation and encouragement of health, literacy, and other welfare programs,

- Expression of public remarks on local governance,
- Providing moral sanction on the promotion of environmental and social health, and the payment of taxes and loans,
- Mobilization of village resources for the development of Village Panchayat,
- Voluntary supervision of the welfare and development initiatives in the village, and
- Periodical reporting and emergency reporting to the panchayats and higher authorities regarding the situations in the village (KPRA, 1994).

4.3.1.2 Village Panchayat

Village Panchayat is a village-level LSG institution of three – a tiered PR system in Kerala. As per the provisions of KPRA-1994, such panchayats at the village level shall be constituted with directly elected persons from the villages or territorial constituencies in the Village Panchayat area. In line with the 73rd Constitutional Amendment of India, the KPRA (1994) provides specific provisions regarding the delimitation of village constituencies and seat allotments in Panchayats, the electoral process of members, and chairpersons of Panchayats and its reservation pattern, and the powers and functions of Village Panchayats.

In addition, the Act provides provisions to constitute one Steering Committee, various Standing Committees (for finance, development, welfare, and health & education), Functional Committees (for different subjects under panchayats), Sub – Committees (to assist the standing committee, and functional committee) and Special Joint Committee (on demand) in every Village Panchayat to fulfil its following functions:

- Fulfill the various needs (regarding the subjects mentioned in the Third Schedule of KPRA) of inhabitants in the villages under the Village Panchayat,
- Offer the various services (mentioned as mandatory function in the Third Schedule of KPRA) to people in the panchayat area,
- Use of exclusive administrative power of panchayats to plan and execute budgets and various initiatives for economic development, human resource development, and Social Justice (subject to the provisions of other acts and regulations of the state).
- Distribution and utilization of government-sanctioned grants – in – aid and resources among the villages,
- Governance and maintenance of all offices, projects, and resources devolved to the Village Panchayats,
- Levy and collect taxes, duties, tolls, and fees within the panchayat area (subject to the provisions of the government's Acts and regulations) (KPRA, 1994).

4.3.1.3 Block Panchayat

Block Panchayat is an intermediate-level institution of three-tiered PR system. The KPRA (1994) insists that all the seats in Block Panchayat shall be filled with directly elected members and presidents of various village panchayats from the Block Panchayat areas and the chairpersons of Block Panchayats may be indirectly elected from the elected members of the same. The reservation pattern in the composition of Block Panchayat is subject to the mandatory provisions of the 73rd Constitutional Amendment of India. As per the provisions of KPRA-1994, Block Panchayats also can be equipped

with various Standing Committees (on the matters of finance, development, welfare, and health & education) to accomplish its major functions as follows;

- The accomplishment of various demands raised by the inhabitants in the Block Panchayat area regarding the subjects included in the Fourth Schedule of KPRA, 1994,
- Use of its exclusive administrative powers for the planning and implementation of various initiatives on the matters of economic and human resource development and social justice,
- Efficient use of various powers, offices, and resources (financial, bureaucratic, and technological) devolved and offered by the State Government and District Panchayat,
- Proper distribution of all grants – in – aid sanctioned from the Centre and State Governments among the beneficiaries in the Block Panchayat area (KPRA, 1994).

4.3.1.4 District Panchayat

District Panchayat is a district-level governing body of a three-tiered PR system. As per the provisions of KPRA (1994), the District Panchayat shall be constituted with the directly elected members and elected presidents of various Block Panchayats from the District Panchayat limit. The reservation quota of scheduled caste and tribe, and women in the seats and posts of president in the composition of District Panchayat is subject to the provisions of the 73rd Constitutional Amendment in 1992. KPRA (1994) allows the District Panchayats to formulate five Standing Committees (regarding the subjects of finance, public works, development, welfare, and health & education) to facilitate the effective discharging of its following functions;

- Address the demands of local people in the regional limit of District Panchayat regarding the matters mentioned in the Fifth Schedule of the KPRA,
- Use of its exclusive administrative powers on the matters included Fifth Schedule in the KPRA,
- Prepare budgets and plans to implement its various initiatives for the development of its economy, human and natural resource, social justice,
- Governance of various institutions, resources, and schemes devolved from the state government in line with the policies of Central and State Governments.

4.3.2 The Kerala Municipality Act (KMA), 1994

In line with the mandatory provisions of the 74th Constitutional Amendment Act of India in 1992, the State of Kerala implement its new Kerala Municipality Act (KMA) with effect on 30th May 1994. KMA-1994 established an institutional framework of the urban LSG system to constitute Municipal Corporation (for a larger urban area), Municipal Council (for smaller urban areas), and Town Panchayat (for transitional areas) at appropriate urban limits of the state in terms of its demography and urban features. Regarding the composition of municipal institutions, the KMA (1994) by provisions endowed that "the ratio between the population of the territorial area of municipal institutions at any level and the number of seats in such urban LSG institutions to be filled by election shall, so far as practical, be the same throughout the municipal area".

As per the provisions of the Kerala Municipality Act, "the government shall, by the criteria specified, notify the total number of seats of the members

to be elected directly in Municipal Corporation, Municipal Council and Town Panchayat considering the population of the area of various municipal institutions concerned". Like the constitution, alteration, and conversion of municipal institutions, the legal provisions on the mode of election, the pattern of seat reservation, and the structure and duration of offices of chairpersons and members in the urban LSG institutions at various levels are also insisted by the KMA (1994).

Subject to the provisions of the 74th Constitutional Amendment of India, the KMA (1994) provides necessary provisions regarding the functions and various functional committees of this urban LSG system of Kerala. By the periodical Amendments in the KMA 1994, the State Legislature of Kerala allows the constitution of a specific number of Standing Committees at the institutions of Municipal Corporation, Municipality, and Town Panchayat on the subjects of finance, development, public works, health, welfare, education, town planning, and tax. All such legislative initiatives of Kerala aimed to strengthen the institutional framework of municipal institutions in its urban LSG system to ensure sector-wise discharging of the following mandatory functions subject to the provisions of KMA 1994.

4.3.2.1 Functions in the public amenities sector

(a) Management of storm water drainage system,

(b) Construction and maintenance of public markets, street lighting, waiting sheds, vehicle parking centers,

(c) Construction and maintenance of burial and burning grounds and public toilets,

(d) Conducting fairs and festivals,

(e) Setting up basic facilities for slums in the town areas, and

(f) Preparation of master plan and action plan for town development (Rajan, 2016).

4.3.2.2 Functions in the public assets maintenance sector

(a) Conservation of government land and other resources from encroachment and exploitation,

(b) Maintenance of roads and other public infrastructure facilities,

(c) Conservation of ponds, rivers, and other traditional drinking water sources and water bodies in the town areas (Rajan, 2016).

4.3.2.3 Regulatory functions

(a) Regulation of land use and building constructions,

(b) Birth and death registrations,

(c) License issuing for dangerous trade practices,

(d) Preventing adulteration in foodstuffs and regulating the sale of quickly perishable food products like meat, fish, etc. (Rajan, 2016).

4.3.2.4 Functions in the public health sector

(a) Maintaining environmental hygiene of town area,

(b) Management of solid waste disposal,

(c) Conducting national or state-level health programs for massive immunization and prevention and control of diseases in town areas (Rajan, 2016).

Even though the Kerala Panchayat Raj Act and Kerala Municipality Act (1994) implemented the mandatory provisions of the 73rd and 74th Constitutional Amendment of India as the institutional framework of the rural

and urban LSG system of Kerala, in practice, during the initial stage Kerala also lacked the true spirit of 73rd and 74th Constitutional Amendment Acts in the practice of such enactments (Parameswaran, 2008). Because the political will of the then Kerala government behind such enactments was limited to "discharging the constitutional obligation of passing the state conformity legislation". In this context, the Government of Kerala introduced its People's Plan Campaign in 1996 to bring a strategic and attitudinal reform in the procedures and practice of decentralized governance.

4.3.3 People's Campaign for Decentralized Planning

In 1996, the Government of Kerala launched a 'people's campaign for decentralized planning', popularly known as the 'People's Plan Campaign' (PPC) as a mass movement to enable LSGs and local people to formulate local development plans in a participatory manner. PPC generated an environment of favourable political consensus toward the democratic decentralization in the state by empowering people to plan, implement and operate indigenous development schemes as a new institutional setup for people's participation in local self–governance (Ramakantan, 2006).

PPC developed a new public sphere of participatory local governance through social mobilization, political awareness building, and effective use of civic capital towards the grass-root level development (Isaac and Franke, 2000). It led the Govt. Of Kerala to enhance the extent of fiscal decentralization by devolving 35 – 40 % of plan funds to its LSG institutions. Because the then State Government thought that it will energize the various local systems and related local beneficiaries to resolve the fiscal stagnation in material production in the state. Such fiscal decentralization initiatives of PPC in Kerala made the various stakeholders in the LSG system confident to undertake all the devolved functional responsibilities (Rajesh, 2013).

To strengthen the decentralized governance of Kerala in a participatory manner, PPC adopted several multi-dimensional strategies to overcome the

poor preparatory measures and absence of public awareness as the major constraining factors of participatory governance. As the first step of PPC, the government adopted various scientific and artistic measures to mobilize and train the society and LSG units with the concept of power devolution. The second stage of PPC focused on the measures to enable the local bodies and people to define their local developmental issues and to prepare reports on such developmental problems. The third step of PPC enabled the public to formulate projects of strategies and solutions to resolve their local developmental issues. The fourth phase of measures of PPC focused on prioritization of such local projects to include in the Five-Year Plans of Panchayats concerned. In the fifth phase, the PPC aimed to formulate annual plans for District and Block Panchayats complementary to the local plans of the Village Panchayats concerned. In the sixth stage, the PPC aimed to conduct a financial and technical appraisal of the locally prepared developmental schemes (Sharma, 2003).

The systematic practice of such strategies in the PPC of Kerala resulted in a significant development in the decentralized governance and grass-root level development of the state. Therefore, the Kerala model of PPC with the spirit of democratic decentralization became one of the promising strategies of participatory governance around the world.

4.4 LSG system in Kozhikode District

Kozhikode also known as Calicut as a district in the State of Kerala came into effect on 1st January 1957. After the origin of the State of Kerala on 1st November 1956, when the former Malabar District of Madras State under British reign was reconstituted into three different districts, the Central District centred on the town of Kozhikode was declared as the District of Kozhikode (Directorate of Census Operations, 2011). At the time of Origin, Kozhikode District had five Taluks; over time the district had undergone various structural and jurisdictional changes and is limited to the present form with 4 Taluks, 2 Revenue Divisions, and 118 villages. Topographically, the

district (with a total area of 2344 Sq. Km) is situated on the South-West Coastal line of India with three different regional features – the rocky high land (637.65 Sq. Km), lateritic midland (1343.50 Sq. Km), and sandy coastal line (362.85 Sq. Km) (District Urbanisation Report, 2011).

4.4.1 The genesis of LSG in Kozhikode: A historical survey

The political history of Kozhikode evolved mainly centred around the political developments and administrative experiences of some distinct principalities such as *'Parappanat'* (covering the areas of Beypore, *Panniyankara*, and *Cheruvannur* of current Kozhikode Taluk), *'Katathanat'* (the major portion of current Vatakara Taluk) and *'Kurumbanat'* (areas of current Koyilandy *Taluk* and some areas of Kozhikode Taluk) in the present Malabar region. Later, major areas of such principalities came under the common governance of *Samuthiris* (Zamorins) in the 14th century. But, the political and social sphere of the region witnessed a drastic transformation during the period of colonial intervention in the 17th century (Town and Country Planning Department, 2017).

Most of the regions in Kozhikode District had experienced a different level of local governance practices since the Pre – Colonial period. According to the writings of various British officials in the Malabar region during the colonial period, the revenue administration of Malabar Province has decentralized among the authorities of districts and villages or *'Desams'*. The base unit of such a local government system of revenue administration is known as 'Tara' (Warden, 1815). Being a regional unit of Malabar province *'Kozhikode Nadu'* also constituted 125 *Desams* and 72 *Taras*. The '*Nadu*' has existed under the local governance of *'Nattukootam'* a locally constituted public representative platform. Such '*Nattukootams'* were enjoyed the authorities to consider the petitions even against the functionaries of state (Logan, 1887).

As a local government body *Taras* in the Malabar regions survived even during the autocratic governance of Mysore rulers. During the colonial period, *Taras* was transformed into subdivisions of the district administration units known as the ' *Hobali'* system (Munro, 1817). Later, the *Hobali* system was also replaced by the system of *'Amsam'* led by the *'Amsam Adhikari'*. In addition, subsequent reforms implemented in such village Tara institutions developed it as a then LSG system (*Amsam*) constituted by an *'Adhikari'*, a headman or *'Menon'*(accountant), and two or three *'Kolkar'* (policemen) recruited by the government authorities concerned (Munro.T, 1817). In the 1800s, Kozhikode began to experience modern versions of local self-governance (Municipal Board) under the British. In 1866, Kozhikode Municipality was established as an urban LSG by the Town Improvement Act, 1865(Town and Country Planning Department, 2017). Such local government formations of past practices in the various parts of Malabar province including *'Kozhikode Nadu'* were continued till the emergence of the elected district boards and other LSG formations of the post-colonial period. Besides, the regional and Jurisdictional limits of various such village *Taras* are still in use without any major differences.

4.4.2 Institutional profile of LSG system of Kozhikode District

Revenue and LSGs are the two major systems of governance being practiced in the Kozhikode District (Directorate of Census Operations, 2011). The revenue system of administration in the district centers on the 118 Villages, 4 Taluks, and 2 Revenue Divisions of the district. The local government system of administration in the district devolved among the statutory municipalities (Urban LSG) and PR units (Rural LSG). Therefore, the Kozhikode District has maintained a well-established urban and rural LSG system.

4.4.2.1 The Urban LSG System of Kozhikode District

Subject to provisions of the 74th Constitutional Amendment of Act, the Kerala Municipality Act, 1994 empowered the Municipal Corporations and Municipalities to function as the Urban LSG system of the district. The Urban LSG system of Kozhikode District (which covers 340 Sq. Km of urban area) has constituted of one Municipal Corporation (Kozhikode) and seven Municipal Councils (Vatakara, Koyilandy, Ramanattukara, Feroke, Payyoli, Mukkam, and Koduvally). Municipal Corporation of Kozhikode is the oldest Corporation in North Kerala established in 1962 by the Calicut City Municipality Act, 1961. Kozhikode Corporation covers an urban area of 118.58 Sq. Km is divided into 75 divisions, each division being represented in the Corporation Council by an elected councillor.

Vatakara is the first Municipal Council in Kozhikode District came to effect in 1958. After a gap of three decades, Koyilandy Panchayat also upgraded as Municipal Council in the urban LSG system of Kozhikode in 1993. As an impact of rapid growth in the trade and commerce, industrial and educational sectors and urban development projects of existing municipal centers of the district, various rural LSG areas adjacent to Corporation and Municipality areas also developed with urban features. Being one of the districts of Kerala with a higher percentage of the urban population than the state average population growth, the urban profile of the Kozhikode District experienced dynamic changes during the last few decades (District Urbanisation Report, 2011).

Such urban growth in the population is mainly centred on the coastal belt of the district. Therefore, most of the urban and semi-urban centers developed around the coastal lines and adjacent midland regions of the district. During the last few decades, the land use concentration of traditional crop patterns in the suburban and rural areas of the district was replaced with the concentration of mixed crop patterns. In addition, the transformation of the traditional economy of forest and agro-based industries of these regions to

tertiary (service activities) and industrial activities due to the development of transportation corridors and other related connectivity intensified the urbanization of such regions in the district (District Urbanisation Report, 2011). As a result, five more panchayats adjacent to the existing urban LSG units of Kozhikode District were upgraded as Municipal Councils in 2015. Table -1 shows the information regarding the name, grade, area, the population of urban LSG institutions in the Kozhikode District.

Table 1

Urban LSGs in Kozhikode District

Sl. No	Name of LSG	Grade of LSG	Area in Hectares	Population
1	Kozhikode	Corporation	8429	609224
2	Vatakara	Municipality	2132	75295
3	Koyilandy	Municipality	2905	71873
4	Payyoli	Municipality	2234	49470
5	Koduvally	Municipality	2385	18821
6	Mukkam	Municipality	3128	62805
7	Feroke	Municipality	1353	54074
8	Ramanattukara	Municipality	1171	35937

Source: LSG Department, Govt. of Kerala, 2021 and Census of India 2011.

4.4.2.2 The Rural LSG System of Kozhikode District

The rural area of Kozhikode District comes to 2004 Sq. Km. The major portion of the total rural area of the Kozhikode District comes under three types of land occupations – residential/agricultural Mix (covers 64 %), forest (covers 20 %), and agricultural land (covers 5.47%). Although coconut, mixed crops, paddy, and rubber are the common crops, the coconut dominant mixed crop pattern covers the major share (74%) of the agricultural land use in the rural areas of Kozhikode. The mid-land and high-land areas of Kozhikode District under the rural LSG system are mainly occupied by the

primary activities (agriculture and plantation) and allied semi-industrial activities (Dept. of Town and Country Planning, 2011).

The present rural LSG system of Kozhikode District is constituted of a single District Panchayat (consists 27 wards), 12 Block Panchayats (consists 169 wards), and 70 Village Panchayats (consists I226 wards) and their ward level *Grama Sabhas*. Table 2 shows the rural LSGs in Kozhikode District. The functions and relations of such district block, and village level panchayats in the district are complementary to each other. Because, as per the provisions of KPRA-1994, the presidents of Village Panchayats and Block Panchayats will be the members of block level and district level panchayats respectively in the three-tiered PR system of the district. It ensures coordination and cooperation between the village, block, and district level panchayats on their developmental initiatives under the rural LSG system. In addition, the KPRA-1994 directs the village, block, and district level panchayats to consider the decisions and demands of *Grama Sabhas* concerned with the developmental and welfare activities in the rural areas.

The present district-level panchayat (with 27 divisions) in the three-tiered PR system of Kozhikode District came into effect in 1996. The elected representatives from 27 divisions of the District Panchayat form the District Panchayat Board, the elected president, and vice-president of the same, and the chairpersons of its various standing committees constitute the governing body of the District Panchayat of Kozhikode. As per the provisions of KPR Act-1994, 12 Block Panchayats named Kozhikode, Vatakara, Balussery, Chelannur, Koduvally, Kunnamangalam, Kunnummal, Melady, Panthalayani, Perambra, Thodannur, and Thooneri are functioning as the intermediate panchayats in the present three-tiered system of the district. These 12 Block Panchayats are divided into 70 Panchayats at the village level in the rural areas of the district to formulate the three-tiered structure of the rural LSG system. (Department of Town and Country Planning, 2011, 2017) Table 3

shows the information regarding the name, ward, area, and population of Village Panchayats in the rural LSG system of Kozhikode.

Table 2
Rural LSGs in Kozhikode District

District Panchayat of Kozhikode					
Sl. No.	**Block Panchayat**	**Village Panchayat**	**Sl. No.**	**Block Panchayat**	**Village Panchayat**
1	Vatakara	Azhiyur	36	Balussery	Atholy
2		Chorode	37		Ulliyeri
3		Eramala	38		Kottur
4		Onchiyam	39		Unnikulam
5	Thooneri	Chekkiad	40		Panangad
6		Edachery	41		Koorachund
7		Purameri	42	Panthalayani	Chemancherry
8		Thunery	43		Arikkulam
9		Valayam	44		Moodadi
10		Vanimel	45		Chengottukavu
11	Kunnummal	Kunnummal	46	Chelannur	Kakkodi
12		Nadapuram	47		Chelannur
13		Kayakkodi	48		Kakkur
14		Kavilumppara	49		Nanminda
15		Kuttiady	50		Narikkuni
16		Maruthomkara	51		Thalakkulathur
17		Velom	52	Koduvally	Thiruvambady
18		Narippatta	53		Koodaranhi
19	Thodannur	Ayanchery	54		Kizhakkoth
20		Villyappally	55		Madavoor
21		Maniyur	56		Puthuppady
22		Thiruvallur	57		Thamarassery
23	Melady	Thurayur	58		Kattippara
24		Keezhariyur	59		Omassery
25		Thikkodi	60	Kunnamangalam	Kodiyathur
26		Meppayur	61		Kuruvattur
27	Perambra	Cheruvannur	62		Mavoor
28		Nochad	63		Karassery
29		Changaroth	64		Kunnamangalam
30		Kayanna	65		Chathamangalam
31		Koothali	66		Kodenchery
32		Perampra	67		Peruvayal
33		Chakkittappara	68		Perumanna
34	Balussery	Balussery	69	Kozhikode	Kadalundy
35		Naduvannur	70		Olavanna

Source: LSG Department, Govt. of Kerala, 2021 and Census of India 2011.

