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Infrastructure Cost Escalation in Kerala: Structural Determinants and Policy Insights

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Infrastructure Cost Escalation in Kerala: Structural Determinants and Policy Insights

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Abstract

This study systematically analyses the factors contributing to elevated infrastructure costs in Kerala, examining the complex interplay of geographical, climatic, and socio-economic variables that result in higher construction and maintenance expenditures relative to the national average. The study employs a comparative analytical approach utilizing secondary data from authoritative sources, including the RBI Handbook of Statistics on Indian States, Economic Reviews, and state budget documents. Findings reveal that the state's unique topography, high population density, elevated labour costs, and stringent environmental constraints collectively escalate the overall cost of infrastructure development. The paper discusses the resultant fiscal implications and proposes concrete policy recommendations, such as enhanced intergovernmental transfers and targeted grant-in-aid mechanisms, to formally acknowledge and address the state's structural cost disadvantage and promote equitable development across the Indian federation.

Keywords: Fiscal Federalism, Infrastructure Costs, Structural Disadvantage, Intergovernmental Transfers, Cost Disparity

1. Introduction

Kerala, a southern Indian state, is internationally recognized for its lush environment, high literacy rates, and exceptional social development indices (Singh, 2011; Kannan, 2023). The state's distinctive geography—marked by coastal plains, the Western Ghats, and high population density—poses significant challenges for infrastructure development, particularly in transportation, energy, and urban sectors (Das & Ks, 2016; Pillai & Joseph, 2011; Bedi, 2019). Despite these constraints, Kerala has achieved remarkable progress in human development, consistently outperforming national averages in literacy, life expectancy, and infant mortality (Kannan & Hari, 2020; Sunny et al., 2020; Haseena, 2015).

Economically, Kerala has traditionally relied on agriculture and remittances from its diaspora, with remittances playing a crucial role in supporting household income, consumption, and investment in education and health (Kannan & Hari, 2020; Sunny et al., 2020; Zachariah et al., 2001; Jafar, 2023). Migration has contributed more to poverty alleviation and reduction in unemployment than any other factor, but has also led to increased dependence on external income sources (Zachariah et al., 2001; Zachariah, Mathew, & Rajan, 2001). The "Kerala Model" of development, characterized by high social development with relatively low economic growth, has been both lauded and critiqued for its sustainability and inclusivity (Kannan, 2023; Jafar, 2023; Savu & Dimitriu, 2012).

Kerala's rapid urbanization and infrastructure needs are further complicated by environmental concerns and the high cost of construction due to its terrain and demographic pressures (Das & Ks, 2016; Bedi, 2019; Prasanna & Vannadil, 2023). Large-scale projects, such as hydroelectric and solar energy initiatives, have

sometimes led to social and environmental injustices, particularly affecting marginalized communities (Bedi, 2019; Raj & Azeez, 2023). The state's development trajectory has also been shaped by robust welfare schemes and a strong sense of community, which have helped maintain high levels of public goods provision despite religious and caste diversity (Singh, 2011; Haseena, 2015).

So, the problem is, Kerala's achievements in human development and social welfare are significant, but the state continues to face formidable challenges in infrastructure development due to its unique geographical, demographic, and economic context. Addressing these disparities requires enhanced financial support, sustainable development practices, and inclusive policy frameworks (Kannan, 2023; Das & Ks, 2016; Prasanna & Vannadil, 2023).

2. Review of Literature

An efficient and comprehensive transportation infrastructure is critical to the development outcomes of high-income countries. Investments in transportation boost output, employment, and city/regional growth. A 1% increase in road accessibility corresponds to a 0.3-0.5% increase in establishments and employment in Britain (Gibbons et al, 2019). Duranton and Turner (2012) discovered that the number of roadways in a city contributes to the rise in city population in the United States between 1980 and 2000.