Table-3
Basic information on Village Panchayats in Kozhikode District

Sl. no	Village Panchayat	Wards	Area in Sq. Km	Popular ion	Sl. no	Village Panchayat	Wards	Area in Sq. Km	Popular ion
1	Arrikkulam	13	16.25	18378	36	Kuttiady	14	15.00	19351
2	Atholy	17	21.06	28213	37	Madavoor	17	19.39	28672
3	Ayancheri	17	20.84	26293	38	Maniyur	21	31.03	39961
4	Azhiyur	18	9.77	30023	39	Maruthonkara	14	26.90	19871
5	Balussery	17	22.44	27363	40	Mavoor	18	20.48	29781
6	Chakkittappara	15	142.45	21086	41	Meppayur	17	23.37	27929
7	Changaroth	19	30.84	32107	42	Moodadi	18	16.01	30170
8	Chathamangalam	23	40.24	46688	43	Nadapuram	22	20.44	40230
9	Chekkiad	15	27.69	24246	44	Naduvannur	16	22.20	25979
10	Chellanur	21	23.81	40697	45	Nanminda	17	28.10	27316
11	Chemmanchery	20	16.76	34819	46	Narikkuni	15	17.64	24290
12	Chengottukavu	17	13.60	26791	47	Narippatta	17	50.63	26529
13	Cheruvannur	15	21.61	23388	48	Nochad	17	23.64	26857
14	Chorode	21	12.75	38245	49	Olavanna	23	21.43	68432
15	Edachery	17	16.17	26819	50	Omassery	19	25.46	35009
16	Eramala	19	19.06	34658	51	Onchiyam	17	8.33	28650
17	Kadalundy	22	12.02	42516	52	Panangad	20	47.00	33971
18	Kakkodi	21	18.59	42866	53	Perambra	19	26.12	32784
19	Kakkur	15	20.38	22788	54	Perumanna	18	13.45	35460
20	Karassery	18	36.90	31536	55	Peruvayal	22	26.39	47700

21	Kattippara	15	28.00	22706	56	Purameri	17	20.27	27612
22	Kavilumpara	16	84.81	22828	57	Puthuppady	21	64.75	42083
23	Kayakkodi	16	28.14	24578	58	Thalakkalathur	17	21.54	29388
24	Kayanna		16.83	13755	59	Thamarasseery	19	27.17	35706
25	Keezhariyur	13	13.69	15116	60	Thikkodi	17	14.15	27051
26	Kizhakkoth	18	19.84	31261	61	Thiruvallur	23	27.54	35598
27	Kodenchery	21	102.56	34854	62	Thiruvambady	17	83.96	28820
28	Kodiyathoor	16	29.81	28335	63	Thurayur	13	10.48	23421
29	Koodaranhi	14	98.21	18678	64	Tuneri	15	15.45	14176
30	Koorachund	13	87.98	17027	65	Ulliyeri	19	25.86	32509
31	Koothali	13	14.13	16969	66	Unnikulam	23	38.26	49348
32	Kottur	19	28.96	30982	67	Valayam	14	31.08	18374
33	Kunnamangalam	23	27.23	53223	68	Vanimel	16	36.53	25412
34	Kunnummal	13	10.58	18031	69	Velom	17	25.80	26738
35	Kuruvattur	18	17.94	34241	70	Villyappalli	19	17.35	34502

Source: LSG Department, Govt. of Kerala, 2021 and Census of India 2011.

The state enactments of Panchayat Raj and Municipality Acts in 1994 that followed the 73rd and 74th Constitutional Amendment Acts have been constitutionally equipped the LSGs in Kerala for decentralized governance. Such institutional reforms resulted in a strong institutional base for local authorities and communities to come together for participatory governance at local level. Such institutional experience of decentralized governance is easily sensitized by Kozhikode District as it is already experienced with different levels of local governance practice since the Pre-Colonial period. The subsequent institutional reforms of the state further enhanced the institutional

relevance of LSG system by fixing LSG institutions as the central point of its decentralized water conservation measures. Such decentralized water conservation initiatives of Kozhikode District analysed in the next chapter.

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CHAPTER 5

WATER CONSERVATION INITIATIVES IN KOZHIKODE DISTRICT

The present chapter is an exclusive discussion on various water conservation initiatives which are centred on the LSG system in the Kozhikode District. The chapter is divided into three sections. The first section explains the water resource profile of the district. The second section is an analysis of the main water consumption sectors, major issues in the water sector, and various challenges in the conservation of water resources of the district. The third section discusses various decentralized water conservational initiatives of the district by its LSG mechanism.

5.1 Introduction

Kozhikode District is one of the coastal districts of Kerala with 2344 Sq.km comes under three distinct physiographic sub-divisions – Coastal Plains (362.85 Sq. Km), Mid-lands (1343.50 Sq. Km) and High-lands (637.65 Sq. Km) lie between North latitudes 11° 08' and 11° 50' and East longitudes 75° 30' and 76° 8'. Such physiographically diverse regions of the district are endowed with a remarkable amount of water bodies. It is about 2.57% of the total land area of the district. Mainly, perennial Water bodies/ Backwaters, Reservoirs / Canals, Riverbed/ Reservoir beds / River Islands, Sands/ Riverine / Flood Plains, and Dam Walls constitute the surface water resource system of the district. In addition, as per the criteria of the Bureau of Indian Standards, the deep aquifers in the groundwater system of the district are also dependable for domestic and irrigational purposes. Along with the aforementioned water resource system, various climatic and physiographic features of related natural resource systems in the district are determining the water resource

profile of the Kozhikode District (Dept. of Mining and Geology, 2016, Town and Country Planning Department, 2017).

5.2 Physiography

Physiographically, the Kozhikode District is divided into three distinct sub-micro regional divisions – Kozhikode Coast, Nadapuram-Mavoor Undulating Plain, and Kozhikode Forest Hills: -

5.2.1 Kozhikode Coast: It situates all along the low-land coastal zone of the district with steep laterite sea cliffs and rocky beaches. The areas of Kozhikode Coast intersect three taluks of the district consists several depositional land forms of marine and fluvial. The coastal plain of Kozhikode Coast is also served by a surface water system of several rivers, canals, backwaters, and tanks;

5.2.2 Nadapuram-Mavoor Undulating Plain: It's a low rolling and moderately undulating plain bounded by a coastal tract of Kozhikode Coast and high-land of Kozhikode Forested Hills. Such mid-land areas lying at a height between 122 m to 244 m comprise rolling laterite hills and valleys of flood plain alluvium and red loamy soil. All the major rivers of the district drain these mid-land slopes towards the west. Its fluvial and gently sloping features make the region a promising tract of ground water resource;

5.2.3 Kozhikode Forested Hills: It's a high-land region with an elevation ranging from 300 m to 600 m situates as a steep slope area dissecting all the taluks of the district. The high-land terrains of this physiographic division are concentrated by a thick forest of wet evergreen and semi-evergreen to moist deciduous forest type and barren rocks (Dept. of Mining and Geology, 2016).

5.3 Soil system

Soil is one of the natural resources which influence the water resource system of the district directly and indirectly. The soil system of the Kozhikode District is mainly constituted of lateritic soil, forest loam, and alluvial soil: -

5.3.1 Alluvial soil: The alluvial in the district is mainly seen as river alluvial (with clay texture) and coastal alluvial (with sandy texture) soils in the coastal and valley tracts (western part of the Kozhikode, Vatakara, and Koyilandi taluks) of the district. Such alluvial soil formations in the district have high surface and ground water tables;

5.3.2 Lateritic soil: It is seen mostly along the gently sloped mid-land and allied low-lands of the district. Even though the laterite soils (covering a major portion of the district) have poor water holding capacity the thick laterite layers with permeable porous can be the aquifer formations with rain water holding capacity;

5.3.3 Forest Loam: It is dark reddish brown and developed from crystalline rock through the weathering under forest cover. This clay-textured soil is seen mostly in the mountainous and hilly tracts (eastern part of the district) under forest cover. It is friable and immature due to slow weathering. So, it will be subject to easy soil erosion and water runoff (Dept. Of Mining and Geology, 2016)

5.4 Forest

The forest cover of the Kozhikode District is generally categorized into southern tropical moist deciduous, western tropical wet evergreen and semi-evergreen divisions. Presently, the major forest cover of the district situates as a narrow belt on its eastern boundaries consisting of private forests, notified forests, and vested forests. The forest tracts (70. Sq. Km of very dense forest, 409. Sq. Km of moderately dense forest, and 956. Sq. Km of the open forest)

of the district constitute Thamarassery, Peruvannamoozhi, and Kuttiyadi Forest Divisions favourably influencing the availability of rainfall and volume of runoff water in the region (Dept. of Town and Country Planning, 2011).

5.5 Rainfall

Being a sole source of fresh water, the surface and ground water systems of the district directly depend on its rainfall availability. Winter (January-March), summer (April-May), South-West Tropical Monsoon (June - October), and North-East Tropical Monsoon (November-December) are the four seasons in the climate of Kozhikode District. The district gets its major share (around 70%) of rainfall during the southwest tropical monsoon season. The district receives an average annual rainfall of around 3177 mm with a standard deviation of 551.7/mm. Usually, the northeast regions of the district especially the Kakkayam Dam and adjacent areas receive the highest volume of rainfall (around 4500 mm) in the district. As per the assessment of the India Meteorological Department, during the period from 1989 to 2018, the district experienced a significant increase in the number of heavy rainfall days on an annual scale. Being a major source of water, rainfall (monsoon) and its climatic order is determining the surface and ground water status of the district (India Meteorological Dept., 2020, Dept. of Mining and Geology, 2016).

5.6 Wetlands

The Wetland system of Kozhikode District (area of 7690 ha) performs a significant role in the natural mechanism of water purification, flood control, and preservation of biodiversity in the district. Based on different hydrological features, the wetlands of the Kozhikode District are classified into ' lacustrine' (depended on reservoir and tank), 'reverie' (depended on the river), and 'palustrine' (independent). Along with Kadalundy estuary,

Olavanna marsh, Mavoor, Kottuli, and Eranhikkal wetlands, lots of different wet ecosystems like bogs, swamps, marshes, fens, and paddy wetlands also constitute the wetland system of the Kozhikode District. These are the natural water recharging systems of groundwater aquifers in the district (KFRI, 2010).

5.7 River System

Kozhikode District is mainly drained by six east flowing rivers (Kuttiyadi, Mahe, Chaliyar, Kallayi, Korapuzha, and Kadalundy) and their miner tributaries. These rivers (most of them originate from the Western Ghats) and dependent water bodies in their drainage system are the major surface water sources of the district;

5.7.1 Chaliyar (Beypore) River: It's an interstate river (length: l69 Km) that originates from the Elambalari hills of Western Ghats and drains into the Beypore estuary. Around 455 Sq. Km drainage area of this interstate river lies in the district. This perennial river serves the district as a major source of drinking water;

5.7.2 Kuttiyadi (Murat) River: It's a 74 Km long river (largest in the district) that flows from the western slopes of Wayanad hills in the Western Ghats. It drains an area of 583. Sq. Km through the Vatakara and Koyilandy Taluks of Kozhikode District. It is dammed at Kakkayam for the major Hydro-electric project and irrigation project of the district;

5.7.3 Korapuzha: It (length: 40 Km) was formed by the union of two minor rivers namely Punnurpuzha and Agalapuzha. It drains an area of (length: 624 Km) in the district and joins the Arabian Sea at Elathur. This river is well known for its mangrove reserve;

5.7.4 Kadalundy River: It's a 130. Km long river originates from the Silent Valley. But it drains only 14. Km length with 120. Sq. Km of catchment area in the Kozhikode District. Kadalundy river formed by the union of *Olipuzha* and *Velliarpuzha* is rich with varieties of mangrove reserves and flows into Lakshadweep Sea at Kadalundy;

5.7.5 Kallayi River: It's a 22. Km long river originates from the Cherukulathur village in Kozhikode District. Kallayi River takes flows from the *Chaliyar* and *Korapuzha* rivers through two man-made canals called Beypore Kallayi (BK) Canal and Elathur Kallayi (EK) Canal. This tidal river with 96. Sq. Km drains to Lakshadweep Sea at Kallayi;

5.7.6 Mahe River (*Mayyazhi puzha*): It's a 284. Sq. Km long river originates from the western slopes of Wayanad in the Western Ghats. Its drainage area forms the northern boundary of the Kozhikode District and empties into the Sea at Mahe (Town and Country Planning Department, 2011 Dept. of Mining and Geology, 2016).

Besides the aforementioned rivers and related wetland formations, lots of natural and artificial lakes, reservoirs, backwaters, ponds, and several networks of canals and rivulets constitute the surface water system of the Kozhikode District. The major backwaters in the district are *Kadalundy Kayal*, *Beypore Kayal*, *Kallayi Kayal*, *Korapuzha*, *Kuttiyadi puzha*, and *Payyoli puzha. Kuttiyadi* (area of 1052 ha), *Kakkayam* (area of 1070 ha) and *Peruvannamoozhi* (area of 1050 ha) dams are the major reservoirs in the district. Major canals like Canoly and Kuttiyadi (*Edathukara* and *Valathukara*) also recharge the surface water bodies in the surroundings of its drainage areas in the district. Besides several man-made lakes like *Mananchira,* the district has around 445 ponds under public ownership to strengthen its surface water system. Even then, the utilizable surface water system of the district is not sufficient even to resolve the water stress in its agricultural sector (Town and Country Planning Department, 2017 and ENVIS Centre: Kerala, 2021).

5.8 Ground Water System

Kozhikode District is endowed with a dependable groundwater system suitable for domestic and irrigational purposes of the region. The commonly utilized (for domestic and irrigation purposes) groundwater bodies in the district are open dug wells, shallow tube wells, and deep lakes. The dug wells are the most utilized ground water body for the domestic purpose of the district. The good density in sandy tracts of the district is 258 per Sq. Km and 315 per Sq. Km in lateritic tracts. The fractured (suitable for bore wells), weathered (suitable for dug wells), crystalline and alluvial tracts of the district have high groundwater bearing capacity. The level of the groundwater table of such tracts depends on the rainfall pattern and hydrological features of the district. In recent years, the groundwater table of the district is in diminishing mode due to over-extraction (for agricultural, industrial, and domestic requirements) and poor ground water recharging. The Joint studies of the Central and State Ground Water Boards-2020 report that the ground water table of two Blocks (Balussery and Kunnamangalam) in the district comes under a partial critical zone. Currently, the groundwater level of the district lies at 2.28 meters below the ground level (Central Ground Water Board, 2020 and Central Ground Water Board, 2013).

5.9 Major Water Consumption Sectors in the District

An assessment of the major water consumption sectors in the Kozhikode District is necessary to understand the actual water stress of the district based on the multi-sectoral freshwater demands and its availability in the region. The major water consumption sectors of the district can be categorized as agricultural, domestic, industrial, and energy production.

5.9.1 Agriculture sector: Like national and state levels, agriculture is the single largest water (both surface and ground water) consumption sector in the district due to intensive water stress from its irrigation fields. Because 74312 ha (net area) of the district comes under irrigation. Around 126 MCM

of annual groundwater availability of the district is utilized for its irrigation sector. Recent studies of CWRDM reports that Kozhikode is one of the districts in Kerala with low (below 40%) irrigation efficiency. Along with the fluctuations in the rainfall pattern, topographic features (sloppy terrain close to the sea), water-intensive crop patterns (paddy, coconut, banana, etc.), and poor irrigational techniques (flood irrigation) in the region adversely affect the irrigation efficiency in the agricultural sector of the district. Besides the Kuttiyadi irrigation project (largest in the district) several small, lift, and community irrigation schemes, canals, and large tanks in the region are mainstays of water consumption in the agriculture sector of Kozhikode District (Dept. of Economics and Statistics, 2019 and State Planning Board, 2017).

5.9.2 Domestic sector: Domestic consumption of water in the district is mainly endowed by human beings (for drinking, bathing, cooking, gardening, etc.) and livestock in urban and rural areas. Popular pressure and intensive urbanization are the main factors raising the level of domestic water consumption in the district. Piped water supply networks, open dug wells and shallow tube wells are the mainstays of freshwater in the domestic water consumption sector of the district. The piped water supply schemes in the district are utilizing both surface and groundwater sources after chlorination. Even then, lots of areas in highland and coastal tracts of the district are suffering a huge supply-demand imbalance in the domestic water consumption sector during the pre-monsoon and post-monsoon periods. Wastage and leakage of water during the transmission, distribution, and consumption stages are the major threats in the domestic sector of Kozhikode District (State Planning Board, 2017 Town, and Country Planning Department, 2017).

5.9.3 Industrial sector: The volume of industrial water consumption in the Kozhikode District has been rising due to its intensive industrial development because; lots of upcoming water-intensive industrial units in the district are

utilizing water as an input in their production chains. Although the industrial sector (miner and major industries) of the district is dependent on the surface and ground water sources, recently the groundwater system has emerged as the mainstay of water consumption in this sector because it ensures uninterrupted availability of sufficient amount of water in a cost-effective manner. Steal, textiles, tile, food, timber, cement, packaged water, paper, and chemical industries under private and government initiatives are the major water users in the industrial sector of Kozhikode District. Such industrial initiatives mainly cantered on the urban and suburban areas (West Hill, Nallalam, Feroke, Kinallur, Mavoor, Thamarassery, etc.) of the district. Some of the industries in the district not only utilize the water but also pollute (by discharging waste water) many freshwater resources of the region. Recently, an increase in the number of water-intensive industries and the volume of industrial effluents in the district making serious stress on this sector (Town and Country Planning Department, 2017 The Energy and Resource Institute, 2017).

5.9.4 Energy production sector: Kuttiyadi hydro-electric project in the Kuttiyadi River (dammed at Kakkayam) is the major energy production center of Kozhikode District. Besides the Kuttiyadi hydro-electric project, the water resource of the district is utilized as a vital input in energy production by various small hydro-electric projects namely Poozhithode hydro- electric project (Maruthonkara Panchayat), Chembukadavu hydro-electric project (Thamarassery Panchayat), Vilangad hydro-electric project (Vanimel-Narippatta Panchayat) and Pathankayam hydro-electric project (Kodenchery Panchayat). Therefore, water is the main source and fuel of energy production in the Kozhikode District. Fluctuations in the rainfall pattern, the need to reserve water for downstream users in the water system, and changes in the qualities (physical, biological, and chemical) of spilled water from the hydro-electric projects are the major challenges in the energy production sector of the district (Dept. Of Mining and Geology, 2016 and The Energy and Resource Institute, 2017).

In addition to the aforementioned water consumption sectors, various ecological services and their conservation measures like conservation of water sources and their various destinations, preservation of water eco-system and related bio diversities, natural and artificial ground water recharging, etc also utilize a little percentage of available water resource system of the district. But, in recent years, all such water consumption sectors of the district faced water scarcity during the peak of the summer session. Intensifying multi-sectoral demand for water and multi-faceted deterioration of the present water resource system resulted in a huge demand-supply gap in the water sector of the district. Urban areas in the coastal tract and elevated areas of the district are most affected by water scarcity. As per the reports of central and state groundwater departments in 2019, the groundwater table of the district also moving down, especially in the areas under Balussery and Kunnamangalam Block Panchayats (Central Ground Water Board, 2020).

5.10 Major Issues in the Water Sector of Kozhikode District

Kozhikode is one of the districts well-endowed with surface and ground water resources in the state. Perhaps, Kozhikode is one of the few districts in the state which can meet the bulk of freshwater requirements with its own surface water resource system. Like in other districts of the state, rainfall is the sole source of freshwater in the Kozhikode region. Even though the district has around 3000 mm of rainfall annually, its "Spatio-temporal distribution" is uneven in the district. Besides, the district is often failed to rationalize the preservation and utilization of this original water source. Therefore, in recent years, the water sector of the district is experiencing some serious issues regarding the quantity and quality of freshwater available. Such intensifying issues in the water sector of the district are categorized as follows;

5.10.1 Water Contamination

One of the serious issues in the water sector of Kozhikode District is intensifying contamination of its surface and ground water resource system.

The water system of the district is mainly contaminated by three sources namely industrial effluents, storm water runoff, and domestic sewage. Such roots of water contaminations are generally classified into 'point sources' (contamination by households, hospitals, and industrial & commercial firms) and 'non-point sources' (agricultural and urban fields). Diverse forms of water contamination result in various bacterial and chemical contamination and variations in the pH value and colour of freshwater resource systems in the district (Deshabhimani, 2019).

Most of the rivers in the district are already contaminated by the huge volume of waste water and solid waste disposed of by the various 'point sources' in the region. Besides, the huge content of various pesticides and fertilizers in the storm water runoff from the 'non-point sources' intensifies such river contamination. Recently, the National Green Tribunal of the country declared the Kadalundy, Kallayi, and Kuttiyadi Rivers as severely contaminated rivers in the district. Along with the river system, related networks of various canals and rivulets are also being contaminated by uncontrolled storm water runoff and waste disposal from various point and non-point sources in both rural and urban areas of the district. For example, the Canoly Canal, one of the contaminated urban water channels is suffering from an accumulation of silts, heavy bacterial and chemical contents, and covering of weeds (Mathrubhumi, 2019).

Due to unscientific and inefficient methods of waste disposal and effluent treatments (by sewages, treatment plants, dumping yards, septic tanks, and other storage systems) the groundwater system of the district is also contaminated with a high count of coliform. Recent studies conducted by CWRDM reports (2019) that most of the open wells and ponds in urban and suburban areas of the district, especially the areas adjacent to the Kallayi River, Canoly Canal, Njelianparamba waste dumbing yard, and Medical College sewage treatment plants are contaminated with a high count of coliform and experiencing variations in pH values and colour of water

(Kumar V, et.al, 2020). Therefore, in recent years, Kozhikode became one of the districts in the state with a high number of cases of waterborne deceases like Chicken guinea, Typhoid, Diarrhoea, etc. Table 4 shows the district-wise data of Kerala on the number of cases reported during the year 2018.

5.10.2 Groundwater depletion

Due to the limitations in timely detection, depletion and contamination of the groundwater system are becoming a complex issue in the water sector of the Kozhikode District. Most of the rural and suburban areas of the district are still depending on the groundwater system (by open dug wells and tube wells) to meet their domestic and irrigation requirements. Along with a highly water-intensive agricultural pattern, rampant industrialization and urbanization also intensified the groundwater extraction in the district. In addition, recently emerged community water supply initiatives of the district are mainly depending on its groundwater sources.

Table. 4
District Wise Data on Waterborne Diseases in Kerala (2018)

Sl. No	District	No. of cases
1	Thiruvananthapuram	418
2	Kollam	284
3	Pathanamthitta	411
4	Alapuzha	174
5	Kottayam	165
6	Idukki	78
7	Ernamkulam	280
8	Thrissur	321
9	Palakkad	334
10	Malappuram	966
11	Kozhikode	344
12	Wayanad	67
13	Kannur	441
14	Kasaragod	790

Source: Directorate of Health Service and Haritha Keralam Mission, 2020.

Thus, the entire groundwater system of the region is being utilized rampantly and irrationally to meet the multi-sectoral water demand of the district because; as of now, the district has no accurate mechanism to determine the exact volume of groundwater extracted by industrial and irrigation sectors. The district is often failed to ensure sufficient recharging of the groundwater system in proportion to the level of on-going groundwater extraction.

Most of the existing tanks, ponds, streams, and other water bodies in the region are not able to recharge the groundwater system due to siltation. Recently introduced rainwater harvesting structures in the district also just store the water to reuse not recharging the groundwater system. Besides, the aggressive transmutation of paddy fields, ponds, streams, and other wetland formations in the district for cash coop patterns and other developmental constructions (domestic, Industrial, infrastructural, etc.) demolished the natural mechanisms of groundwater recharging in the region. Therefore, the heavy groundwater extraction beyond the rechargeable limit and poor groundwater recharging capacity of the district led to a lowering of its groundwater level resulting in groundwater depletion in the region. As per the recent report of the Central Groundwater Board (2020), the depth of groundwater table in the district fluctuated between the range of 0.21 to 16.57 mg in open dug wells, 0.48 to 38.13 mg in bore wells and 0.76 to 35.25 mg in tube wells lies in the region.

The Joint survey of the Central and State Groundwater Board in 2019 already observed that two Block Panchayats (Balussery and Kunnamangalam) of Kozhikode District experiencing a falling down of groundwater table resulting in semi-critical groundwater depletion in the region. Recently, the groundwater table of the district fell deep during the summer term, especially in the eastern parts of the district. It adversely affects many water consumption sectors which are depending (directly and indirectly) on dug wells and tube wells in the district because; the district has 258 per Sq. Km

well density in its sandy region and 315 per Sq. Km in the lateritic region. Along with the excessive groundwater extraction regions of Kadalundy, Chekkiad, and Unnikulam in the district, urban and suburban areas of Cheruvannur, Nallalam, Palayad, and Perumanna have also experienced the worst form of groundwater depletion in recent years (Central Ground Water Board, 2020 and Kumar V, et.al, 2020).

5.10.3 Salinity Intrusion

Being one of the coastal districts in Kerala, Kozhikode District has a coastal tract of 91 Sq. Km. Therefore, salinity encroachment into the freshwater sources in such coastal and related backwater regions is a serious threat to the water sector of the district. Major freshwater sources (wells, ponds, tanks, rivers, etc.) of domestic water consumption in the regions of Beypore, Feroke, Nallalam, Kadalundy, Chorode, Thikkodi, Kappad, and Elathur in the district are seriously affected by severe salinity encroachment. All the rivers of the district are monsoon-fed and fast-flowing towards the Arabian sea. Therefore, along with the lower stretches of such rivers, most of the groundwater sources in areas adjacent to the salinated rivers and coastal belt in the district are also being affected by severe salinity intrusion during the pre-monsoon period (CWRDM, 2019).

Moreover, the downfall in the groundwater table of the district during peak summer is intensifying the spreading of salinity encroachment into the freshwater system of more downstream regions like Kannankadavu, Kadalundy, Kallayi, etc. For example, during the summer session, the salinity of the Beypore estuary in the district can encroach into the freshwater sources upstream up to the range of 24 km (KRWSA, 2000). Therefore, such upstream regions adjacent to the salinized coastal and backwater terrains in the district also cannot depend on their groundwater system by dug wells, especially during the dry season (Kumar V, et.al, 2020).

5.10.4 Water Scarcity

Water scarcity during the pre-monsoon and post-monsoon periods is the most serious issue facing the water sector of Kozhikode District. Especially, urban areas in the coastal tract and rural areas in the elevated tract of the district are experiencing severe freshwater scarcity in recent years. The urban people of the coastal tract in the district are depending various water supply (piped and packaged) services from distant sources. Presently, such core urban areas of the district indigenously have a freshwater supply of 84 ml per day against the daily water demand of 200 ml/d (Kumar V, et al, 2020). The high land regions in the eastern parts of the district also depending various distant water sources to meet even their domestic water requirements in the pre-monsoon period. As per the recent report of the Central Groundwater Board (CGWB), most of the Block Panchayats (Kunnamangalam, Koduvally, Balussery, Perambra, Kunnummal, and Thooneri) in the district bordering Wayanad district is experiencing serious water scarcity during the summer session (CGWB, 2013).

The majority of the rural and urban population in the district still depends on household wells (open dug wells and tube wells) for their domestic water purposes. But, for the last decade, such wells have been extensively drained (in highland) or salinated (coastal land) during the non-monsoon sessions, especially in peak pre-monsoon sessions. Similar issues are extended to other surface and groundwater sources (rivers, tanks, ponds, rivulets, etc.) of the district resulting shortage of per capita freshwater availability in the region. A recent study by Kerala State Drought Monitoring Cell reports (2016) that seven villages in the Kozhikode District experiencing drought and 110 villages come under the category of moderate drought. Vatakara, Nadakkuthazham, Palayad, and lrringal are the main drought-facing villages without any perennial water bodies. Table 5 and 6 show the villages in Kozhikode District with a different classes of drought susceptibility.

Table. 5

Drought susceptibility of villages (without perennial water bodies) in Kozhikode District

Sl. no	Village	Talu k	Class of drought susceptibilit y	Sl. no	Village	Talu k	Class of drought susceptibilit y
1	Vilangad	Vatakara	Moderate drought	15	Unnikulam	Koyilandy	Moderate drought
2	Thinur		Moderate drought	16	Koorachund		Moderate drought
3	Kavilumpara		Moderate drought	17	Kottur		Moderate drought
4	Azhiyur		Moderate drought	18	Sivapuram		Moderate drought
5	Kunnummal		Moderate drought	19	Kapoor	Kozhikode	Moderate drought
6	Purameri		Moderate drought	20	Nellippoyil		Moderate drought
7	Ayancheri		Moderate drought	21	Nanminda		Moderate drought
8	Kottapalli		Moderate drought	22	Narikkuni		Moderate drought
9	Onchiyam		Drought	23	Kakkur		Moderate drought
10	Chorode		Drought	24	Puthiyangadi		Moderate drought
11	Villyappalli		Drought	25	Chelavoor		Moderate drought
12	Nochad	Koyilandy	Moderate drought	26	Kuttikattur		Moderate drought
13	Meppayur		Moderate drought	27	Nellicode		Moderate drought
14	Kozhukkalur		Moderate drought				Moderate drought

Source: Kerala State Drought Monitoring Cell, 2016.

Over the last decade, due to various factors, both the quantity and quality of freshwater available in the district are going under serious threat. Along with the above-discussed issues of water pollution, groundwater depletion and salinity intrusion in the region, fluctuations in the rainfall pattern, differences in spatio-temporal precipitation, and inefficiency and the unsustainability of

various water use (irrigational and industrial) practices also intensifies the water the scarce scenario of various drought-prone areas in the district. The water efficiency of several irrigation techniques like flood irrigation prevalent in the district is very poor. The percentage of water leaked and wasted in the domestic and industrial sectors is remarkably high, especially in piped water services. Similarly, the widening gap between the monsoon and non-monsoon days in the region also threatens the drought-prone villages in the district by extending its water-scarce period from four months to seven months (CWRDM, 2019).

Table. 6

Drought susceptibility of villages (with perennial water bodies) in Kozhikode District

Sl. no	**Taluk**	**Village**	**Class of Drought**	**Sl. no**	**Taluk**	**Village**	**Class of Drought**	
1	**Vatakara**	Chkkyad	**Moderate Drought**	46		Chembanoda	**Moderate Drought**	
2		Valayam		47	**Kozhikode**	Kodencheri		
3		Vanimel		48		Thiruvambadi		
4		Narippatta		49		Engapuzha		
5		Thuneri		50		Koodattai		
6		Edacheri		51		Raroth		
7		Kayakkodi		52		Koodaranhi		
8		Nadapuram		53		Kizhakoth		
9		Eramala		54		Vavad		
10		Maruthonkara		55		Puthur		
1		Kuttiyadi		5		Thalakkulathu		

1				6		r		S o u r c e : K e r a l a S t a t e D r o u g h t M o n i t o r i n g C e l
12		Velom		57		Chelannur		
13		Thiruvallur		58		Neeleswaram		
14		Maniyur		59		Koduralli		
15		Vatakara	**Drought**	60		Madavoor		
16		Nadakkuthazha		61		Elathur		
17		Palayad		62		Kakkodi		
18	**Koyilandy**	Iringal		63		Chathamangalam		
19		Paleri	**Moderate Drought**	64		Thazhekode		
20		Changaroth		65		Kuruvattur		
21		Chakkittappara		66		Kunnamangalam		
22		Perambra		67		Kumaranalloor		
23		Cheruvannur		68		Poolakode		
24		Eravattur		69		Kakkad		
25		Koothali		70		Vengeri		
26		Meshanyam		71		Kodiyallur		
27		Kayanna		72		Chevayur		
28		Kanthalad		73		Peruvayal		
29		Thurayur		74		Katcheri		
30		Payyoli		75		Mavoor		
31		Arikkulam		76		Kottuli		
32		Thikkodi		77		Kasaba		

33		Keezhariyur		78		Perumanna		
34		Naduvannur		79		Valavanad		
35		Avidanallur		80		Pantheerankavu		
36		Mudadi		81		Nagaram		
37		Kinalur		82		Olavanna		
38		Viyyur		83		Panniankara		
39		Panangad		84		Cheruvanur		l, 2016.
40		Ulliyeri		85		Beypore		
41		Panthalayani		86		Ramanattukara		
42		Balussery		87		Feroke		
43		Atholi		88		Karuvanthirut hi		
44		Chengottukavu		89		Kadalundy		
45		Chenancheri		90		Puthuppadi		

In this context, the Kozhikode District was also forced to adopt a paradigm shift in its mind-set towards the concept of conservation-oriented water governance from on-going consumption-oriented governance. Therefore, the district started to implement various measures to resolve the aforementioned issues in the water sector by government and non-government institutions in recent years. The recent SWP and Five-Year Plans of Kerala are promoting such initiatives of the district by strategic and infrastructural inputs for sustainable water conservation in an integrated and decentralized manner. However, the district is facing many challenges in its efforts for water conservation in a sustainable manner.

5.11 Challenges for Water Conservation in the District of Kozhikode

The major challenges of water conservation in the Kozhikode District have been mainly observed under three distinct perspectives namely water resource conservation, water resource consumption and contamination, and water resource governance. Because, as per the guidelines of global, national, and state-level water policies, an integrated practice of sustainable water conservation measures, rational consumption of water and reduction of water contamination, and an appropriate water governance approach constitute the effective method of water conservation to resolve various issues in the water sector, especially water scarcity. In this context, this section discusses various challenges of water conservation comes under such different perspectives to address the issues in the water sector of Kozhikode District.

5.11.1 Water conservational challenges

a. Sloppy and undulated terrain: Physiographically, the Kozhikode District has been categorized into low-land, mid-land, and high-land. Sloppy and undulated terrains of the high-land (lies at the height between 7.6 to 76 m AMSL) and mid-land (lies at the height of above 76 m AMSL) regions cover the major portion of the district. Due to quick surface runoff, the natural water conservation system in such slopping and undulating terrains alone is not meeting the water requirements of the region sufficiently. A wide network of rivulets, streams, and rivers in such regions of the district maximizes the speedy surface runoff resulting in low percolation and groundwater recharging (State Planning Board, 2017).

b. Horizontal hydraulic conductivity: Due to the high lateralization process, the large portion of the Kozhikode District especially high lands covered with a layered shallow soil system. Comparatively, such a layered soil system has high horizontal hydraulic conductivity causing a quick lateral flow of

infiltrated water. It reduces the volume of deep percolation in the groundwater system resulting in groundwater depletion in the district (State Planning Board, 2017).

c. Transmutation of water bodies and wetland formations: Growing urbanization and industrialization and increasing cash crop patterns led to the rampant transmutation of water bodies, paddy fields, and other wetland formations in the district for the construction of buildings, houses, roads, etc. Such constructions in the wetland areas reduce the infiltration capacity of the region resulting in no groundwater recharging. Besides, such constructions led to heavy concentration runoff of rainwater without any percolation to the groundwater system (State Planning Board, 2017). Land encroachment and building constructions at the riversides in the urban limit is an aggravating issue in the district, especially at the Kallayi River. Both urban and rural areas of the district experiencing rampant landfilling on its available drainage channels, paddy fields, wetlands, and water bodies for cash crop patterns and building constructions. Similarly, The Town and Country Planning Department already reported that around 4000 constructions in the district come under the violation of Coastal Regulation Zone (The Hindu, 2020).

d. Rampant sand mining: Sand mining from the rivers and streams of the district is going unchecked. Such legal and illegal sand mining in an unsustainable manner deepens the riverbed than the level of adjoining land areas resulting in quick groundwater depletion and demolishing natural river banks. Besides, the heavy loss of sand deposits in the riverbeds by irrational sand mining subverts the fluvial and related hydrological functions of rivers and streams of the district (Kumar V, et al. 2020).

e. Growing population pressure: Increasing population density and related urbanization in the district is accompanied by the rampant removal of natural vegetation for various built-ups for habitation and developmental

requirements. In addition, most of such constructions, especially small land holding built-ups followed by unfriendly and unsustainable measures regarding the water conservation of the region because; all kinds of deforestation in the district adversely affect the hydrological cycle and groundwater recharging of the region (State Planning Board, 2017).

f. High drainage density: Due to the high drainage density and rolling topography of Kozhikode District, the rainwater collected at the surface land losing or passing quickly to the Arabian Sea without any remarkable percolation to the groundwater system. Besides, the impervious granite layered at the subsurface also aggravates the situation similarly (Town and Country Planning Dept., 2011).

5.11.2 Challenges of water consumption and contamination

a. Misuse and overuse of water in the domestic sector: As a district in the water-rich state of Kerala, the Kozhikode District still follows a liberal approach to water consumption. Therefore, the misuse and overuse of water are common in the domestic life pattern of people in the district. Such tendencies of inefficient use of water in the domestic sector intensified by the system of unregulated supply of water by household sources (dug wells, tube wells, ponds, etc.) resulting in high wastage of water in the district (Kumar V, et al, 2020).

b. Overuse in the irrigation sector: Like most of the districts in the state, surplus irrigation is very common in the Kozhikode District also, especially in the household irrigation sector. Along with the unregulated facilities for plumbing from open wells, tube wells, and adjoining rivers and ponds, water inefficiency in practicing irrigation techniques results such over-irrigation. In addition to the heavy loss of water in the sector, surplus irrigation result in the unnecessary growth of other water-intensive plants in the irrigated fields.

Therefore, many prevalent irrigation patterns lacking water efficiency and sustainability lead to increasing loss of water and groundwater depletion in the district (State Planning Board, 2017).

c. Wastage of water in the irrigation sector: Due to the multi-formed deficiencies in the various irrigation projects and methods, a huge amount of water getting wasted in the district. Irrigation canals without proper hydraulic slope or bed slope, minor distributary channels of irrigation without required carrying capacity and water flaws to the desired direction, and deficiently prepared farmers' field channels are the major means of water wastage in this sector because; all such deficiencies of irrigation channels lead to wastage of water by evaporation, seepage, and runoff (State Planning Board, 2017).

d. Leakage of water: Constant water leakage in various piped water supply networks depending on rivers, reservoirs, and tanks for domestic and irrigation purposes are very common incidents in the district. The estimated physical loss of water by leakage in the district is 35.5 % of supplied water. Obsolescent pipes, deficient constructions, and constant repairs in the network are leading to a considerable amount (75%) of water loss by leakage in the district, especially in the urban limits. Recently emerged community water supply schemes are raised the volume of water leakage in the district (Town and Country Planning Dept., 2017).

e. Contamination of water resource system: Contamination of rivers, streams, canals, lakes, tanks, and other wetland formations by the wastage of urban centers, industrial units, hospitals, and domestic life is a serious challenge in the water conservation efforts of the district. Besides, a heavy load of pesticides and fertilizers in the runoff from various agricultural fields and polluted flows from various waste dumping yards in the urban limits also contaminate various freshwater sources in the surface water system of the district, especially in the dry season. Therefore, all such point sources and

non-point sources of contamination severely affect the quality of water available in the district (Kumar V, et al, 2020).

f. Deficient sanitary engineering practices: Unscientific construction of septic tanks and various sewage disposal systems by the commercial establishments and household units resulting in serious groundwater contamination in the district, especially in the urban region. Because most of such constructions in urban and rural limits of the district are not following any sanitary engineering principle. It leads to serious bio-chemical contamination in the groundwater sources of the district (CWRDM, 2019)

5.11.3 Water governance challenges

Even after the emergence of decentralized water governance, the formal governance of many water conservation initiatives in Kerala exists as an interdependent system among the different administrative units of Central and State governments. The essential elements of water conservation such as preservation of surface water bodies, prevention of water contamination, and maintenance of groundwater systems are directly or indirectly under the jurisdiction of various administrative units and regulatory boards of central, state, and local governments. Therefore, such a multi-sectoral and multi-layered role often results from some following administrative uncertainties of decentralization and decentralization in the water conservation initiatives of Kozhikode District also.

a. Clash of interest among the stakeholders: Most of the flowing and non-flowing water bodies in the surface water system of the Kozhikode District have different stakeholders with diverse interests (institutional and personal). Such stakeholders follow the different modes of operations to maintain their stake and interests in the water bodies such as rivers, reservoirs, ponds, streams, and different wetland formations like paddy fields, mangroves, etc.

For example, in the case of various reservoirs in the district, various government institutions such as KWA, KSEB, Forest, Tourism, Fisheries, and Disaster Management Departments enjoy a legal stake in the resource in the water reservoir with different and conflicting interests. Besides, the local user communities residing in the adjoining areas of the outlets of the reservoirs also have their interests (Kumar, 2021).

Similarly, various river conservation initiatives (eg: conservation of the Kallayi River, Korapuzha, Canoly Canal, etc.) in the district also facing the situations of clash of interest among various government and non-government stakeholders like Revenue Dept., LSG Dept., Forest Dept., Community Organisations, etc. Along with such differences in the institutional interests and requirements, a lot of diminishing water bodies and wetland formations under private ownership also weaken or subvert the collective efforts of water conservation governance, especially the watershed governance model.

b. Lack of effective legal framework in groundwater governance: Unlike surface water governance, the ground water sector lacks an effective legal framework and types of machinery to regulate groundwater extraction and other activities resulting in ground water depletion beyond the rechargeable limit. Especially, the volume of exploitative groundwater pumping remains unregulated with appropriate legal mechanisms due to the traditional privilege of appendage with land ownership enjoyed by the land holders. Besides the uncertainties on the mandate of central and state mechanisms over groundwater governance, infrastructural limitations and institutional gaps in the state also weaken the governance of groundwater conservation in the district (State Planning Board, 2017).

c. Institutional overlapping in the water governance: In addition to Water Resource Department, other administrative departments such as Forest, Revenue, LSG, Tourism, and many sectoral agencies are introduced by the

Central and State Governments also involved in the water governance of Kerala. Such multi-level operations often lead to institutional overlapping in this sector. Because, in most cases, such water governing systems lack the institutional fit and proper coordination across their various working units and operations. Such institutional overlapping often delays the desired results of several water conservation structures in the decentralized water conservation initiatives of the district (Kumar, 2020).

d. Institutional unrest in the two-fold decentralization model: Recently, in addition to the existing decentralized federal governing bodies (central, state, and local govt. units) with a statutory stake in water governance, the central and state governments are assigning various exclusive sectoral agencies to act locally in this sector for water conservation. However, such sectoral types of machinery often have to depend on the pre-existing units of governments (central or state, or local) in this sector for financial and infrastructural inputs. It often results in professional unrest among various institutional stakeholders in the decentralized and integrated water conservation mission, especially in Kozhikode District, one of the districts in the state with a strong and stable urban and rural LSG system (Kumar, 2020). Such unrests are evident in the various initiatives of the district for the conservation of Kottuli wetland, Kallayi River, Canoly Canal, Korapuzha, etc.