Similarly, Garcia-Lopez et al. (2015) observed that highways promote population growth at nearly the same rate in Spanish cities. Ali et al. (2015) apply a simulation-based technique to evaluate the differential development consequences of alternative road construction projects, focusing on a program funded by the New Partnership for Africa's Development. They discovered that

a 10% reduction in transportation costs boosts local GDP (wealth index) by 5.4% (2.3%). Ghani et al. (2016) investigate the impact of transportation infrastructure on the organization of manufacturing activity and conclude that the Golden Quadrilateral renovations resulted in a significant boost in manufacturing activity.

The largest boost in manufacturing activity was recorded in regions within 10 kilometres of the GQ highway, where output increased by 49 percent over the decade following construction. Gonzalez Navarro and Quintana Domeque (2016) conducted the first experimental estimate of the effects of publicly funded urban infrastructure on property values. According to the cost-benefit analysis, the valuation of street pavement as capitalized into property prices is almost equal to construction costs. Driving on residential streets in low-income communities boosts home values by 17% and land values by 72%. Nigeria's infrastructure planning and distribution have been beset with issues, including interference from politicians, money laundering, and inadequate financing. Flyvbjerg, B. (2021). Anyaogu (2020) found that road projects are often awarded based on political factors rather than genuine need, leading to disparities in infrastructure development across areas.

This literature provides a clear understanding that infrastructural development in a region has multi-fold benefits, including growth and development, sectoral development (such as manufacturing), effects on productivity and output, and land value. In this backdrop, the state of Kerala continues to face severe infrastructure development challenges due to its unique geographical, demographic, and economic environment, all of which must be addressed.

3. Objectives

- ✓ Systematically analyse and quantify the structural factors contributing to elevated infrastructure costs.
- ✓ Assess the fiscal impact of this cost disparity on state finances and capital expenditure capacity.
- ✓ Propose specific policy directions to facilitate a more efficient and equitable financing framework for Kerala's infrastructure projects.

4. Methodology and Data Sources

The study is grounded in secondary data analysis. Key data sources include, RBI Handbook of Statistics on Indian States, Reports of the various Finance Commissions and State-level Economic Reviews and Budget Documents. A comparative analytical approach is employed to examine variations in key infrastructure cost components—such as land acquisition, labour, and materials—across Indian states. The analysis is augmented by case-based evidence drawn from national highway construction projects to empirically illustrate Kerala's demonstrated cost disadvantage

5. Discussion

5.1 Comparative Analysis of Infrastructure Cost factors

A comparative analysis of infrastructure cost factors in Kerala reveals a stark disparity when contrasting with the national factors.

Table 1 - Infrastructure Cost Factors in Kerala

Factor	Impact on Cost
Topography	Increased costs due to challenging terrain
Population Density	Amplified infrastructure needs
Land Acquisition	High land prices
Labor Costs	Highest in India (Rs. 852)
Environmental Regulations	Eco-sensitive zones complicate projects
Natural Disasters	Need for disaster-resilient infrastructure

The construction of roads, a fundamental component of infrastructure, is significantly more expensive in Kerala. Similarly, the construction of bridges, an essential element of connectivity, also exhibits a marked cost differential. The elevated costs can be attributed to challenges posed by geographical conditions, the need for specialised engineering, and the procurement of high-quality materials. In the realm of building construction, Kerala also faces elevated costs. This discrepancy can be attributed to factors such as higher labour costs, the use of premium building materials, and stringent building codes to withstand Kerala's climatic conditions.

It is imperative to highlight that these are representative figures and variations may exist within different regions of the state and the country. Nevertheless, the overall trend indicates a consistent pattern of significantly higher infrastructure costs in Kerala compared to the national average.

5.2 Factors contributing to the cost differential

Kerala faces several challenges in infrastructure funding, leading to cost disadvantages. The prominent challenges include

topography, high population density, labour costs, environmental rules, restricted fiscal space, natural disasters, etc.