Similarly, some water conservation projects are formulated through two-stage decentralization. The initial part (planning phase of decentralization) of such projects developed through the stakeholders in central or state governments by defining the various terms and conditions and mode of operations in the water conservation projects based on the ideas (decentralization, privatization, liberalization, etc.) favoured by the govt. or non-govt. funding agencies. Its second part (execution phase of decentralization) involves the implementation of strategy outputs of the initial

stage by the actors (political, bureaucratic, fiscal, social, etc.) and factors (institutional, geographical, skill, financial, technological, etc.) at the local level. In this stage of decentralization, such local actors or factors may oppose or non-cooperate with such externally made-up terms and measures as they do not match local ideas or resources (Kumar, 2021). Due to such political or administrative dilemmas, a lot of water conservation initiatives in the district are left unfinished or abandoned.

The aforementioned issues in the distinct aspects of water conservation management are the major challenges in the water conservation initiatives of the Kozhikode District. Even though, the district is practicing several measures to overcome such challenges by ensuring sustainable techniques of water conservation, rational and judicious consumption of water, prevention of water contamination, and appropriate and effective institutional arrangements in the governance of water conservation. Such major water conservational measures in the district will be discussed in the next section of the chapter.

5.12 Water Conservation Measures in the Kozhikode District

Today, it's a universally realized concept that the water crisis in Kerala is more about the governance of water (conservation, consumption, contamination, etc.) than the availability of water resources (surface and ground) and source (rainfall). During the early decades of the water crisis, along with the global and national perception, Kerala also followed a centralized and political economy-oriented strategy to address water scarcity issues in the state especially, the conservation of water resources. But in recent decades, in line with transitions in global and national water policies, Kerala also adopted a policy shift towards decentralized and integrated water governance by multi-level and participatory measures (SWP, 2008). Therefore, the legal framework of Kerala for water governance in the state is

being experienced structural and strategic changes towards various aspects of decentralized water governance, especially for water conservation measures by the LSG system.

When the government of India recognized the rampant development based on political economy principles as one of the root causes of emerging threats in its water sector, India began to adopt the concept of watershed development into the policy framework of water governance in the country. Therefore, the NWP of India (1987) authorized its state governments to prepare their watershed projects and to constitute appropriate governing bodies to plan and implement the development of drainage (river) basin in a multi-disciplinary and integrated manner. Besides, the NWP-1987 explicitly mentioned that "resource planning in the case of water has to be done for a hydrological unit such as drainage basin as a whole, or a sub-basin". By subsequent revisions in 2002 and 2012, the NWP further widened and strengthened the concept of watershed management by integrating the ideas of decentralization and community participation, and incorporating the quantity, quality, and environmental aspects into the watershed governance (NWP, 2002, 2012).

5.12.1 Watershed Development Initiatives

In line with national water policies, the state water policy frameworks of Kerala also opted for decentralized and watershed-based water governance in the state as a strategic step to enhance the institutional efficiency by integrating various actors in the water sector towards sustainable water conservation. In Kerala, SWP (1992) suggested integrated management and development of land and water by watershed/river basin-centred planning with a clear emphasis on the preservation of maximum rainwater. Therefore, "an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, month of a bay, or any point along a stream

channel" comes under the definition of the term watershed (Firoz and Banerji, 2014). SWP of Kerala (2008) further emphasized recognizing “the micro-watersheds as a basic unit and river basin as an integrated unit of micro-watersheds" to ensure resource and community-centred (decentralized) water governance by LSG institutions concerned.

Therefore, under the guidance of various expert committees constituted by the state government " 44 river basins in Kerala divided into 151 sub-watersheds (10,000 to 50,000 ha), 960 milli-watersheds (1000 to 10,000 hectares) and several thousands of micro-watersheds (100 to 1000 hectares)" (State Planning Board, 2017). Since then, Kerala witnessed a lot of initiatives in each district for the formulation of their own Watershed Based Development Master Plan at the Block Panchayat level to facilitate decentralized planning based on the geohydrological unit under various LSG units. Such watershed-based initiatives in each district of Kerala were further accelerated by many similar projects of the Central Government like CADP (Command Area Development Programme), IWDP (Integrated Watershed Development Project), WGDP (Western Ghats Development Programme), NWDPRA (National Watershed Development Programme for Rain fed Areas) and *Hariyali*. Besides, MNREGA (Mahatma Gandhi National Rural Employment Guarantee Act) scheme was also implemented in the districts with the topmost preference for watershed programs by the LSG units (State Planning Board, 2017).

The first full-fledged watershed development master plan of Kerala was formulated in Kozhikode District by the Perambra Block Panchayat in collaboration with a regional unit of the People’s Science Movement named *Kerala Sasthra Sahitya Parishath*. Preparation of such plans at the Block Panchayat level involves the following processes preparing micro-watershed maps, training local actors in the micro-watersheds, constituting village-level

watershed committees and micro-watershed assembles (*Mahasabhas*), and finalizing the master plans of watershed development. As per the circular of the Panchayat Development Commissionerate in Kerala (2012), the district constituted separate watershed committees in its panchayats under the headship of presidents in each panchayat to ensure the local interests and participation of *Grama Sabhas* in the watershed practices (State Planning Board, 2017). In the case of the watershed lies under different panchayats, an integrated committee with necessary panchayat level sub-committees is also constituted to run the management of large size watersheds in the district. The size of each watershed in the district varies from hectares to square kilometres as in the case of tanks, lakes, reservoirs, streams, rivers, etc. Therefore, the district comes under the major watersheds of rivers like Kuttiyadi, Korapuzha, Chaliyar, etc.

Watershed-based planning and practices intended for the water conservation of Kozhikode District involve the sustainable management of evaporation, precipitation, transpiration and infiltration of water, land cover and slopes, and soil features in and around the surface and ground water system (rivers, lakes, reservoirs, wetland formations, etc.) of the region (Firoz and Banerji, 2014). Bottom-up planning and implementation of watershed development practices in the district are facilitated various water conservation structures appropriate to the local geo-hydrological features of the region resulting in better groundwater recharging, reduction of surface runoff and soil erosion, and promotion and preservation of vegetation cover. All such factors have influenced the sustainability and perennially of many surface and ground water sources in the district because; the water resource available in the district is the end product of the interaction between the rainfall and geo-hydrological factors of each watershed (KRWSSA, 2000).

During the subsequent years, the concept of water (watershed) governance in Kerala reformed with many strategic changes to meet the water sector issues under broader perspectives of ecological balancing and sustainability. Unfortunately, the desired outcomes of such initiatives by LSG institutions are varied in each district. Many of such strategic programs in this sector fail or subvert at their implementation phase due to institutional and technical lapses. Consequently, in recent years, Kerala adopted many institutional reforms in this sector to balance the "bottom up and top down" approaches by a polycentric mechanism with the settings for institutional (inter-departmental) interactions for effective water governance. In line with such reforms, Kerala initiated a comprehensive mission known as "Haritha Keralam" as an umbrella mission to ensure the revival of its water resource system by various conservational measures in a sustainable manner. To ensure local perspectives and participation in these initiatives, the three-tiered LSG system of each district is taken as the central point of all the institutional measures for water resource development by the Haritha Keralam Mission.

5.12.2 Initiatives under Haritha Keralam Mission

Haritha Keralam Mission is a combination of three interconnected sub-missions viz. *'Sujalam - Sufalam'* for the development of agriculture, *'Jalasamridhi'* for the conservation of water resources, and 'Hygienic Waste Management' for the proper waste management. It involves various initiatives of watershed development at river basins comprehensively by integrating various administrative, technical, and community initiatives for sustainable water conservation. LSG system in each district performs a lead role in the various initiatives of *Jalasamridhi'*, the water sub-mission of Haritha Keralam Mission, for water conservation and the inculcation of new water culture for the sustainable consumption and conservation of water by the people (Dept.

Of Finance & Planning, 2017). All such water conservational initiatives by the mission are formulated under the following perspectives;

1. **River rejuvenation and sustainability challenge**: It addresses the sustainability issues in the revival of the river system by restoring the water retaining capacity of various filled up or dried up river networks, ponds, flood moderation tanks, etc. in a sustainable manner;

2. **Local water resources for water security plan**: It addresses the challenges of water security in each of the LSG institutions by water budgeting through making all local water sources and related hydrological units active and contamination free;

3. **City river network and grey water management**: It aims the rejuvenation and sustenance of the network of canals/streams getting dried or contaminated in the urban regions through proper grey water management by LSG units with community participation (Haritha Keralam Mission, 2019).

All such water conservational initiatives coming under the Haritha Keralam Mission in Kozhikode District are planned based on micro–watershed development centred around the urban and local LSG units. In addition to the state-level mission committee, many executive cum technical committees of the mission are constituted in association with urban and rural LSGs at the district, block, and village levels facilitating the various water conservational initiatives in the district. Such committees are constituting necessary action (civic) committees in association with local bodies concerned, and planning and coordinating their water conservational missions in favour of local needs and deeds. In such local missions, various community and social institutions, and relevant government and non-government institutions in the education, health, and welfare sectors are incorporated to

make the mission socially and technically resourceful (Haritha Keralam Mission, 2019).

In line with such initiatives, several water conservational programs are being conducted in the various water-sensitive areas of the district. Such programs are led by local bodies mainly utilizing the local community participation and resourceful cooperation of other government projects like the Mahatma Gandhi National Rural Employment Guarantee Scheme. Some of the major water conservational programs in the district during the first phase of the *Jalasamridhi* Mission are following;

a. Revival of *Mampuzha*: Under the Haritha Keralam Mission, collective of the District Panchayat of Kozhikode, Block Panchayats (Kunnamangalam, and Kozhikode), and Village Panchayats (Perumanna, Peruvayal, and Olavanna) in the riverine areas have started the '*Mampuzha'* revival program with the active participation of various user communities and volunteer organizations in the region. Mission planned a comprehensive program of river revival structured in four stages. During the first stage of the programme, around 4 Km of the river and adjacent drainages were cleaned by removing the various plastic and bio-wastages. To ensure proper water flow, the second phase mainly focused on the desolation and deepening of the river. It is planned to cover the river walls with bio geotextiles and to start aquaponics farming, boat services, and river tourism schemes in the river during the successive stages to keep the river clean and live. Besides, several civic committees led by the members of LSGs are constituted at each panchayat in riverine areas to prevent further contaminating and deteriorating activities in the river (Haritha Keralam Mission, 2019).

b. Operation Canoly: '*Niravu'*, one of the organizations empanelled in the Haritha Keralam Mission in the district, started a mass movement to clean the Canoly Canal in 2018. In association with district administrative authorities,

Corporation, CWRDM, and various political, civic, and voluntary organizations, this mass movement removed plastic and bio wastages from 11.2 kilometres of the canal by the primary stage of Operation Canoly Canal. After the aforesaid mass cleaning programme, Kozhikode Corporation started to remove silt and deepening of the canal to facilitate water transport to keep the canal clean and flowing. Around 180 sewage pipes draining into the canal were also forcefully blocked by this mission. The coming phase of the operation is planned to divide the canal into eight sectors or centers and to assign a 'Green Partner' in each sector to continue the canal preservation and up keeping activities by preventing further deterioration or contamination of the Cannoli canal (Haritha Keralam Mission, 2019).

c. Formation of Biodiversity Block: The initiatives for the formulation of Kozhikode Block Panchayat as the 'Biodiversity Block' in the district are implemented in association with the 'Malabar Botanical Garden' one of the scientific institutions in the government sector. Various programs in this initiative are being conducted as the water conservational measures of ' *Oro thulliyum karuthalode'*, one of the sub-missions of the eco-friendly development project (*'Sundharam, Susthiram, Harithabham'*) of the Kozhikode Block. This project constructs an aquatic bio-park with a large lake (10 acres) in the wetlands of Malabar Botanical Garden. Construction of ponds and rejuvenation of various surface water sources in each biodiversity cluster or watersheds in the Kozhikode Block is in progress. Under this initiative, the Block Panchayat started a mission (*Haritha Bavanam*) to ensure proper good recharging and rainwater harvesting in all houses in the Biodiversity Block to enhance the groundwater table of the region. Various community organizations are constituted in each biodiversity cluster to ensure the conservation of wetlands, ponds, streams, and other water sources from contamination and deterioration (Haritha Keralam Mission, 2019).

Similarly, Mavoor Panchayat in Kunnamangalam Block started an initiative to develop a ‘Community Reserve' on 300 acres by conserving the wetland formations in Kalppalli, Thengilakadavu, and Palliyode areas in Mavoor Panchayat. According to C. Muneerath, the President of Mavoor Village Panchayat, it is planned to develop such wetland formations on private land as a Community Reserve and eco-friendly tourism destination in association with the local division of the Forest Department. Recently, so many similar efforts for the conservation of wetlands and their biodiversity have been started in the various parts of the district under LSG initiatives (Mathrubhumi, 2020).

d. *'Jeevajalam’*: It is one of the water conservation initiatives of Kozhikode District run by the 'SAVE' (Students Army for Vivid Environment) - one of the environmental education schemes under the Haritha Keralam Mission. Water conservation measures in *Jeevajalam* are formulated based on a slogan - *'Oru vidyalayam oru Jalasayam'* (one pond for one school). Therefore, the implementation of this project is centred around the schools in the district in association with LSG institutions. In 2018, under the first phase of the project, 200 schools in the district agreed to adopt a deteriorating water body (ponds, wells, streams, etc.) in their regional limit to revive and upkeep sustainably with community participation.

So, all schools in the *Jeevajalam* scheme constituted civic or community groups consisting of local body representatives, PTA members, environmental activists, teachers, students, and native people for the execution of appropriate water conservational measures in the adopted water bodies. In addition to the conservation and construction of more water bodies, proper community awareness of sustainable water consumption at the local level also resulted from the *Jeevajalam* program. All the operations in the *Jeevajalam* are facilitated by the LSG institutions in the regions concerned.

Presently, the project moving under its second phase focused on the water bodies kept by various mosques and temples in the region by adding more schools to the project (Mathrubhumi-Nagaram, 2019).

e. *'Ini Njan Ozhukatte'* (Now, let me flow): It's a state-wide water conservational campaign initiated in 2019 by Haritha Keralam Mission to rejuvenate the drainage network of the river system in the state. LSGs are assigned to merge the other related departments into the mission for the revival of stream network coupled with tanks, ponds, paddy fields, and other wetland formations in each district. LSG department in the state has provided financial support to such stream network rejuvenation activities in the districts by local bodies in a scientific and participatory manner.

'Ini Njan Ozhukatte' campaign in Kozhikode District revived around 60 major drains. The district coordination team of the mission managed to rejuvenate maximum drains in the stream network by using the watershed map kept by GPLTC (Grama Panchayat Level Technical Committee) of the region. During the first phase of the campaign, the collective effort of 2590 local people led by LSG institutions scientifically revived 122.6 km length of drains in the district. Thus, the campaign carried out by local bodies in the district became the best example of the convergence of civic organizations, residence associations, student units, merchant groups, and various consortiums in a participatory manner. In addition, the mission planned to formulate a convenient mechanism for the regular water quality test in the rejuvenated streams by using the science labs in the adjacent Higher Secondary Schools. Table 7 shows the details regarding the major drains rejuvenated by various LSGs under this campaign in the district (Haritha Keralam, 2020).

Table 7

Rejuvenated Drains in the District by "*Ini Njan Ozhukatte*" Campaign

Sl.no	Name of LSG	Name of Drain	Length of Rejuvenated Area (in Kilometre)
1	Chorode	*Peruvana thode*	3
2	Thooneri	*Kappathode*	8
3	Vanimel	*Vanimel puzha*	2
4	Nadapuram	*Pulikkool thode*	3
5	Kunnummal	*Meenmuttikkal thode*	2.5
6	Kayakkodi	*Naranathu thazhe thode*	0.4
7	Velom	*Athirthi theekkuni thode*	4
8	Ayancheri	*Mangalaadam thode*	3
9	Keezhariyur	*Aachei thode*	2
10	Cheruvannur	*Koormuzhi thode*	3
11	Nochad	*Vaalyakkode valiya thode*	6
12	Changaroth	*Kooottalott thode*	3
13	Kayanna	*Cherukad kuttivayalthode*	5
14	Perambra	*Marakkadi thode*	3
15	Kottoor	*Manjappozhiyil puzha*	2.5
16	Koorachund	*Vattachira athyodi thode*	2
17	Atholi	*Cherattakkara thode*	0.5
18	Moodadi	*Kallada thode*	0.95
19	Chengottukavu	*Paavara vayal thode*	3.5
20	Nanminda	*Narakkasseri thode*	4
21	Kakkur	*Kakkur thode*	3.5
22	Kattippara	*Poonoor puzha*	3
23	Kunnamangalam	*Manathazhath thode*	0.2
24	Kunnamangalam	*Chukkikulam*	0.5
25	Payyoli	*Naivaarani thode*	1
26	Vatakara	*Nadukku thazhe canal*	4
27	Mukkam	*Vattoli-pulparambuthode*	4.5
28	Koduvally	*Kaayangal keepoyil thode*	3

Source: Haritha Keralam Mission, 2020.

Similarly, Haritha Keralam Mission in the district is conducting several different water conservational programmes in various water-sensitive areas of the district. Especially, the river revival operations in the extremely deteriorated rivers like the Poonur River, Kallayi River, Anjarakkandi River, etc. Mission conducted many surveys, discussions, and awareness programs in association with appropriate government and non-government institutions regarding the effective river revival measures for such rivers. Thus, various river revival activities like removal of wastage and silt in the river and channel network draining into the river, and deepening and widening of river-beds in the Poonur and Kallayi Rivers are moving under different phases of progress. Besides, the construction of many new ponds, lakes, water harvesting structures, and rejuvenation and preservation of many deteriorating (polluting, drying, filling, etc.) tanks, streams, wetland formations, and other water bodies are being operated under the Haritha Keralam Mission initiatives of the district.

Even though, the planning and implementation of all such water conservational efforts are centred on the LSG system of the district. In line with recent central and state water policies, LSG institutions are the strategic center of most of the government and non-government initiatives of water conservation. Therefore, in addition to the cooperative roles in various sectoral (state-wide) initiatives, the LSG institutions in the district directly initiate or facilitate many regional schemes of water conservation in association with institutional and community resources at the local level. Some of such regional initiatives in the Kozhikode District are extracted and given below.

a. Mission *'Thelineer'*: It's a water conservational programme initiated by the District Panchayat of Kozhikode for the revival of deteriorating ponds in the district. Under the project, around 77 LSG institutions collectively

identified 80 most deteriorated ponds across the district. Such identified ponds are deteriorated differently by waste disposal, siltation, biochemical contamination, and dry-up. Such damaged or unused ponds are rejuvenated by the various urban and rural LSG institutions in the district before the next monsoon season. All such pond revival programmes under Mission *Thelineer* of District Panchayat were carried out in a participatory manner in association with Haritha Kerala Mission, and various local community organizations like residents' associations, youth clubs, etc. Besides, such local community institutions are in charge of the post-revival maintenance of the rejuvenated ponds (The Hindu, 2020).

Similarly, Kozhikode Corporation also started a mission of many cleaning drives for the revival of dying ponds and streams in urban limits. According to Corporation authorities, 30% of the total ponds (above 100) and streams in urban limits are in a dying stage due to disposal of wastes (hospital, septic, slaughter, and solid wastes), disposal of untreated effluents, and infestation of weeds. Therefore, under the initiative of the Corporation, a civic body of 500 volunteers, residents' associations, and workers in the Corporation and Ayyankali Urban Employment Guarantee Scheme was constituted to carry out different phases of the water conservation drive. Such initiatives of the Corporation led to the conservation of many major ponds and streams like *Bilathikulam*, *Aamaganithodu*, etc.

b. Conservation of '*Noonji'* (natural spring channel): The natural spring originates from the valleys of big hills and is locally known as '*Noonji'*. Such perennial springs are one of the unique features of midland surrounded by hills. Most of the terrains in the Peruvayal, Mavoor, Kunnamangalam, and Chathamangalam panchayats in the Kozhikode District were endowed with a large number of *'Noonjis'*. But, the rampant demolition of hills in these areas deactivated such natural springs which have satisfied the domestic and

agricultural water needs of the region in the past. In this context, in association with local bodies, local units of some environmental organizations (Kerala River Conservation Council and *Nariyorakunnu* Environment Conservation Council) and residents associations like the Chola Residents Association in the region collectively started a mission to conserve the deteriorating *Noonjis*.

Initially, they conducted a massive awareness campaign among the public on the relevance of the conservation of *Noonjis*. In the next phase, they adopted many local *Noonjis* to revive them through community efforts. *'Areeparambu chola*, one of the major *Noonjis* in the region adopted by Peruvayal Panchayat from the private party. Similarly, the *'Muthashikundu'*, one of the perennial *Noonjis* in the region provides the origin of the Kallayi River, adopted by the Biodiversity Preservation Council of Peruvayal Panchayat as a traditional center of regional biodiversity. Presently, progress and expansion of such measures are facilitated by the various local bodies in the region concerned (Mathrubhumi, 2020).

c. Kakoor Model Sustainable Farming: The Kakoor Panchayat in Kozhikode District developed an indigenous model of sustainable farming based on a watershed development approach. Farming by sustainable consumption of water from the properly preserved natural water bodies (springs, ponds, streams, etc.) in the regions is the unique character of this initiative. Conservation of such local water sources facilitated by the watershed schemes of local bodies and agricultural departments ensures the water availability for farming even in the dry season. Under this community initiative, many barren paddy fields are also made usable for farming by utilizing preserved local water bodies sustainably. According to C. M. Shiji (President of Kakoor Panchayat), this sustainable farming model is run by a collective of hundreds of families in the Kakoor region farming around 50

acres of land based on watershed principles formulated by the local bodies. Such integrated practice of farming and water conservation in the Kakoor region is a community initiative of local people and the 'Paddy Fields Committee' in association with Village Panchayat and Krishi Bhavan in Kakoor (Mathrubhumi, 2021).

d. Declaration of Panchayat Water Policy: The first panchayat level water policy in Kerala is formulated by Perumanna Village Panchayat in Kozhikode District. In line with State Water Policy - 2008, Perumanna Panchayat drafted its water policy framework by considering the local hydrological features with the help of CWRDM. The water policy framework of Perumanna Panchayat consists of a 13-Point Action Plan to facilitate sustainable consumption and conservation of water in the 18 wards of the panchayat. Major action plans in the water policy framework focused on the programs for water literacy campaign, estimation of maximum freshwater requirements in the panchayat till 2030, waste disposal management, rational consumption and Judicial distribution of water, and the setting up of a water volunteer system at neighbourhood group level for water conservation. As per the provisions of the Panchayat Water Policy, committees for water conservation are constituted at the panchayat level and its ward level to co-act with the various sectoral committees of agriculture, health, education, basic and industrial development in the panchayat for the water conservational objectives (Chattopadhyay and Harilal, 2017 and the Hindu, 2015).

e. Water Quality Test Drive: In association with *'Jal Jeevan* Mission', the LSG system of Kozhikode and Kerala Water Authority jointly started a district-wide quality test drive on the drinking water sources in rural limits. In the first phase of the scheme, '*Kudumbasree*' workers, under the supervision of 5 trained volunteers selected from each panchayat, ran the test drive by collecting samples of 500 wells from each panchayat limit. Besides, this water

quality check drive used a field test kit to conduct a sanitary survey in the wells to identify the presence of septic waste. According to P.C. Kavitha, District Mission Coordinator of *Kudumbasree*, this quality check drive will be conducted twice a year in 70 panchayats of Kozhikode District (Mathrubhumi, 2021).

In addition to the aforementioned specific initiatives of LSGs for water conservation, in 2019, the District Administration led by District Collector constituted a special team of experts invited from multi disciplines regarding water security. The special team convened by the Assistant Director of Panchayats will be coordinated by the CWRDM. It plans various long-term and short-term programs for the water security of the district by using the institutional and technical resources of LSGs, CWRDM, Water Authority, and various government departments of Agriculture, Groundwater, Irrigation, Soil, Forest, and Disaster Management in the district. Even though, all the action plans formulated by this team will be implemented through the LSG system of the district because; constitutionally, the urban and rural LSG institutions are already entrusted with many statutory stakes in the water conservational aspects of water governance. Such constitutional responsibilities of urban (municipalities) and rural (Panchayat Raj institutions) LSGs regarding water conservational measures carried out by Kozhikode District are extracted and given below.

5.12.3 Operations at Village Panchayats:

1 Maintaining various traditional freshwater sources in the panchayat;

2 Conducting local programmes for the conservation of ponds, lakes, and other water tanks;

3 Maintaining various canals and water channels in panchayat limit;

4 Preventing the effluents and disposal of liquid and solid waste into water bodies;

5 Managing storm water drainage system;

6 Ensuring the judicial distribution and rational consumption of water by various water conservational measures (Kerala Panchayat Raj Act, 1994).

5.12.4 Operations at Block Panchayats:

1 Offering necessary technical support to water conservational efforts of panchayats at the village level;

2 Formulating more water conservation schemes by considering similar efforts at village panchayats;

3 Implementing and operating lift or minor irrigation project comes under the Block Panchayat limit;

4 Coordinating water conservation programs that cover more than one village and interconnecting such programs with District Panchayat (Kerala Panchayat Raj Act, 1994).

5.12.5 Operations at District Panchayat:

1 Providing technical resources mobilized from government and non-government agencies to the block and village level panchayats and municipal institutions;

2 Implementing various measures for groundwater development;

3 Implementing irrigation projects which are connecting more than one Block Panchayat

4 Formulating projects taking into consideration the relevant efforts and interests of village and block level panchayats (Kerala Panchayat Raj Act, 1994).

5.12.6 Operations at Municipalities:

1 Preserving the traditional freshwater sources in urban areas;

2 Conducting various programs for the conservation of ponds, lakes, and tanks in urban limits;

3 Preserving canals and other water channels in the urban region;

4 Managing urban network of storm water drainage;

5 Implementing and operating various irrigation projects under Municipalities;

6 Implementing measures for groundwater development;

7 Ensuring water conservation by judicial distribution and rational consumption of water in the urban areas of the district (Kerala Municipality Act, 1994).

Based on the aforementioned statutory responsibilities, inter alia, LSG institutions are practicing or facilitating many long-term and short-term measures of water conservation to reduce drought impact in the district by maximizing its water availability. Such measures which are operated by LSG institutions in local areas wherever it is feasible in the district are framed in line with the strategies formulated by the state government as follows;

5.12.7 Long term strategies

- Tying up of urban and rural water supply networks with irrigation and hydel reservoirs in the region;

- In situ soil and water conservation by contour trenches and bunds, gully plugs, rain pits, and other watershed practices;
- Regulation of groundwater pumping by legislative measures;
- Promotion of water sustainable and drought-tolerant crop patterns;
- Judicious and rational groundwater development without resulting in any chances for salinity encroachment and drying up of adjacent wells (KRWSSA, 2000).

5.12.8 Short term strategies

- Deepening and de-siltation of ponds, streams, community wells, etc.;
- Implementation of appropriate water-saving techniques of irrigation like precision farming, sprinkler, and drip, mulch methods;
- Repairing of damaged pipes in the distribution network and pumps in the tube and bore wells;
- Construction of various sub-surface dams and check dams in rivers without affecting their natural flow;
- Regulation of water consumption by water pricing;
- Promotion of various rainwater harvesting structures and appropriate groundwater recharging methods;
- Conducting awareness campaigns and training sessions among the public on various water conservational measures (KRWSSA, 2000).

5.13 Water Saving Practices in the District

In line with the aforementioned strategies of the state, LSGs in the district promote different forms of water-saving techniques based on their

topographic features. Most of the LSGs in the district already initiated legislative measures also to ensure any water harvesting structure in each house and institution within their regional limits, and to implement water pricing techniques (by the networks of paid freshwater supply) to reduce water demand. Urban and suburban areas in the midland of the district mainly practice various forms of rainwater harvesting structures. Many government and non-government institutions facilitate such varieties of water harvesting in the district.

'*Mazhapolima*', a government-supported non-government scheme, facilitates household well recharging by harvesting (collecting, filtering, and redirecting to well) rooftop rainwater in a financially and technically feasible manner.

Similarly, '*Jalanidhi*' is another state-promoted project, facilitating the households to harvest and store filtered rooftop water in ferro- cement tanks built at low cost with government subsidies. Such water recharging is mainly practiced in Meladi, Panthalayani, Vatakara, Chelavoor, and Kozhikode blocks in the district.

Many ' Community ponds' are also constructed in the suitable terrains of the district under community initiative for collecting the rooftop and runoff water by using appropriate land pooling techniques to channel them into the ponds. Many paddy fields in the district are also prepared as feasible destinations and storage of such redirected channels of runoff water.

'Percolation tanks' are suggested as a suitable method of artificial water recharging for the terrains in the district featured with colluvium, valley fill, and weathered rocks. The gently sloped wide valleys in the Kunnummal, Koduvally, Thooneri, Balussery, and Kunnamangalam Blocks in the district

have opted for ' sub-surface dykes' as its appropriate groundwater recharging structure (Central Groundwater Board, 2013).

The water conservational structures like contour trenching and gully plugging are mainly suggested for the highland areas with the local break-in slop and high volume of water runoff in the regions of Perambra, Kunnummal, Koduvally, Balussery, and Thooneri Blocks of Kozhikode District. Above all, as a region endowed with a wide network of rivers and streams with the short-distance course, the district is promoting the practice of many check dams across the network of gently sloped streams with permeable beds in the terrains of its various blocks except Vatakara, Meladi, and Kozhikode in line with the suggestions of Central Groundwater Board (2013).

As per the present national and state water policy reforms towards decentralized water conservational initiatives, the LSGs are the central point of planning, implementation, and maintenance of all such water conservational efforts of the district. In this mission, the LSGs are carrying out such responsibilities by utilizing the community resources along with the institutional and technical resources of other related institutions like KWA, GWD, CWRDM, etc. in a scientific and participatory manner. Though, the actual institutional stake and inputs of LSG institutions in such local initiatives need to be analysed for the assessment of the institutional impact and feasibility of such reforms in the water conservation mission. Therefore, the level of LSG participation in the major water conservational initiative run by LSGs (under the Haritha Keralam Mission) in the district will be analysed in the next chapter of the present study.

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CHAPTER 6

THE QUESTION OF LSG PARTICIPATION IN WATER CONSERVATION

The present chapter discusses the actual institutional role of LSG institutions carried out in the various water conservation initiatives in Kozhikode District. Therefore, the chapter covers a closure analysis on five case studies conducted on selected water conservation programs in the district carried by Kozhikode District Panchayat, Kozhikode Block Panchayat, Vanimel Village Panchayat, Kozhikode Municipal Corporation, and Feroke Municipality.

Since the 1990's the State of Kerala began to focus more seriously on the conservational aspect of water management based on watershed principles. The subsequent water policies of the state further enumerated such policy shifts by considering river basins and sub-basins as the units of watershed development initiatives centred on the LSGs. The SWP-1992 of Kerala introduced a policy framework of integrated and decentralized approach in the state mission for water conservation by watershed-based planning in development. Such policy guidelines led to a resource-based approach to sustainable water conservation. By 2008, the revised water policy framework of Kerala further delineated the institutional stake of urban and rural LSG institutions in the water conservational activities of the state in a decentralized manner. Therefore, the present water policy framework of Kerala is more relevant in consolidating the lead role of LSGs on various water conservational initiatives in water governance.

Moreover, the state enactments of the Panchayat Raj and Municipality Acts in 1994 that followed the 73rd and 74th Constitutional Amendment Acts have constitutionally equipped the LSGs in Kerala for decentralized

initiatives on water conservation. It offered a strong institutional base for authorities and communities to come together for water conservational measures at the local level. Such institutional experience of decentralized governance is easily sensitized by Kerala as it is already experienced with the 'Peoples Planning Campaign' implemented by the state government in a phased manner since 1996. Therefore, along with subsequent state water policy reforms, several statutory measures of the state also placed the LSG institutions as the central point of its water conservational initiatives in Kerala.

Even though, during the subsequent years, the concept of participatory water conservation by LSG units in the state was refined by many strategic and institutional reforms to ensure the conservation of local water resources sustainably. But, due to institutional and infrastructural limitations, many of such institutional reforms for decentralized water conservation subverted even at the implementation phase resulting in mixed and varied impacts in each LSG system. Consequently, the Govt. of Kerala launched an umbrella mechanism known as "*Haritha Keralam*" as a comprehensive mission to ensure the convergence of inter-departmental resources for water conservation initiatives with local perspectives and participation led by LSGs (Dept. Of Finance & Planning, 2017). Therefore, the present chapter discusses the actual role of LSG institutions carried out in the various water conservation initiatives led by the Haritha Keralam Mission in Kozhikode District.

6.1 Analysing the role of LSGs in water conservation initiatives

Since 2017, the District Mission of Haritha Keralam coordinating the major water conservation initiatives carried out by the LSGs in the Kozhikode District. The District Mission is presided over by the president of District Panchayat coordinating the water conservational efforts of various LSG units of the district in line with the policies and guidelines of the state mission of

Haritha Keralam. The watershed master plans prepared by various urban and rural LSGs in the district are the basis of the mission's operations for water conservation. Such operations ensure the necessary services of various government departments such as Water Authority, Forest, Health, Education, Tourism, and Agriculture as supporting agencies in the water conservation measures of local governments. The District Mission combined with the District Coordinator, Resource Persons, and Internship Trainees facilitates the convergence of such inter-departmental resources for local water conservation by LSG institutions.

Therefore, the decentralized water conservation led by local governments became a comprehensive initiative of sustainable water conservation with the active participation of inter-departmental resources of the government and non-government agencies. Conceptually, LSG institutions are the central point of such water conservation programmes with local perspectives and participation coordinated by the Water Sub-Mission of Haritha Keralam. In this context, the present chapter analyses the actual role done by LSG units in the major water conservation operations coordinated by Haritha Keralam Mission since its origin in the district. Therefore, few case studies are conducted on selected water conservation programs in the district to analyse the institutional role of the LSG mechanism carried out in such initiatives.

6.1.1 Operation Canoly Canal

The Canoly Canal in the Kozhikode District is a vital portion of the West Coast Canal Network of water transportation constructed during the British reign. This coastal water transportation network stretches from Kozhikode to Kodungallur by interconnecting various rivers and streams in the region envisioned by Henry Valentine Canoly, the then Malabar District Collector, in 1848. Therefore, the construction of the canal, which began

under the supervision of H.V. Canoly, came to a halt with his death in 1855, but further work on the canal was completed by the later collector Robinson. The main issue faced by this navigation project was the availability of land for the construction of the canal at a time when the Land Acquisition Acts were not in force. However, with the intervention of the then Zamorin King, required land was made available for canal construction under certain conditions. Under the said conditions, the canal project designed for navigation purposes also included irrigation facilities for agricultural purposes in the area. As part of this mission, appropriate measures were taken at both ends of the canal to prevent saltwater intrusion into the Canoly Canal (Haritha Keralam Mission, 2019).

The Canoly Canal lies in Kozhikode District and is 11.4 km long and drains through Peruvanthuruthi and Kottuli wetlands to connect the main rivers of the district, *Korapuzha* (northern end) and *Kallayi puzha* (Southern end). The width of the canal in the city varies from 6 to 20 meters and the water level in the monsoon period ranges from 0.5 to 2 meters. Since the Canoly Canal became operational, this inland navigation route has become an integral part of the commercial activities in the Kozhikode District. About 35 stops have functioned as part of the water transport system in the canal. In 1924, 538 boats (*Thonikal*) and 2035 rafts were registered in Olavanna, and 236 boats and 506 rafts in Kallayi during the inspection of boats and rafts used by the Canoly Canal. Besides, the canal was used by 2000 British-owned boats in the area. After 1950, the use of this water route grew to play a vital role in the commercial growth of Malabar itself (Haritha Keralam Mission, 2019).

As the city has grown rampantly over the last few decades, the canal navigation has become obsolete and the transport facilities in the Canoly Canal have gradually disappeared due to the growth of land transport and

vehicle facilities in the district. As a result, the canal, which had not been utilized and maintained for a long time, became utterly useless. Gradually, the unusable canal became a convenient dumping field for urban and household wastes from the city and canal areas. Such accumulated solid and bio wastes (plastic wastes, slaughter wastes, industrial and household wastes, etc) in the canal began to obstruct the natural flow of water in the Canoly Canal. Consequently, mud and silt accumulated heavily in many parts of the canal bed and bushes grew in those parts of the canal. In addition, the water in the canal became utterly polluted and blackened with a foul smell as sewage from hundreds of sewers from the city opened into the canal, which lost its flow.

Moreover, the continuous seepage of stagnant sewage in the canal into the various drinking water sources including household wells in the areas adjacent to the polluted canal made such water bodies also contaminated, coloured, and smelly, especially during the non-monsoon period. A field study on the water quality of such areas conducted by CWRDM also observed the same. It led to the formation of active public unrest among the local communities towards the contamination of the Canoly Canal. Besides, as a result of constant landslides in the sidewalls of the canal, the depth and water storage capacity of the canal were so low that even if it rained well, the contaminated canal would often overflow and flood the city. Due to the floods in 2018, the polluted canal overflowed and it submerged and polluted many drinking water sources, including *Sarovaram* Bio-Park, Mini Bypass, and Mavoor road in the low-lying surrounding areas of the canal, resulting in huge protests among the residents about the deplorable condition of the Canoly Canal. The affected urban community group led by environmentalists has argued that blockage of the canal caused by the clogging of solid and bio-wastes that had accumulated in the canal for years resulted in the flood in the city. Therefore, the demand for the conservation of the Canoly Canal has become a serious social issue in the city with the emergence of such local

community protests and some local environmental organizations that have long been working for the revival of the deteriorating canal (The Hindu, 2018).

Consequently, as the local authority of the region, the Kozhikode Corporation had to respond immediately to such emerging local demands and protests to address the dilapidated condition of the Canoly Canal in the district, which also affects the drinking water sources in the area. It was in this context that 'Operation Canoly Canal' was launched by the Kozhikode Corporation in association with the District Administration under the banner of Haritha Keralam Mission of Kozhikode District. Operation Canoly Canal was planned to clean 11.2 km of the canal by community participation led by *'Niravu Vengeri'*, an empanelled green institution in the Haritha Keralam Mission of the district. As part of the scheme, Corporation planned to carry out the activities of waste removal, water quality assurance, and renovation and beautification at various stages of Operation Canoly Canal.

The first phase of Operation Canoly Canal aimed to restore the flow of the canal by removing the clogged sewage and wastes and overgrown bushes and trees in the canal. On August 28, 2018, the local community initiative led by the ' *Niravu Vengeri* ' launched Operation Canoly Canal by removing the wastes from the canal. Mr. Thottathil Raveendran, Mayor of the Corporation inaugurated the canal clean-up drive, which started near the *Sarovaram* Bio-Park led by 50 trained volunteers and 10 coordinators of the *Niravu* (The Hindu, 2018). Instantly, the canal cleaning drive has become a mass movement with the active participation of various socio-political groups, volunteers of environmental and community organizations, workers of various government departments including the Corporation and District Administration of Kozhikode, and student groups from various educational institutions in the city. Along with the technicians of the CWRDM and

Irrigation Department, many private institutions also offered their institutional expertise to this cleaning mission (Haritha Keralam Mission, 2019).

Throughout the cleaning mission, food and water for the cleaning workers were provided by the Kozhikode Catering Association and medical assistance by the Aster Mims Hospital. Similarly, Sign Printing Association also participated in the Operation Canoly Canal by providing expert labour for the cleaning mission and an adequate number of boards with canal conservation messages. During the first 15 days of the cleaning mission, 2513 bags of plastic waste were removed from the canal. An average of 200 bags of different sorts of waste were removed from the canal daily. Separately collected plastic wastes are dried on the spot and sent to the recycling unit of the Corporation for safe disposal. However, the bio-wastes removed from the canal were treated safely in the vicinity of the canal and composted. Sometimes, the community clean-up drive was partially hampered as the canal from Eranjipalam to Karaparambu was utterly covered with heavy slaughter waste and venomous reptiles. Due to a lack of skilled people to remove waste, silt, moss, and huge trees in such deepest part of the canal, Corporation authorities cleaned that dangerous part of the canal using the expert service of the fire force in the city. Besides, the cleaning of the canal was carried out by spraying a bio solution on this rotten and smelly area of the canal (Haritha Keralam Mission, 2020).

Thus, the first phase of Operation Canoly Canal was able to restore the flow of the canal to an extent, which had been clogged for a long time by a mixture of waste and silt. Therefore, the first phase of Operation Canoly Canal became a prime example of the participatory model in water conservation initiatives organized under the Kozhikode Corporation. The next phase of Operation Canoly Canal mainly focused on the activities for preventing further contamination of the canal. By this phase of the operation,

Corporation aimed to restore the quality of water in the canal by preventing the current practice of depositing wastes and sewage into the canal. The second phase of the operation began on December 1, 2018.

Canoly Canal was divided into 8 sectors as the first step in the implementation of the second phase activities of the canal conservation mission. To prevent further contamination of the canal, community canal conservation councils consisting of residents, environmentalists, and other social groups have been formed in each of such sectors. Besides, in each of these sectors, 'Green Centre' was set up, and 'Green Guards' were assigned to manage them. Along with the regular up-keeping activities of the canal, they have been assigned to prevent further contamination of the canal by depositing wastes and sewage. Such centers are assigned to maintain the green boards with canal conservation messages at the canal premises. *Nirav Vengeri* has taken up the responsibility of coordinating such Green Centres and other community initiatives for the conservation of the canal. The Corporation also signed a memorandum of understanding with 8 Green Partners formed in 8 sectors of the canal to retain the quality of water in the canal by further up-keeping.