1. Topography

Kerala is a tiny strip of land (38,852 sq.km, 21st largest state in India by area) between the Arabian Sea and the Western Ghats. This tight strip presents major obstacles for large-scale infrastructure initiatives. Kerala's land structure can be categorised into three groups: high land (48%), mid land (42%), and low land (10%), with the high land proportion being larger (Envis Centre, Ministry of Environment & Forest, Govt. of India). This raises the price of building and maintenance cost. Kerala's unique geographical features significantly contribute to the elevated costs of infrastructure development. The state's undulating terrain, characterised by hills, valleys, and rivers, presents formidable challenges for construction activities.

A substantial portion of Kerala is covered by hilly terrain, necessitating extensive earthwork, tunnelling, and bridge construction. The construction of roads and railways in these areas is time-consuming and expensive due to the complex topography. The coastal regions, while offering economic opportunities, also pose infrastructure challenges. The risk of erosion, cyclones, and saltwater intrusion necessitates robust and resilient infrastructure, increasing construction costs. Kerala's extensive river network requires the construction of numerous bridges and culverts, adding to infrastructure expenses. The frequent occurrence of floods and landslides further exacerbates the situation. The state's susceptibility to landslides and other geo-hazards necessitates additional measures for slope stabilisation and disaster mitigation, increasing project costs. These topographical factors significantly impact the design, construction, and maintenance of infrastructure projects in Kerala, resulting in

higher overall costs compared to states with relatively flat terrains (Bedi, 2019; Chitra, 2019; Salini & Rahul, 2024; Salini et al., 2021; Sreelakshmi et al., 2024; Saikrishnan et al., 2023).

2. High Population Density

Kerala's high population density is another critical factor contributing to elevated infrastructure costs. The state's limited land area coupled with a large population exerts significant pressure on infrastructure resources. Purchasing land for infrastructure projects is challenging and costly in areas with a high population density (Table 2). The land cost in Kerala is relatively high because of high population density. Higher expenses and longer project schedules result from this. The scarcity of available land due to high population density drives up land acquisition costs for infrastructure projects. This is particularly evident in urban areas where land prices are exorbitant. Procuring right of way for roads, railways, and other infrastructure projects becomes complex and time-consuming due to the dense population. This leads to delays and cost escalations.

Table 2 - State-wise density of population

Sl.No	State/UT	Density
1	Bihar	1106
2	West Bengal	1028
3	Kerala	860
4	Uttar Pradesh	829
5	Haryana	573
6	Tamil Nadu	555
7	Punjab	551
8	Jharkhand	414
9	Assam	398
10	Goa	394
11	Maharashtra	365
12	Tripura	350
13	Karnataka	319
14	Andhra Pradesh	308
15	Gujarat	308
16	Odisha	270
17	Madhya Pradesh	236
18	Rajasthan	200
19	Chhattisgarh	189
20	Uttarakhand	189
21	Meghalaya	132
22	Jammu & Kashmir	124
23	Himachal Pradesh	123
24	Nagaland	119
25	Manipur	115
26	Sikkim	86
27	Mizoram	52
28	Arunachal Pradesh	17
	ALL INDIA	382

Source: RBI Handbook of Statistics on Indian States

The high population density results in congested roads, overburdened public transportation systems, and inadequate infrastructure facilities. Addressing these issues requires

substantial investments and ongoing maintenance. The concentration of population in specific areas increases the potential environmental impact of infrastructure projects. Mitigation measures and environmental clearances add to project costs. The high population density necessitates a robust social infrastructure, including schools, hospitals, and other public facilities, which further strains public resources. Consequently, Kerala's high population density amplifies the challenges of infrastructure development, leading to increased costs and reduced efficiency.

3. Labour Costs

Kerala's labour market dynamics significantly influence infrastructure costs. Higher labour costs in Kerala, driven by strong labour unions and better wages compared other Indian states (Table 3), contribute to the overall higher cost of infrastructure projects. The state average wage per day is more than twice compared to the national level average wage per day.