However, keeping the water in the canal unpolluted was a major challenge to Corporation. Hundreds of sewers that were open to the canal for long period are one of the main pollutants in the water of the canal. An inspection already conducted by Pollution Control Board found that 169 sewage pipes, including those of public and private institutions, were open to the Canoly Canal (Manorama News, 2018). The main challenge faced by the Corporation during the second phase of Operation Canoly Canal was to find and prevent all such sewers from draining into the canal over the years. In inspections conducted by Corporation during this period, 178 sewage pipes, including 30 larger sewers, were identified and legal actions were taken to

prevent them forcefully. Besides, Corporation took immediate actions to cover the openings of all the sewers with wire mesh to check the deposit of solid wastes in the canal through the sewers (Haritha Keralam Mission, 2020).

However, despite all the community vigilance and precautions, slaughter wastes and various solid wastes continue to be dumped in many parts of the canal. It was in this context that Mr. Thottathil Raveendran, then Mayor of the Corporation announced the decision of the Corporation to install cameras to track down the culprits and to take strict legal actions against those who polluted the canal under the Water (Prevention and Control of Pollution) Act, 1974, Kerala Irrigation and Water Conservation Act and Kerala Municipality Act (Manorama News, 2018). As a result of the continued vigilance and awareness of community groups, canal maintenance of Green Partners, and the strict legal measures taken by the Corporation, the water in the canal began to become clean and flowing.

Although, the next phase of the Operation Canoly Canal included the removal of silt and algae from the canal, as the silt in the canal had to be removed and the original depth had to be retained to fully restore the natural flow and cleanliness of the canal. As a perpetual solution for the conservation of the canal, the Corporation also has included such programs in its annual plan and sanctioned Rs. 46 lakhs for it. Subsequently, the works to remove silt from Kallayi to Eranjikkal of the canal began in the first week of May 2019. The work of deepening the canal by removing the silt and mud from the 11.2 km long canal within three months has been done by the Kerala Waterways and Infrastructure Limited (KWIL), the special purpose vehicle formulated by the Govt. of Kerala for the rejuvenation of its inland waterways. The first phase of the canal deepening work started with the removal of silt at the confluence of the canal and the Kallayi River (Manorama News, 2019).

As the Canoly Canal is also part of the newly formulated waterway scheme of the state, the KWIL has completed its canal deepening work by dredging to a depth of 1.5 to 2 meters to enable boating on the canal. Although the canal was cleaned during the six-month-long Operation Canoly Canal, the Corporation authorities were forced to hand over this task to the KWIL as the canal continued to be polluted due to limitations in follow-up works. However, the planned works on the canal renovation have been halted several times due to floods, Covid-19, and tender procedures, but the Corporation reactivated the canal conservation mission by starting the institutional procedures for canal renovation as early as 2021. At a press conference convened by Ms. Beena Philip in 2021, Mayor of the Corporation, such recent procedural progress of the Corporation regarding reactivation of the canal renovation was explained. She announced that the Corporation had handed over Rs. 7.5 crores to the Irrigation Department for the canal renovation. Mayor added that as part of the canal renovation, the Corporation also planned to study the possibilities of converting the silt and mud obtained during the deepening of the canal into sand (The Hindu, 2021).

Presently, the Canoly Canal is undergoing extensive renovation work as part of the State Waterway Project led by KWIL. In addition, the Corporation is planning with the KWIL on the 'Kozhikode Canal City Project', which aims to maximize the transport and tourism potential of the Canoly Canal and ensure comprehensive conservation of the canal (Mathrubhumi, 2022). As conservational activities of canals, wells, rivers, and streams cannot be limited to a specific period or event, a local initiative with community participation is required to ensure their continued conservational activities. Operation Canoly Canal was such a successful water conservation initiative run under the Kozhikode Corporation, an urban LSG institution that was locally planned and implemented with community participation. This local water conservation initiative was able to make maximum use of all the

merits and institutional resources of the Corporation as an urban LSG. Therefore, the institutional role played by the Corporation in association with Haritha Keralam Mission in reviving the Canoly Canal, which was completely dormant due to contamination, was highlighted by the relevance of the LSGs in the decentralized water conservation model.

6.1.2 Revival of *'Peruvanmadu Thodu* (canal)'

Feroke is one of the major urban centers in Kozhikode District. It situates on the southern bank of Chaliyar and 13 km southwest of Kozhikode town. It is bounded on the east by Ramanattukkara Municipality, on the north by Chaliyar, on the south by the 'Vadakkumpadu' river, and on the west by Chaliyar river. Initially, it was constituted as a Village Panchayat and was upgraded and re-established as a Municipal Council with 38 divisions on 1st November 2015. Now, it's an urbanized region comprised of the topographical features of plain land, high land, valley, sandy belt, and riverine land. Feroke Municipality with 15.54 Sq. Km of such geographical area is included in Kozhikode Taluk in the Kozhikode Revenue Division of the district (LSGD, 2021).

Salinity encroachment and water contamination are the major issues in the water sector of Feroke Municipality. Salinity issues in the northwest regions of the Municipality are mainly due to the encroachment of salt water from the regions near the Chaliyar estuary. The falling groundwater table in the region intensifies such seepage of salt water into water sources from the Chaliyar estuary, especially during the dry season. Similarly, pollution from various point sources also threatens the freshwater availability of many areas under Feroke Municipality (Kumar, et al., 2020). The field survey conducted among the households in the surroundings of *'Peruvanmadu thodu'* which drains parallel to the Chaliyar estuary reveals that the local communities had experienced such issues together for a long time.

In this context too, Feroke Municipality has conducted a stream revival drive in 2018 by rejuvenating the *'Peruvanmadu thodu'* within its municipal limit. *Peruvanmadu* canal is an artificial stream built over fifty years ago. This stream was built about the coir industries that were once active in the region. The coir factories mainly used this stream for soaking the raw materials (coconut husk) for coir making. Later, it became one of the major rivulets in the region with a 600-meter length, 3.5-meter width, and 4.5-meter depth. Therefore, it was played as a water channel satisfying diverse local needs and maintaining the soil moisture in the surrounding areas active (Haritha Keralam Mission, 2020).

But the stream that used the flow through the boundaries of ward 1 and ward 38 of the Feroke Municipality has been in a state of complete damage for the last 15 years. Because a large amount of bio-wastes and solid wastes flowing from the Chaliyar has been accumulated in the stream bed for a long time and the natural flow of the stream has been disrupted. Such debris accumulated in the stream course polluted the water in the stream. In addition, heavy sewage from about 70 households on both sides of the stream has intensified the volume of contamination in the stream to such an extent that its water could not be used for any purpose.

The water in the flow less canal turned black and smelly due to the frequent accumulation of sewage. It has adversely affected water sources in the areas, especially household wells, and paved the way for many health issues such as mosquito-borne diseases and insect pests in the region. The sidewalls of more than 150 meters of the stream collapsed, resulting in landmass and overgrowth of bushes and trees, which transformed the streambed into a land field. Thus, the fifty-year-old ‘*Peruvanmadu Thodu'* slowly deteriorated into the kind of a wasteland in the area.

Unfortunately, this deteriorated and contaminated stream has remained un-defended and un-cared for almost fifteen years, even though it has become a major challenge to the water sources and sanitation in the surrounding areas. Recently, as the water pollution issues in the area worsened, there was a strong demand among the affected people and local communities to rejuvenate the *Peruvanmadu* canal to resolve the environmental and health issues raised by this contaminated and deteriorated canal. As a result of the constant demand raised in the periodical ward meetings of Division 01 and Division 38 of the Feroke municipality and public meetings in the region by local people, municipal authorities decided to act on the revival of the *Peruvanmadu* canal under the banner of Haritha Keralam Mission in the district (Haritha Keralam Mission, 2020).

Consequently, Feroke Municipality convened a joint meeting of ward councillors and municipal officials on 1st December 2018 to discuss further movements on it. Next meetings of municipal authorities and ward councillors concerned, and local communities in Division 01 and Division 38 of Feroke Municipality organized at *'Pathirikkad Madrassa'* on 3rd December 2018. This meeting led by Feroke Municipality in association with the Haritha Keralam Mission decided to constitute an action committee led by the councillors of Division 01 and Division 38 to conduct a massive cleaning drive on the *Peruvanmadu thodu* in a participatory manner. In addition, several sub-committees were also constituted by assigning specific duties to different sections in various government departments and programs such as Health, Engineering, Irrigation, Municipality, Haritha Keralam Mission, Suchitwa Mission, Ayyankali Urban Employment Guarantee Scheme, and Municipal Technical Committee for Water Conservation. Various non-government institutions like residents' associations and local community institutions were also included in the sub-committees to carry out the stream

revival activities planned to execute on 8th December 2018 (Haritha Keralam Mission, 2020).

During the previous days of the stream cleaning drive, a team of resource persons from Haritha Keralam Mission conducted a household campaign on the relevance of the stream rejuvenation mission to ensure community participation and cooperation in this mass movement. Before the stream revival drive, Feroke Municipality conducted a water conservation declaration rally with the participation of B.E.M School students. It became a mass demonstration by the presence of the Municipal Chairperson, District Coordinator of Haritha Keralam Mission, Councillors, municipality officials, teachers, and resource persons, and the active participation of various residents and community associations in the region. After the public rally, the program committee led by the municipality divided the total stream course into six different sectors (each sector covers 100 meters of the canal) and formulated sector-wise committees to set up various pre-requisites for the stream rejuvenation activities. Such sector committees arranged the required instruments and materials for the removal of wastes, silt, and trees in the streambed. Besides, they have arranged the food materials and drinking water for the volunteers in the canal cleaning drive (Haritha Keralam Mission, 2020).

'Peruvanmadu thodu' revival drive was inaugurated by V.K.C Mammad Koya MLA on 8th December 2018. In the presence of many eminent persons representing various government and non-government institutions involved in the mission, K. Kamarulaila (Chairperson, Feroke Municipality) presided over the inaugural session. During the session, the District Coordinator of Haritha Keralam Mission explained the overall activities planned in the mass cleaning drive for *Peruvanmadu thodu*. On 8th December, sector-wise teams of members from *'Harithakarma Sena'*, National Service

Scheme, residents' associations, and local communities started the cleaning drive by removing plastic and bio-wastes, and silt accumulated in the streambed. A huge amount of bio-wastes, solid wastes, and silt were collected from the canal by various measures. The collected bio-wastes were buried safely in the surrounding fields of the canal. Solid wastes like bottles, plastics, leather materials, etc. were collected separately for proper treatment by external agencies like 'Nirav'. A special team was deployed to cut down the trees and shrubs growing in several parts of the stream bed. Another team of volunteers engaged in the arrangements of food, drinking water, and medicines for all members who participated in the cleaning drive. Simultaneously, a trained team of volunteers and resource persons carried out a household campaign to ensure the cooperation of native people in the upkeeping of the cleaned stream by creating water conservational awareness among them (Haritha Keralam Mission, 2020).

Most of the workers in the Ayyankali Urban Labour Guarantee Scheme and Suchitwa Mission under the Feroke Municipality actively participated in stream rejuvenation activities. In addition, locally arranged machinery was also used in the mission to remove heavily accumulated silt and wastages in a few parts of the stream. Thus, the water flow in the *Peruvanmadu* canal which had been lost 28 years ago, has been restored after a month-long united effort of above 250 volunteers led by Feroke Municipality under the Haritha Keralam Mission. With the restoration of the stream, the water in the stream became cleaner and the fish wealth began to flow back into the *Peruvanmadu* canal. The *Peruvanmadu thodu* revival programme concluded with a boat ride led by the programme committee through the rejuvenated stream that regained its original depth by removing accumulated silt in it.

Thus, one of the local water conservation initiatives of Feroke Municipality under the banner of Haritha Keralam Mission in Kozhikode District revived the completely deteriorated stream in the region through a community drive in a participatory manner. The revived *Peruvanmadu* canal with clean and active water flow resulted in an inspirational impact among other LSG institutions in the district. Therefore, Feroke Municipality continued this mission with follow-up activities for up-keeping the *Peruvanmadu thodu*. In this regard, various sectoral committees are constituted to preserve the stream from further deterioration and contamination. Besides, they have been assigned a duty to start fish farming in the stream to keep it clean and live. A set of nets was also fixed at the entry points of the canal to prevent the inflow of wastes from the Chaliyar river. Moreover, the community initiative led by Feroke Municipality managed to avail the allotment of 42 lakh rupees from the MLA fund of V.K.C Mammad Koya to build safety walls and check dam across the *Peruvanmadu* canal (Haritha Keralam Mission, 2020).

Feroke Municipality organized a special session to declare the completion of its scheme for the revival of *'Peruvanmadu thodu'* by using 68.27 lakh from the 15th Finance Commission Grant for the term of 2019-2020. This session was held on 19th July 2021 and inaugurated by P. A. Muhammad Riyas, Minister for Public Works & Tourism. Presently, the construction of the side walls of the canal with stone and concrete slabs have completed by the municipality. Mr. M. Afsal, Councillor of Division 38 in the municipality (2021) stated that the construction of a new culvert in proportion to the width, depth, and height of the rejuvenated canal ensures proper flow in the *Peruvanmadu* stream is also completed recently. But, one older culvert on the other end of the canal still needs to be renovated. Because the narrow sluice under the old culvert still causes the accumulation of silt around the culvert resulting in the break of flow in the stream during the dry time, said

Mr. A. Azeez, one of the residents of the canal (2021). After the cleaning drive, the residents are vigilant about not letting the household sewage and wastes into the canal, he added.

According to K. Kumaran, Standing Committee (Development) Chairman of Feroke Municipality in 2021, the declared plans for the renovation of the remaining old culvert and fish farming project in the *Peruvanmadu thodu* are still awaiting the fund allotment of the Municipality. However, the maintenance activities of the canal like periodic levelling of the streambed by removing the silt and preventing the inflow of wastages into the stream are being conducted properly by using the central government schemes (funds) for cleaning in municipal areas, he added. Above all, the resident groups at the banks of the canal are alerting themselves and municipal authorities on their local mission to prevent the further deterioration and contamination of *'Peruvanmadu thodu'*.

6.1.3 *Mampuzha* Restoration Project

It is one of the comprehensive river conservation projects in the district led by District Panchayat of Kozhikode under the banner of Haritha Keralam Mission. District Panchayat started this major water conservation initiative in the district for the restoration of *Mampuzha* as a joint venture between the Kozhikode and Kunnamangalam Block Panchayats and the Perumanna, Peruvayal, and Olavanna Village Panchayats on March 2018 (The Hindu, 2018). Therefore, along with the institutional machinery of District Panchayat, such Block and Village Panchayats in the riverine areas of *Mampuzha* also contributed their institutional and financial resources to the collective mission for river restoration. At the beginning stage of the project, the District Panchayat has allocated 50 lakh and the Block and Village Panchayats are concerned 25 lakh each for the implementation of this river restoration scheme. Thus, the District Panchayat prepared a comprehensive

river conservation project of 1.75 crores for the revival of *Mampuzha* which affects the various water sources of the Olavanna, Perumanna, and Peruvayal Panchayats (Haritha Keralam Mission, 2020).

Mampuzha is a minor river in the district that originates from *'Muthashikundu'* and lies in the valleys of '*Aanorakunnu*' situates in the 'Mundakkal' region of Peruvayal panchayat included in the Kozhikode Taluk. Mampuzha drains through various parts of the Olavanna, Peruvayal, and Perumanna Panchayats in Kozhikode and Kunnamangalam Block Panchayats of the district and joins the Kallayi River. *Mampuzha* played a crucial role in ensuring water availability for the domestic and agricultural purposes of these panchayats. Because, this 18 km long river, which once drained clean and full, maintained the high freshwater level in the various water bodies (wells, ponds, streams, etc.) in the whole areas of such panchayats. At that time, various crops cultivated widely on both sides of the river depended on the freshwater resource of *Mampuzha* for the irrigational requirements. In addition, most of the coir-making centers that were widespread in the region were mainly located at about 35 river crossings (*Kadavukal*) and existed in the various parts of Mampuzha. Mampuzha itself was the major means of cargo transportation and soaking of coconut husk for such coir-making centers, which employed more than 500 workers (Haritha Keralam Mission, 2019).

The large fish stocks in the *Mampuzha,* which were rich in local fishes like *Karimeen, Punnaram, Poomeen, Irimeen, Amaral, Thirutha,* etc., were also the main livelihood of a section of the local communities. Until a few decades ago, road facilities were inadequate, all major cargo (food products, construction materials, agricultural products, etc.) traffic between the region and Kozhikode city depended on this river, which was navigable due to its depth, width, and flow. *Mampuzha* was used in such a way mainly by the

villages like Puthoormadam, Kuttikatoor, Pantheerankavu, Payyadimeethal, Palazzi, and Olavanna, etc. Besides, the riverine areas of *Mampuzha* were a regular visiting center for many diverse migratory birds when the river was flowing cleanly and actively (Haritha Keralam Mission, 2019).

But, over the past few decades, *Mampuzha* has been facing some severe threats as a result of human interventions in the context of population pressure and changed life patterns of local communities towards urbanization. Contamination and encroachment of riverine areas were the main issues resulting in the deterioration of *Mampuzha*. The high volume of sewage, slaughter wastes, plastic wastes, and other sort of bio-wastes and solid wastes that were constantly accumulating polluted the river severely and weakened the flow of the river itself. With the accumulation of heavy silt along with wastage, the natural flow in the narrow parts of the river stopped and the water in the river became discoloured and smelly in such parts.

The constant river encroachment and erosion of the river walls at various parts of the river also intensified such river deteriorating situations in *Mampuzha*. To defend against such massive land encroachment of riverine areas in the '*Porumboke* land', a local community initiative known as *Mampuzha* Protection Committee has been engaged in a constant fight with authorities concerned. As a result, in 2014, the Revenue Department conducted a land survey in the riverine areas of *Mampuzha* to identify the encroached land. Consequently, based on this land survey report, the local authorities of Peruvayal, Perumanna, and Olavanna Village Panchayats were forced to start land recovery procedures in the region in 2016 (Times of India, 2016).

Besides, most of the streams and minor canals in the region which used to drain into the *Mampuzha* have been filled up or covered with waste which has led to the weakening of the river. In addition, most of the areas in the

Mampuzha are severely covered with African and Anabaena algae resulting in the flow-less river. Gradually, the contamination and deterioration of *Mampuzha* began to affect the various freshwater sources in the region adversely. The colour and smell of the water in household wells and other water bodies in the areas adjacent to the *Mampuzha* also began to change, especially during the non-monsoon period (Haritha Keralam Mission, 2019).

Therefore, a water quality test drive led by Olavanna Panchayat in association with CWRDM was conducted at different locations between *'Kuunath palam'* and *'Kannamchinnam palam'*. This study of CWRDM found that *Mampuzha* is contaminated intensively by plastic wastes, slaughter wastes, sewage, and household wastage. Samples collected from different areas adjacent to the *Mampuzha* showed a considerable fall in oxygen level in the water and the strong presence of coliform bacteria in tested water bodies. With the reporting of the scientific assessment of CWRDM, it was undoubtedly established among the local authorities and communities that the deplorable condition of *Mampuzha* has affected the water sources of various areas under Olavanna, Perumanna, and Peruvayal Panchayats (Haritha Keralam Mission, 2019).

In many parts of the *Mampuzha*, which loses their natural flow during the non-monsoon period, polluted water was trapped, causing severe mosquito and insect infestation and mosquito-borne diseases in the surrounding areas of the river. Moreover, as the 18 km long *Mampuzha* is the central point of all the water resources in its river basin areas, the drought and depletion experienced by the *Mampuzha* during the non-monsoon period have become a major cause of declining water table in the surrounding water bodies and subsequent water scarcity in the region. Recently, realizing that one of the root causes of the aforementioned environmental issues in the region is the continuing deplorable condition of the *Mampuzha*, some local

community groups have initiated some miner river conservation measures in their areas.

The *'Puzhampuram'* regional committee was the first to initiate such community interventions for the revival of *Mampuzha* by removing the accumulated solid wastes and overgrown African algae in the river in *'Puzhampuram'* region. Subsequently, some other local community groups and voluntary associations also joined in such community interventions for the conservation of the river in a participatory manner. Similarly, student groups of various NSS units in the region organized their social service camps in the riverine areas of *Mampuzha* to clean the river by removing the different sorts of waste accumulated in it. In addition, such student groups have conducted household campaigns in the region regarding the relevance of river and river conservation. Gradually, such distinct community initiatives became a mass movement of community interventions for the restoration of deteriorating *Mampuzha* (Haritha Keralam Mission, 2020).