Table 3 - Wage rate (construction) (average)

Sl. No	State/Union Territory	Per day wage (2022-23)
1	Kerala	852.5
2	Jammu & Kashmir	534.5
3	Tamil Nadu	500.9
4	Himachal Pradesh	488.3
5	Andhra Pradesh	482.4
6	Haryana	461.0
7	Karnataka	431.0
8	Punjab	400.9
9	Rajasthan	393.7
10	Meghalaya	372.2

Sl. No	State/Union Territory	Per day wage (2022-23)
11	Maharashtra	371.0
12	Assam	368.9
13	Uttar Pradesh	352.8
14	Manipur	350.0
15	Bihar	342.8
16	West Bengal	340.6
17	Odisha	328.9
18	Gujarat	323.2
19	Tripura	286.1
20	Madhya Pradesh	278.7
	ALL INDIA	393.3

Source: RBI Handbook of Statistics on Indian States

Several factors contribute to higher labour costs in the state such as higher wage rates, skill shortages, labour unions, and productivity of the worker etc. Historically, Kerala has witnessed a higher standard of living compared to many other Indian states. This has led to relatively higher wage expectations in the labour market. Consequently, the cost of employing skilled and unskilled labour for infrastructure projects is correspondingly higher. While Kerala boasts a high literacy rate, the availability of skilled labour for specialised infrastructure projects might be limited. To bridge this gap, contractors often need to invest in training or recruit from outside the state, increasing labour costs.

A strong labour union presence and stringent labour regulations in Kerala can influence wage levels and project timelines. While these factors contribute to better worker welfare, they can also impact project costs. Factors such as climate, working conditions, and infrastructure availability can influence worker productivity. If these conditions are less favourable in Kerala, it might necessitate

employing more labour to achieve the same output, thereby increasing costs. The combined effect of these factors results in elevated labour costs for infrastructure projects in Kerala, contributing to the overall higher project expenses.

4. Environmental Rules

Kerala's abundant biodiversity and ecosystems are safeguarded by strict environmental restrictions. Kerala's geographic area is covered in forests to the tune of 54.70 percent (Table 4). Because of the significant environmental impact studies and mitigation actions required by these standards, expenses are increased. The report by Gadgil committee and Kasthurirangan committee reported about the fragility of land in Kerala. It results in non-availability of land for infrastructure development.

Table 4 - Forest cover

Sl. No	States/UT	Percentage of Geographical area have forest cover
1	Mizoram	84.53
2	Arunachal Pradesh	79.33
3	Meghalaya	76
4	Manipur	74.34
5	Nagaland	73.9
6	Tripura	73.64
7	Goa	60.62
8	Kerala	54.7
9	Sikkim	47.08
10	Uttarakhand	45.44
11	Chhattisgarh	41.21
12	Assam	36.09
13	Odisha	33.5

Sl. No	States/UT	Percentage of Geographical area have forest cover
14	Jharkhand	29.76
15	Himachal Pradesh	27.73
16	Madhya Pradesh	25.14
17	Tamil Nadu	20.31
18	Karnataka	20.19
19	West Bengal	18.96
20	Telangana	18.93
21	Andhra Pradesh	18.28
22	Maharashtra	16.51
23	Bihar	7.84
24	Gujarat	7.61
25	Uttar Pradesh	6.15
26	Rajasthan	4.87
27	Punjab	3.67
28	Haryana	3.63

Source: PIB Press release dtd 20.07.2023

Kerala's stringent environmental regulations, while essential for preserving the state's ecological balance, significantly impact infrastructure costs. The rigorous Environmental Impact Assessment (EIA) process required for infrastructure projects in Kerala is time-consuming and expensive. It often involves detailed studies, public consultations, and mitigation measures, which add to project timelines and costs. Kerala's extensive coastline is subject to stringent Coastal Regulation Zone (CRZ) regulations, limiting development options and increasing costs. Infrastructure projects in coastal areas often require additional approvals and safeguards, leading to higher expenses.

Kerala has significant forest cover, and obtaining clearances for infrastructure projects passing through forest areas is a complex

and time-consuming process, contributing to increased costs. Stricter waste management regulations in Kerala necessitate proper disposal and treatment of construction waste, adding to project expenses. While these regulations are crucial for environmental protection, they undoubtedly increase the cost of infrastructure development in Kerala compared to states with less stringent norms.

5. Restricted Fiscal Space

Kerala has a large expenditure commitment, especially in the social sector, and a restricted revenue base. This restricts the state's capacity to finance significant infrastructure projects without borrowing money from outside sources (Madakkara & Akhtar, 2023). Kerala's limited fiscal space significantly hampers its ability to invest in large-scale infrastructure projects. The state's revenue generation capacity is relatively lower compared to other states, primarily due to its agrarian economy and limited industrial base. This restricts the availability of funds for infrastructure development. Collectively all states and Union Territories have projected their debt-GSDP ratio to inch up to 27.6 per cent at the end of 2023-24. Kerala has a higher debt-to-GSDP ratio (36.9) compared to many other states, limiting its borrowing capacity (Table 5). This restricts the state's ability to finance large-scale infrastructure projects.

A significant portion of Kerala's budget is allocated to social sector schemes, such as education, health, and social welfare. While these are essential, they reduce the fiscal space available for infrastructure investment. Kerala's reliance on central grants for infrastructure funding is relatively higher compared to other states. Fluctuations in central grants can impact the state's ability to plan and execute infrastructure projects. These factors collectively limit Kerala's capacity to invest in infrastructure,

necessitating a higher dependence on external funding sources, including grant-in-aid.

Table 5 - Debt to GSDP Ratio

States	Debt to GSDP Ratio
Arunachal Pradesh	50.4
Punjab	47.6
Nagaland	44.3
Himachal Pradesh	44.2
Meghalaya	42.1
Manipur	39.5
Goa	38.3
West Bengal	38.3
Bihar	37.0
Kerala	36.9
Mizoram	36.2
Rajasthan	35.9

Source: RBI publication State Finance: A Study of Budgets

6. Natural Disasters

Kerala is vulnerable to landslides and floods, which can seriously destroy infrastructure and necessitate expensive reconstruction. Due to flood in 2018, the main sectors of the state had suffered a loss of Rs 25,050 crore (estimation by World bank & ADB) which causes huge financial distress. Kerala's vulnerability to natural disasters significantly contributes to elevated infrastructure costs. The state frequently experiences floods, landslides, coastal erosions, cyclones etc.

Kerala's geographical features, including heavy rainfall and extensive river networks, make it prone to floods. This

necessitates the construction of flood-resistant infrastructure, such as elevated roads, bridges, and buildings, which increases costs. The hilly terrain of Kerala makes it susceptible to landslides, particularly during the monsoon season. Infrastructure projects in these areas require additional safety measures and often need to be rebuilt after landslides. The state's long coastline is vulnerable to erosion, requiring coastal protection measures and the construction of resilient infrastructure. While less frequent compared to other coastal states, Kerala is not immune to cyclones, which can cause significant damage to infrastructure. The recurring impact of these natural disasters results in higher maintenance costs, frequent repairs, and the need for more robust infrastructure, ultimately leading to elevated overall costs. The major disasters are shown in Table 6.

Table 6 - Major natural disasters in Kerala

Year	Natural disaster
1924	Great flood of 1924
2001	Earthquake
2004	Tsunami
2010	Cyclone Laila
2017	Cyclone Ockhi
2018	Kerala Floods and Landslides
2019	Landslides in Wayanad
2020	Landslides in Idukki
2024	Landslides in Wayanad

Source: compiled from different websites

5.3 Project-Wise Cost Comparison: National Highway Construction as a Case

To illustrate the disparity in infrastructure costs between Kerala and other states, a comparative analysis of national highway

construction projects is presented. While a comprehensive, project-specific cost breakdown is beyond the scope of this input to memorandum, available data indicates a significant cost differential. For instance, the construction of a four-lane highway in a plain terrain state might cost approximately Rs. 30 crore per kilometre. However, constructing a similar highway in Kerala, often involving hilly terrains, landslides, and heavy rainfall, can escalate costs as much as more than 3 times the national average.