Thus, as a united platform of various community initiatives for *Mampuzha*, the 'Mampuzha Conservation Council' (*Mampuzha Samrakshana Samithi)* evolved to carry out various river restoration efforts by the public. *Mampuzha* conservation council has constituted many environmentalists, voluntary organizations, residents' associations, and youth groups in the riverine areas of *Mampuzha* in Perumanna, Peruvayal, and Olavanna Panchayats. Such community efforts under the *Mampuzha* conservation council conducted many cleaning drives in the river by removing wastage and followed relevant measures to prevent further contamination of the river. As a result of many collective efforts led by this council, the volume of contamination in *Mampuzha* significantly reduced for a few months. However, a few months later, the dumping of wastes into the river resumed in earnest. In addition, it has become a common incident in many parts of the

Mampuzha that the river turns green due to stagnant sewage and the fishes in the river die extensively and the stench spreads to the surrounding residential areas (Haritha Keralam Mission, 2019).

Such persistent situations led to the failure of all river restoration efforts practiced by the local community initiatives. In this context too, the various LSGs in the areas where the *Mampuzha* flows are coming forward with legal procedures for the revival of this deteriorating river. Initially, the block and village level panchayats in the region have started formulating their programs of interventions for the conservation of *Mampuzha* as the deplorable condition of the river has started directly affecting the drinking water sources and public health of a large section of the residents in the riverine areas. However, such LSGs soon realized that the conservation of *Mampuzha,* which is spread over 18 km in different Block-Village Panchayat limits, would require an integrated scheme of interventions by the LSGs concerned.

Therefore, inspired by such integrated projects for water conservation being carried out by the LSGs under Haritha Keralam Mission, Kozhikode and Kunnamangalam Block Panchayats and Olavanna, Perumanna, and Peruvayal Panchayats have incorporated such an integrated river conservation programme for *Mampuzha* in their annual project activities of 2018 - 2019 and allocated fund. Subsequently, realizing the ecological relevance of the river along with the public concerns raised by the deplorable condition of the *Mampuzha*, the District Panchayat of Kozhikode has decided to undertake the integrated initiative of block-village panchayats under the district panchayat for the restoration of *Mampuzha*. Thus, the local initiatives for the conservation of *Mampuzha* became an integrated and comprehensive river restoration project led by District Panchayat of Kozhikode in association with Kozhikode and Kunnamangalam Block Panchayat and Olavanna, Perumanna,

and Peruvayal Village Panchayat under the banner of Haritha Keralam District Mission (Haritha Keralam Mission, 2019).

As an initial step, the district panchayat conducted a comprehensive survey at a distance of 8.94 km riverine areas from Kuttikatoor in Peruvayal Panchayat to Kunnathpalam in Olavanna Panchayat and prepared a detailed report for the scientific revival of the *Mampuzha*. Subsequently, the District Panchayat started the Joint project of LSGs worth 1.75 cores for the restoration of *Mampuzha* by using the institutional and financial resources of such Block-Village panchayats concerned (Haritha Keralam Mission, 2019). T.P. Ramakrishnan, Minister for Labour and Exercise inaugurated the project launching session organized by the district panchayat in March 2018. In this session, Babu Parassery (then President of District Panchayat) explained the operations of this river restoration project. The District Panchayat has planned this comprehensive project by dividing the whole river revival activities including cleaning and preservation of *Mampuzha* into four phases. The District Panchayat assigned the ULCCS (Uralungal Labour Contract Co-operative Society) to carry out the dredging activities in the river and CWRDM to guide the river preservation measures in the Mampuzha Restoration Project (Times of India, 2018).

During the first phase of the *Mampuzha* Restoration Project, about 3.75 km of the riverbed of *Mampuzha,* which was in a critical condition, was cleaned by removing the accumulated bio-wastes and solid wastes in the river. At this stage, such wastes were mainly removed from the narrow riverbeds of the *Mampuzha* and the adjacent minor canals which flow into the river. The second phase of the project mainly focused on the dredging works to increase the river depth for retaining the original depth of *Mampuzha* by removing the accumulated silt and mud in the shallow parts of the river. It was the ULCCS that restored the original depth and natural flow of *Mampuzha* by removing

the silt that had accumulated over the years in many parts of the riverbed (Haritha Keralam Mission, 2020).

After the completion of the second phase of works related to cleaning and deepening of the riverbed in the prescribed areas of *Mampuzha*, the District Panchayat planned to protect the river walls in the rejuvenated areas of the *Mampuzha* by the covering of bio-geo textiles. In the third phase of the project, the District Panchayat utilized the service of workers in MGNREGS under various panchayats included in the project to complete the covering work of river walls with bio-geo textiles. Thus, the river wall protection measures planned for required parts of the rejuvenated river sustainably were completed by the third phase of the Mampuzha Restoration Project. Subsequently, the District Panchayat led to a participatory movement by constituting river conservation councils in riverine areas to ensure the up-keeping of rejuvenated *Mampuzha* by preventing the further contamination of the river (Haritha Keralam Mission, 2020).

Consequently, such river conservation councils formulated in panchayats and wards in the areas where the river flows are headed by the Panchayat Presidents at the panchayat level and the Ward Members at the ward level. Such river conservation councils led by LSGs were active with mass participation of local youths, environmentalists, volunteers, residents, etc. in the participatory model up keeping restored *Mampuzha* from further deterioration by human interventions. Such locally constituted committees led by the LSGs involving the residents of the riverine areas play a vital role in preventing river contamination situations by household wastes and sewage. To keep *Mampuzha* clean and flowing, the Block Panchayat of Kozhikode and Panchayat of Olavanna have jointly planned some recreational programmes in the river in association with the local youth organizations (Haritha Keralam Mission, 2020).

According to Mr. P. Shibin, Resource person at Haritha Keralam Mission-Kozhikode in 2021, as part of this mission, a boating program (*Jalayathra* Tourism Project) based on the concept of 'tourism along with river conservation' led by the collective of LSGs and youths in the region implemented in *Mampuzha*. The merit of this scheme is that the riverbed of the boating area is cleared as a result of such regular boating while enjoying the rural life and scenes of the *Mampuzha* river basin. In addition, the *Mampuzha* Restoration Project led by District Panchayat of Kozhikode is planned to implement farm tourism in *Mampuzha* based on the aquaponics farming model. Thus, the joint initiative of Block-Village Panchayats led by the District Panchayat of Kozhikode was able to revive the dilapidated *Mampuzha*, which had been covered with wastes, silt, and algae, and bring it back into a clean and flowing river (Shibin, 2021). Therefore, the comprehensive project for the revival of *Mampuzha* implemented by the District Panchayat of Kozhikode as a joint scheme of various Block-Village Panchayats has become an effective governance model for the conservation of other deteriorating rivers spread across different LSG institutions.

6.1.4 Formation of Biodiversity Block

'Biodiversity Block' is a green project formulated by the Kozhikode Block Panchayat to conserve and nurture the rampantly deteriorating biodiversity in the region. Kozhikode Block Panchayat is one of the largest biodiversity hotspots in the district with a wide range of water resource systems. Therefore, Block Panchayat has given great importance to the programmes based on the conservation of various water sources in the region. As part of this project, a variety of programs are being implemented for the conservation of rivers, streams, ponds, wetlands, beaches, hills, groves, and mangrove forests as well as their flora and fauna, which are included in the biodiversity centers of the Kozhikode Block Panchayat. Biodiversity Block

project is being implemented by integrating some of the other green initiatives of the Block Panchayat itself, such as *'Sundharam Susthiram Harithabam'*, 'Oro *Thulliyum Karuthalode'*, *'Harithabavanam'*, and '*Jalayanam*'.

Biodiversity Block Project is mainly centred on the Kadalundy and Olavanna Village Panchayats which are the largest biodiversity centers in the district. These biodiversity hotspots are home to a large portion of the water-related ecosystems in the district. Kadalundy Village Panchayat itself is an area surrounded by the sea on one side and rivers on the other three sides. Therefore, the region is home to one of the rarest and most diverse aquatic ecosystems in the state. 'Kadalundy Community Reserve', the first community reserve in India, is located in this panchayat and is home to rare mangrove forests and bird sanctuaries. The water sources of the panchayats and surrounding areas are maintained by the proximity of the many wetlands that exist in the panchayat limit along with such biodiversity in the region. Olavanna Village Panchayat is also a hub for biodiversity systems that are formulated by the wetlands, eyots, groves, hills, and rivers in its region. Similarly, the whole area of Kozhikode Block Panchayat is endowed with various networks of rivers, rivulets, wetlands, and estuaries and their ecosystems.

The rivers such as Mampuzha, Chaliyar, and Kadalundy rivers, which drain through the regions, are the major source of water resource system and biodiversity in the Block Panchayat. Although, for the last few decades, most of the biodiversity spots in the Block Panchayat limit, which is full of urban and sub-urban areas, have been used or destroyed for other purposes. The depletion of such biodiversity, which were the natural features of the region, turned in such a way that they led to many adverse ecological changes in the region. Some of the major environmental setbacks were the depletion of traditional water resources and the falling of groundwater tables in the region.

It was at a time when the continuous depletion of biodiversity was affecting the availability of essential natural resources, including water, in the region that the local people and the authorities began to think seriously about the conservation of local biodiversity (Haritha Keralam Mission, 2019).

Subsequently, they recognized the need for exclusive programmes aimed at the comprehensive conservation of such biodiversity centers, along with sustainable development models that ensure the balanced utilization of essential natural resources. It is in this context that the concept of 'Biodiversity Block' was adopted by the Kozhikode Block Panchayat and started to be implemented as a Block Panchayat scheme. The project, which aims to be the first Biodiversity Block in Kerala, is mainly a set of decentralized and sustainable programmes of Block Panchayat with local community participation. Block Panchayat has planned many appropriate programmes for the conservation of various natural resource systems such as wetland ecosystem, coastal ecosystem, agro-ecosystem, urban biodiversity, and floral and faunal biodiversity within the panchayat limits. Therefore, Block Panchayat has identified the major threats facing each of such ecosystems and tried to formulate remedial programs in a sustainable manner (Haritha Keralam Mission, 2019).

In this context too, Block Panchayat has planned to launch a unique eco-conservation scheme called Biodiversity Block. This sustainable model project for biodiversity conservation is being planned and implemented by the Kozhikode Block Panchayat in active collaboration with Malabar Botanical Garden and Haritha Keralam Mission. The action plan of the green project for realizing the Biodiversity Block was prepared on October 4, 2018, at a workshop organized by the Haritha Keralam Mission at Govt. Rest House, Thiruvananthapuram. Mr. Manoj Kumar (President of Kozhikode Block Panchayat), Dr N. S. Pradeep (senior scientist at Malabar Botanical Garden),

and G. Sankar (Architect at Habitat) made presentations on the project at the workshop presided over by T.N. Seema (Vice Chairperson of Haritha Keralam Mission). Subsequently, the Govt. of Kerala in its State Budget for the period 2018-2019, Rs. 3 crores have been allotted for the Biodiversity Block and Bio-park of Kozhikode Block Panchayat (Information & Public Relations Department, 2018).

Various programmes like the following were also planned at the workshop to make the Kozhikode Block Panchayat the first Biodiversity Block in Kerala.

- Construction of new water bodies and conservation of traditional water resources;
- Conservation of water ecosystems and mangroves;
- Construction of biodiversity gardens at schools, public places, and shores of water bodies;
- Production, collection, and distribution of traditional seeds;
- Scientific waste treatment measures;
- Creation of biodiversity awareness among the people and students.

Based on the aforementioned activities, the Biodiversity Block aims at sustainable and scientific conservation of the biodiversity of the area, including the water resource system. All such activities in the project are mainly carried out in association with the Malabar Botanical Garden & Institute for Plant Sciences (MBGIPS), a government science institution dedicated to the conservation and research on aquatic plants, which is one of the vital partners in the biodiversity conservation mission. MBGIPS is a well-maintained biodiversity center spread over an area of 45 acres covering a lot

of wetlands, hills, and valleys in Olavanna Panchayat. One of the major steps of the Biodiversity Block is the 10-acre lake built for the 15-acre Aquatic Bio-park located in the wetlands of this bio-garden. The entire construction of the Aquatic Bio-park in the garden, which has been funded by the State Government, is planned based on the design prepared by the Habitat Technology Group (Information & Public Relations Department, 2018).

The Plan of the Bio-park is prepared to conserve the water system and aquatic biodiversity of the area as well as to alleviate summer water shortage and drought in the surrounding regions. In addition, the lake in the bio-park helps to keep the groundwater level in the surrounding regions of the park high even in the non-monsoon period. Therefore, along with the conservation of aquatic biodiversity of the region, the Block Panchayat plans and implements all the biodiversity conservation activities based on them, such as studies, research, and tourism programmes, cantered on the vision and mission of MBGIPS. All such activities are carried out by dividing each watershed area under the Block Panchayat into different biodiversity clusters. The Biodiversity Block is implementing various activities for the conservation of freshwater resources in the region through the *'Oro Thulliyum Karuthalode'*, a freshwater conservation program of the *'Sundharam Susthiram Harithabam*', an eco-friendly development scheme of the Kozhikode Block Panchayat. Such water conservational measures of the project include the revival and preservation of deteriorated freshwater resources, conservation of traditional water resources, and construction of maximum freshwater bodies such as ponds and lakes in all available places (Haritha Keralam Mission, 2019).

Another program called *'Haritha Bhavanam'* was launched in the Block Panchayat limits as part of the Biodiversity Block for implementing extensive good recharging and rainwater harvesting to enhance the

groundwater table and ensure water availability in the area during the non-monsoon period. During the first phase of the *Haritha Bhavanam* scheme, well recharging was fully implemented in four selected wards included in the project area. At this phase, the scheme was able to complete the recharging of more than 300 wells in the water-scarce areas of the project. As a result, the groundwater table in these areas was found to be high during the following summer season. Therefore, such water conservational activities were extended to the rest of the areas in Block Panchayat.

The project measures towards the goal of having a new pool in each ward of the project area have also received great acclaim from the public. As a result, a large amount of local community participation in the construction of new ponds and the rejuvenation works of deteriorated ponds in the public places under the project became regular. Besides, several individuals declared their solidarity with such project activities and came forward to preserve existing ponds and build new ponds on their private lands. In this context, Block Panchayat has taken steps to extend such pond constructions throughout the project area by utilizing the service of workers in the MGNREG scheme. During the initial phase, 26 ponds, 9 streams, and 8 wells were constructed utilizing the workers of the MGNREG scheme alone (Haritha Keralam Mission, 2019).

'Jalayanam' is another eco-friendly development programme that combines river conservation and water tourism implemented in the region as part of the Biodiversity Block. Sri Kadakampally Surendran, then Minister for Tourism and Cooperation inaugurated this responsible tourism initiative under Kozhikode Block Panchayat on March 24, 2018. Block Panchayat has implemented this model of sustainable development by forming a chain of local tourism destinations interconnecting the riverbanks of Mampuzha, Chaliyar, Kadalundy river, and Canoly Canal. The network of water tourism

spots is made up of local initiatives formed based on watershed tourism development principles. Therefore, such water tourism programmes are designed in such a way that the river can be cleaned and natural flow can be maintained during recreational activities such as boating. Moreover, such local initiatives, which combine water conservation and recreation, can introduce the declining aquatic ecosystem of the region to the new generations and inculcate in them a sense of biodiversity conservation. Various recreation points on the Chaliyar and Kadalundy rivers, farm tourism in Mampuzha, and Island tourism in the Kadalundy river all operate with a sustainable vision and mission (The Hindu, 2018).

Most of the aforementioned water conservation programmes and measures under the Biodiversity Block project are being carried out using the plan funds of the Block Panchayat and the social and human resources of the local communities in the Block Panchayat limits. As part of the project, all wetlands, ponds, streams, and other traditional water sources within the Block Panchayat limits were identified, and formed many local community associations to protect them from being polluted and destroyed. Various local bodies under the Block Panchayat use their institutional resources to support and monitor such community involvement in biodiversity conservation efforts in a participatory manner. Such community vigilance cells are playing a vital role in combating many anti-environmental human interventions on biodiversity assets and bringing such encroachments to the law.

As part of the Biodiversity Block, several environmental campaigns have been undertaken to make the public aware of the rarity of the remaining biodiversity in the region and their ecological and social relevance. One of the most important of such biodiversity conservation campaigns was the *'Jaiva Sandhesa Yathra'* (Organic Campaign Walk), which was organized to create biodiversity awareness among the students. The campaign was led by the

teachers and local body representatives to introduce the students to the biodiversity of various rivers, ponds, streams, wetlands, and paddy fields located in the four watersheds of the region by a long walk. The event was organized by Block Panchayat and Haritha Keralam Mission to spread awareness among the households and natives by the students about the need to protect the biodiversity centers in the region (Haritha Keralam Mission, 2019).

Biodiversity Block is a prime example of the institutional capacity of LSG institutions to plan and implement such a sustainable and comprehensive project that conserves a complex ecosystem that consists of essential natural resources such as water. In addition to utilizing the institutional resources of the Block Panchayat to enable effective biodiversity conservation, the Biodiversity Block has been able to integrate other similarly targeted LSG initiatives within the project area. As an intermediate local body, the Kozhikode Block Panchayat has been able to obtain the appropriate services of the upper local bodies and lower local bodies for implementing the participatory conservation measures of interdependent biodiversity networks spread across different LSGs in the district.

6.1.5 Rejuvenation of Vanimel River

Vanimel is a large Village Panchayat with 35 Sq. Km area situated in Thooneri Block Panchayat of Vatakara Taluk. Vanimel Panchayat consists of 16 ward divisions with a total population of 25412 (LSGD, 2021). Vanimel village situates in the rural areas of the highland region in the Kozhikode District. Therefore, most of the people in the village depend on the agricultural sector for their livelihood. As per the Drought – Situation Assessment Report (2016) of the Kerala State Drought Monitoring Cell, the Vanimel Panchayat belongs to the category of the region with moderate drought. Vanimel River is one of the major sources of freshwater for the

people in the panchayat to meet their distinct water requirements, especially for agricultural requirements. The Vanimel River originates from the Vilangadu Hills of the Western Ghats sector lies in the eastern part of the Vanimel Panchayat and flows into various streams and creeks which later converge at Vanimel as the Vanimel River. Several local drinking water projects have been implemented along the river, including the 'Vishnumangalam Bund' built for irrigation purposes. In addition, the Vilangadu Hydropower Project also operates using water from the Vanimel River, a major tributary of the Mahe River (Suprabhaatham, 2018).

However, for the past several years, the river has been covered with wastes, formed by mounds and groves that have grown and stopped flowing during the non-monsoon period. Due to the rampant and unscientific sand mining, the natural sand bed at the river where the water was stored was lost and huge trenches were formed in many parts of the river. The depth and breadth of the river have been lost in many parts due to frequent encroachment on the riverbanks and the collapse of the river wall. Besides, the river has become severely polluted with the widespread dumping of solid and bio-wastes such as plastic wastes, slaughter wastes, and household wastes into the river (Suprabhaatham, 2018). At the same time, the river which dries up throughout the non-monsoon period overflows during the monsoon season and floods the surrounding areas regularly.

Such depleting conditions of the Vanimel River began to adversely affect the various river-dependent sectors in the riverine areas of the Vanimel Panchayat. It has adversely affected the freshwater availability of the residential sectors around the riverine areas. As the river remained dry throughout the non-monsoon, the water table in the surrounding areas of the river receded and all the household wells dried up quickly. Due to the scarcity of water in the river, the operations of various local drinking water schemes in

the Vanimel River also went out of tune. The operation of the Vilangadu Hydropower Project, which used river water, was also often stopped. Moreover, the deteriorated condition of the Vanimel River began to affect the social life of the Vanimel Panchayat itself, an agricultural village that depended on the water resource in the river.

It was in this context that the local people organized themselves to rejuvenate the Vanimel River and bring back the major freshwater resources of the panchayat. Following such community vigilance, the public pressure on the local authorities to take needful measures to restore the natural flow of the river by removing the mounds, groves, and wastes on the river bed and protecting the sidewalls of the river became severe. In June 2016, the Vanimel Panchayat launched community initiatives for river conservation by planting 2000 tree saplings along the river banks. But, the comprehensive institutional intervention of the local authorities was obstructed by the inadequacy of regional funds for the implementation of such river conservational measures. In this context, a social movement led by Vanimel Panchayat constituted many river conservation councils in the major riverine areas such as Vanimel, Puthukkayam, Kodiyoora, Vilangadu, and Mudikkal and began to mobilize adequate financial and infrastructure resources required for river conservation from the public by such community councils (Rajeevan, 2022).

This step of river conservation led by Vanimel Panchayat became an excellent model of participatory water conservation initiative in the district. In addition, the panchayat designed a community awareness programme called '*Puzhayorasabha'* (Riverbank Assembly) to organize the locals toward the river conservation movement. Subsequently, such riverbank assemblies have been conducted in riverine areas of Vilangadu, Vanimel, and Kodiyoora as part of the measures to restore the natural flow of the river and prevent harmful activities such as encroachments, sand mining, and waste dumping in the river. Along with local body representatives, many leading environmental

scientists and activists participated in such riverbank assemblies and inspired the local communities on a water conservation mission (Haritha Keralam Mission, 2020). Consequently, the panchayat was able to inculcate water conservation awareness among the local communities while making them part of the river rejuvenation mission.

The first phase of the Vanimel River rejuvenation led by Vanimel Panchayat was started in June 2019 using the funds and other resources arose from the public for river conservation. This river conservation programme, which was implemented under the Biodiversity Conservation Scheme (2018-2019) of Panchayat, mainly involved the work of removing the mounds, groves, and wastes on the riverbed that had obstructed the natural flow and course of the river with the participation of local communities. All the silt and soil removed from the reverbed was deposited along the side wall of the river like a mud bund and facilitates the flow of the river. The groves are overgrown amid the riverbed and also removed by this community mission. The accumulated bio-wastes and solid wastes are collected separately and disposed of safely (Manorama News, 2019).

To protect the mud bunds formed on the sides of the river from falling back into the river, their protection was included in the soil-water conservation program of the MGNREG Scheme and they were covered with coir geotextile for a length of one kilometre. The Panchayat has also planned a social forestry programme in association with the Bamboo Corporation as part of the river conservation. Thus, with the participation of workers in the MGNREG Scheme and local communities, bamboo and vetiver saplings were widely planted along the riverbanks to protect the river walls of more parts of the river from landslides. Thus, as a result of this remarkable river rejuvenation mission carried out by active vigilance and participation of local communities, the natural health, and beauty of the Vanimel River have been restored to a certain extent (Haritha Keralam Mission, 2020).

However, during the course of time, sand and silt accumulated again in many parts of the river, forming mounds, especially in the lower reaches of the Vishnumangalam Bund. Due to this, the depth of the river decreases, leading to changes in the natural course of the river and frequent landslides in many parts of the river. Besides, during the monsoon season, many riverine areas on both sides of the river are flooded. To solve such serious issues permanently, the Vanimel River rejuvenation has been included in the mega river conservation project formulated for the Mahe River. As a result, an amount of Rs. 2 crores 96 lakh has been sanctioned from the Disaster Relief Fund for removing silt and sand accumulated in the riverbed from *Paingholi thazha* to *Kadoli palam* in the Vanimel Panchayat limits. The work of deepening the river by removing silt and sand from the riverbed started from the lower reach of Vishnumangalam Bund in the river on October 2020 (Rajeevan, 2022, Mediaone News, 2020).

As a local government institution, the Vanimel Village Panchayat was able to create a sense of local responsibility among the natives for the environmental security of the Vanimel River by organizing the community programmes such as riverbank assembly and public fundraising included in the Vanimel River rejuvenation mission. The Vanimel Panchayat has also set a good example of converging closely with external institutions such as Bamboo Corporation and the MGNREG scheme for adopting their sustainable (water conservation) techniques such as social forestry, and mud bund and coir geotextile cover in its river rejuvenation programme. Therefore, the Vanimel River rejuvenation programme was a good example of how Village Panchayats can make use of local resources and features for water conservation initiatives that require continuous institutional intervention, such as river conservation.

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CHAPTER VII
FINDINGS AND CONCLUSIONS

Over the years, Kerala has adopted various institutional reforms on ideas and practices of its decentralized water conservation. Both national and local level experiences and developments significantly contributed to such reforms. Apart from meeting the freshwater requirements of people, environmental issues such as the sustainable restoration of the water eco-system and maintaining the ecological balance are evident in such reforms. Recently, as the provisions of the "New Institutionalism" perspective discussed in the theoretical framework of the present study, a decentralized water conservation method with a balance between "bottom-up and top-down" approach is being implemented in Kerala to adopt "a complex set of interacting institutional settings" in decentralized as well as integrated water conservation practices.

Generally, such experience of decentralized water conservation in Kerala reflects that it is easier to sensitize LSG institutions to the vital stake that exists among water resources within a watershed, whereas the provisions in the national and state level water policies and guidelines that focused on the institutional role of LSGs and participation of local communities in water conservation were found fitted with the Kerala context. Moreover, many SPVs also introduced in the state to facilitate the institutional fit of the "bottom-up and top-down" approach and community participation in water conservation within the framework of decentralized water conservation by LSG institutions. By analysing the various case studies on selected water conservation initiatives of LSG institutions in the Kozhikode District, the institutional fit and capacity of LSGs in decentralized water conservation are presented as follows;

1 As an institutional agency of effective community participation: The decentralized water conservation mission by LSGs opened an institutional platform both for planning authorities and local committees to work together on water conservation at the local level. The national and state-level water policies also emphasized the institutional stake of community participation in the framework of decentralized water conservation by LSG institutions which effectively fitted with the Kerala context. In addition to this, the Govt. of Kerala has introduced an SPV called Haritha Keralam Mission to facilitate the active participation of local communities and institutions in the water conservational initiatives of LSGs. Therefore, as per the case studies discussed in chapter 6, the LSGs in Kozhikode District were able to ensure high community participation in their various water conservational initiatives implemented in association with Haritha Keralam Mission.

The local communities participated well in such water conservational programs as they were implemented with priority given to addressing the local concerns and protests raised by the affected user communities regarding local issues such as water scarcity and water pollution. Meanwhile, many state-wide water conservational campaigns organized by LSGs are often limited to official stakeholders with nominal community participation. Therefore, as the theoretical observations discussed in the theoretical (behavioural) framework of the present study, the volume of community participation in water conservation efforts led by even LSGs often varies to contextual factors like the level of concern for local water resources, and incremental scarcity information and attitude on fragility.

2 As a convenient mechanism of multi- institutional convergence for local water conservation: Apart from the own institutions of LSG,

many Central and State Government Programmes such as IWDP, MNREGA, *Kudumbasree*, *Suchitwa Mission* also provide top priority for the conservation of local water resources. As a grass-route level institution, LSGs are the central point of such sectoral schemes. Therefore, the LSG institutions became institutionally able to appropriate the institutional resources and services of such schemes conveniently. Many water conservational drives conducted by LSGs in the district, especially the case study programs discussed in chapter 6 successfully utilized the institutional and financial resources of such centrally sponsored programs to address their water sector issues. The services of *Suchitwa Mission*, *Kudumbasree,* and MNREGS workers were the major component of many successful water conservation drives led by LSGs in the district.

Similarly, the institutional settings of the water conservation mission by LSGs are effectively utilized the interdepartmental expertise and resources which are required for its water conservational projects. The institutional expertise of the CWRDM, Krishi Bhavan, Water Authority, Health Department, etc. is widely used in the various scientific water conservational interventions in the district. The diverse institutional efficiency and contributions of local non-government institutions are also channelized into the success of such a decentralized water conservation mission. The appropriate use of the aforementioned institutional resources is very evident in the various water conservational interventions such as river/stream rejuvenation, cleaning of ponds/wells, construction of rainwater harvesting structures, and conservation of water bodies/wetlands in the district.

3 As a local statutory mechanism to implement sustainable measures of the state: The LSG institutions are the grass-route level statutory agencies for the implementation of many long-term and short-term

measures of sustainable water conservation in the state, because the urban and rural LSGs are constitutionally entrusted with such statutory roles in local water conservation. Therefore, the LSGs are the major statutory stakeholder in the regular water conservation measures carried out by Kozhikode District to reduce the drought impact in the region by maximizing the efficiency and sustainability of its preservation of water bodies, and rainwater harvesting, groundwater recharging, and other water saving techniques. As the discussions in chapter 5, such institutional measures are combined with traditional and modern water conservational techniques sustainably and effectively managed by the urban and rural LSG units wherever it is feasible in the district.

In line with such water conservational strategies, the LSG institutions implemented the legislative measures to ensure any rainwater harvesting structure in each building (houses and institutions) within their territorial limits, especially in the urban and sub-urban regions of the midland. Similarly, based on the topographic features of the land, each of the LSGs enabled to adopt the promotion and construction of other suitable water harvestings and groundwater recharging techniques such as percolation tanks, sub-surface dykes, contour trenching, gully plugging, community ponds, and check dams. Along with such sustainable and topographic-based water conservation techniques, the LSGs are widely initiated water pricing techniques also to ensure the regulation of irrational water consumption and intensifying water demand in the district. The statutory stakes of LSGs on local water conservation which are discussed in chapter 5 facilitate the institutional fit and capacity of LSG institutions in the selection and appropriation of user-based and topographic-based measures of continuous water conservation in a sustainable manner.

4 As an agency of local resource mobilization towards water conservation: It's a common experience that the institutional settings of LSGs are enjoying an institutional fit in mobilizing the user community and civil society resources for distinct water conservation drives at a low cost and sustainable manner. The national and state water policies also emphasized the responsible utilization of such local community resources in decentralized water conservation initiatives. The LSG institutions are widely appropriated all the available community resources to handle the diverse water conservation measures cost-effectively than any other institutions since they are having indigenous knowledge and first-hand information on the past and present of the local water resources.

Such resources and experiences of local civil society groups are being utilized responsibly in most of the LSG initiatives for water conservation in the district. Such mobilization of services and human resources of students, youths, resident's associations, and other volunteer groups were an integral part of many water conservational drives mentioned in chapters 5 and 6 in this study. Along with such community groups, the expertise and experience of local environmentalists, social activists, and resource persons are also appropriate in the various programmes for the conservation of deteriorating water bodies, especially in the awareness programs for water conservation.

Apart from these sorts of contributions, the LSGs often managed to mobilize the financial and infrastructural resources from the local communities for immediate water conservational interventions as the LSGs suffer a shortage of funds. The rejuvenation of the Vanimel River by the Vanimel Panchayat is a classic example of such responsible community fund raising. In Kozhikode District, it's a general experience that such community resource mobilizations in the water conservational measures resulted in a

sense of responsibility among the communities regarding the preservation of water resources. As mentioned in chapter 6, it is significantly evident in the up keeping of such conserved water bodies in the district. Therefore, the major water sector issues such as wastage of water and abuse of water bodies can be arrested quickly as now such water resources belong to the local communities than the authorities.

5 As a central point of watershed development programmes: Since the 1990's the Govt. Of Kerala enhanced the institutional role of LSGs in watershed development programmes. Especially, by the policy of Kerala which adopts micro watershed as the basic unit for the implementation of all watershed programmes the LSG institutions became the central point of such watershed-based development approach in the state. In addition, as an institutional intervention, the operations of panchayat level watershed committees resulting the consonance and co-action of *Grama Sabhas* in such watershed governance. Subsequent enactments and guidelines issued by the state accelerated more resource-based and user-based watershed initiatives at the grass-route level, especially in agriculture and allied sectors.

Since then, appropriating the institutional fit of LSGs; many unique watershed-based environmental programmes resulting in sustainable water conservation were taken place in Kozhikode District. For instance, the first Watershed Master Plan in the state was formulated by the Perambra Block Panchayat in the district. Besides, in 2012, the panchayat level water policy in Kerala was prepared by the Perumanna Panchayat in the district. Similarly, on-going projects like Biodiversity Block by Kozhikode Block Panchayat are exploring the institutional capacities of LSGs in water conservation by watershed-based programmes.

Although, the aforementioned institutional features and resources of LSGs have been facilitated for decentralized water conservation, in Kozhikode District it is often a complicated task with several unresolved institutional limitations, especially in the implementation of macro projects of comprehensive and integrated water conservation initiatives such as mega river conservation programme, wetland conservation scheme and water ecosystem development. Such factors resulting in institutional gaps or limitations have been experienced in decentralized water conservation initiatives of LSG institutions in the district are following;

The proliferation of LSG units: Due to the proliferation of LSGs, the territorial limits of LSGs in the district are not favourable to back up the macro initiatives for water conservation by LSG institutions, especially the conservation of flowing water bodies like rivers, canals, streams, etc., because, in a district like Kozhikode with a high density of population, the territorial area of most of the LSGs is very limited. Therefore, many water resource systems in the region, especially the rivers extend beyond the territorial jurisdiction of each LSG in the district. Here, the local initiatives for the conservation of such flowing water bodies across the territorial range of different LSGs are remaining incomplete or ignored due to the absence of integrated intervention of such local bodies which are running with uneven financial backup or sources. The institutional limitations or reluctance of district and block level panchayats to take over such responsibilities of water conservation needs to be integrated and continuous intervention intensifies the dilemma.

In addition, the political executives who lead the administration LSGs in politically sensitive districts like Kozhikode are usually from distinct political groups competing with each other. It is often subverting possibilities for institutional cooperation among such LSGs on the integrated initiatives for

the conservation of such water bodies draining across the territorial limits of different LSGs. Because such political heads of each LSG in the district may have their priorities regarding the freshwater sources to be conserved and the water conservation strategies to be adopted. Such differences in institutional priorities on water conservation often led to distinct perspectives and impacts in adjacent regions producing social unrest among the adversely affected local communities towards the water conservation mission itself.

Departmentalism: Distinct institutional priorities of the departments which are involved in the macro water conservation programmes is another institutional constraint met by decentralized water conservation efforts of LSGs. It is often resulting in the institutional limitations on LSGs to act or coordinate across such departments and along scales regarding the mega water conservation projects. In Kozhikode District, the lack of such institutional cooperation and operational complementarity among such departments having an institutional stake in the water eco-system is still constraining many sustainable water conservation efforts LSGs like conservation of rivers, groundwater, a network of wetland formations, etc. Over the years, most of the mega river conservation projects in the district such as the revival of the Kallayi River and deepening of Korapuzha are being undermined or delayed due to continuing inter-departmental disagreements or proceedings on river conservation measures, because the fulfilment of such mega initiatives led by LSGs is mainly based on the cross-sector cooperation and institutional fit among the various stakeholder departments which deal with the sectors like agriculture, land, water, forest, and the institutions providing fiscal, technological, and information assistance for water conservation.

Although Special Purpose Vehicles like Haritha Keralam Mission were introduced in this sector to enhance the efficiency of interdepartmental

coordination in decentralized water conservation initiatives, it was often limited to implementing various micro water conservation programmes by LSGs with local community participation. Therefore, such SPVs with a limited and fixed mandate can do nothing effectively on resolving the complications of such departmentalism in macro projects like the aforementioned river conservation efforts in the district which has been stuck on departmentalism and financial liabilities for several years. The Kallayi River rejuvenation project is one of the classic examples of such macro projects that have not been completed due to the absence of such departmental complementarity and coordination. It has been more than thirteen years since the implementation of a comprehensive river rejuvenation programme in the Kallayi River using the Rs. 7.5 crores was sanctioned by the Kozhikode Corporation, but the corporation has not yet been able to complete the river conservation due to disagreements and procedural complications between the LSG, Revenue, and Water Resource Departments. The major challenge facing the Corporation in completing the conservation of the Kallayi River was that the river rejuvenation activities including the evacuation of illegal occupations and constructions encroaching on the river were entangled in the distinct institutional interests and interventions of various government departments including the judiciary.

Similarly, the wetland conservation initiative of Mavoor Panchayat also remains incomplete due to such inter-departmental differences. Mavoor wetland is one of the largest wetland formations in the district, covering an area of above 300 acres. To conserve this deteriorating wetland, Mavoor Panchayat launched the procedures of declaring this wetland region as a Community Reserve. But this project has not been implemented due to institutional disagreement with the Forest Department for more than ten years since the project procedures were initiated by the Panchayat.

Community protests against innovative measures: Local community resistance against the scientific and innovative water conservation techniques that LSGs are trying to implement often undermines sustainable water conservation strategies like water recycling to resolve the immediate local water issues, especially in urban sectors. For example, the local protests against the Sewage Treatment Plant (STP) to recycle the wastewater often led by the unresolved local concerns of communities regarding the possible impact of such initiatives upon them. As such local concerns are not permanently allayed; even those who acknowledge the water conservation mission of LSGs become part of such protests and seem to thwart such innovative measures of LSG institutions for water conservation.

For instance, the STP Project of Kozhikode Corporation is one of the innovative water conservation initiatives in the district which has been hampered by such local protests. This is a project planned by the Kozhikode Corporation in the year 2015-2016 to resolve the water contamination issues regarding the urban water bodies by scientifically treating the urban sewage before it joins other freshwater sources in the region. This 116.5 crores project, which received administrative and technical approval in 2019, has a deadline of March 2023. Unfortunately, the Corporation has not yet been able to launch the project, which is crucial in the water conservation efforts of Kozhikode City, following local protests in the Vellayil region over the decision to set up the STP. At the same time, such local interests and environmental concerns of local people or even LSGs are often overlooked when implementing large-scale development projects planned at the national or state level.

Private property right on water resource system: Private ownership of water bodies and related eco-systems is another factor that constrains the LSG interventions for sustainable water conservation. In addition to illegal

occupations of flood plains, a large percentage of water bodies and related ecosystems in the district remain privately owned. Although most of such water resource systems on private land are being deteriorated or transmuted for other purposes, LSG interventions to conserve them are often not possible due to private property rights over them. Because in Kerala where the private land owners enjoy wide powers over the choice of land-use patterns such landholders' interests and actions do not always supplement the sustainable water conservation efforts of LSGs.

For instance, the Community Reserve Project of Mavoor Panchayat in the district to take over and protect 300 acres of degrading wetland in the Panchayat limit has been stuck for more than ten years due to strong opposition from the wetland owners. Similarly, a large number of local ponds, rivulets, *noonjis* (natural streams), paddy fields, and other wetland formations in the private land are remaining unpreserved and resulting in gradual transmutation of such water-sensitive areas for other purposes. Therefore, who enjoys property rights over land on which the water resource systems (rivers, lakes, paddy fields, wetlands, etc.) are to be conserved is crucial to decentralized water conservation efforts by LSG institutions.

The state-level relaxation in the Wetland Conservation Acts also intensifies the environmental impact of this institutional crisis. As per the report of the Directorate of Economics and Statistics (2021), 30.71 % (84,691 hectares) of total paddy fields in Kerala have been left fallow or perhaps converted for other purposes during the last fifteen years. Besides, the irrational extraction of groundwater in private land remains unregulated due to the institutional gap and jurisdictional limit in the LSG system. Because, as per the Indian Easement Act 1882, the groundwater still exists as private property, and the prevailing mandates of CGWB regarding groundwater regulation are not effectively internalized in the LSG system**.**

CHAPTER VIII
RECOMMENDATIONS

To overcome the aforementioned institutional deficiencies and forecasted issues of decentralized water conservation mission by LSGs in Kerala, the present study developed a framework of recommendations for future study and research.

1. This study suggests looking into the question of strengthening of the institutional stake of LSGs in the comprehensive and integrated initiatives for water conservation, especially the notion that statutory powers may help overcome the constraints of departmentalism in integrated water conservation measures by LSGs.

2. Examine the possibilities of enhancing the financial capacity of LSGs sufficiently to carry out the various water conservational measures entrusted to them with a focus on the argument that the financial back up of such local bodies must be adequate to take care of the comprehensive and macro initiatives, wherever it seems necessary or feasible for water conservation.

3. Consider the question of formulating a strong statutory framework of institutional stakeholders in the decentralized water conservation spelling out their powers and functions analysing the argument that the framework should be based on the emerging trends and issues in water conservation by LSGs.

4. Look into the chances of formulating river basin authorities to facilitate the conservation of major rivers on a comprehensive manner discussing the suggestion that the authorities must be constituted with all the line departments and LSGs in the region where the river drains

to facilitate the integration of their individual plans and resources on river basin. Similarly, the argument to equip the LSGs with proper statutory powers and sufficient infrastructures to regulate the groundwater extraction and to arrest the irrational pumping of groundwater need to be discussed in detail.

5. Analyse the prospects of maximizing the use of human and institutional resources with scientific and technological expertise in order to develop a strong institutional network to ensure the water ecosystem services such sustainability of water resources, conservation of aquatic biodiversity and maintaining of groundwater balance and ecosystem balance. Discuss the conclusion that the LSGs should conduct necessary capacity building programmes to internalize such resources of smart and sustainable water conservation.

6. Look into the possibilities of establishing a regular institutional mechanism to identify the water sensitive and drought prone areas at District or Block Panchayat level and to frame special package of water conservational measures to be implemented by LSGs understanding the proposal for identifying water sensitive areas must be given top priority in the water conservational intervention of LSGs concerned.

7. Consider the question of formulation of a local framework of preventive measures to arrest the pollution of water by the abuse of freshwater resources examining the conclusion that the establishment of STPs and other cost-effective water purification facilities, effective institutional control on the non-point sources of contamination and the institutional and community surveillance and monitoring on the use of water resources.

8. Examine the problems and prospects of ensuring zero-wastage of water during the distribution and consumption of water, adoption of water saving techniques such as water budgeting and water pricing, the LSGs need to install an institutional mechanism to ensure the regular maintenance of water distribution networks (by pipe and canal) to reduce the wastage of water by evaporation, precipitation, leakage, etc.

9. Conduct research on the question of creating new structures of sustainable water harvesting and groundwater recharging in the water sensitive regions and creation of natural and artificial structures of water harvesting and recharging, wherever it is feasible and possible under the LSGs. Also look into the proposal of water efficient methods of precision water management, virtual water assessment and water sustainable crop-pattern must be applied by the LSGs for their major water consumption sectors.

10. Analyse the suggestion to enhance the efficiency of water use by adopting scientific and innovative water consumption techniques available, develop a cognitive behavioural change among the public and officials towards the necessity of sustainable water conservation. Examine in detail the suggestion for incremental information on water conservation, virtual water literacy, scientific and sustainable techniques of water saving and sense of environmental responsibility must be inculcated among them by various formal and informal water conservational campaigns and awareness programmes of LSGs.

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