1. High Land Acquisition Costs: Purchasing land in Kerala is extremely expensive. This is partially caused by the state's dense population and land scarcity, which raises land costs. For example, as reported by the honourable union minister Shri. Nitin Gadkari, building a single kilometre of highway in Kerala costs about Rs 100 crore (words from Nitin Gadkari, Union Minister). Generally, the entire cost of execution of national highway projects is borne by the Centre. In some cases, State governments share part of some cost components of the projects. The precarious financial situation and the new norm mandating the State to bear 25% of the land acquisition cost for national highway development works have proved costly with the State being forced to pay the largest share of Rs.5,580 crore in the country in the past five years (PIB dtd 26.07.2023).
2. Labor Costs: The highest labour prices in Kerala are found in all of India. Compared to many other states, the daily pay for unskilled labour can be significantly greater, ranging from Rs 700 to Rs 900 (Refer Table 4).
3. Geographical and Environmental Challenges: The topography of the state, environmental regulations, non-availability of land etc imposed geographical hurdles for

infrastructure development in the state. This also attribute high construction and maintenance cost.

4. Material Costs: Kerala is not a producing state, rather it is one of the biggest consumer states in the country. Hence, the materials required for infrastructure has to be sourced from other states, that result in high material cost. Transportation costs is another factor which give rise to the material cost. Being a coastal state, the internal transport to remote or hilly areas can be costly.

Furthermore, the maintenance cost of highways in Kerala is also significantly higher due to the harsh climatic conditions and geographical challenges. Factors such as frequent landslides, soil erosion, and heavy rainfall necessitate frequent repairs and maintenance, adding to the overall expenditure.

These cost escalations are not isolated to highways but are representative of the broader infrastructure development scenario in Kerala. Buildings, bridges, and other infrastructure projects also face similar cost pressures due to the state's unique geographical and climatic conditions. A detailed cost comparison of similar national highway projects in Kerala and other states, considering factors such as unit cost per kilometre, time overrun, and cost overruns, would further substantiate the elevated infrastructure costs in Kerala. The high cost for infrastructure development in Kerala is compelling evidence for an enhanced grant-in-aid.

5.4 Impact of High Infrastructure Costs on Kerala's Development

The elevated costs of infrastructure development in Kerala have far-reaching implications for the state's overall progress. A direct consequence is the slower pace of infrastructure creation

compared to other states. The time taken to conceptualise, plan, and execute projects is significantly extended due to the higher financial outlay required. This delay in infrastructure development hampers economic growth by hindering industrialisation, trade, and tourism. Moreover, the high cost of infrastructure projects diverts scarce public resources away from other critical sectors such as education, healthcare, and social welfare. A disproportionate amount of the state's budget is consumed in building roads, bridges, and other infrastructure, leaving limited funds for essential social services. This can lead to imbalances in development, with infrastructure lagging behind human development indicators.

The high cost of infrastructure also impacts the affordability of housing, transportation, and other essential services for the people of Kerala. Increased infrastructure costs are often passed on to consumers in the form of higher prices, affecting the livelihood of the common people. This, in turn, can lead to social unrest and discontent. Furthermore, the higher cost of infrastructure development in Kerala makes the state less attractive for private investments. Investors often prefer locations with lower infrastructure costs, which can hinder job creation and industrial growth. This can exacerbate the issue of unemployment and out-migration, particularly among the youth. Hence, the elevated infrastructure costs in Kerala pose a significant challenge to the state's development trajectory. Addressing this issue through enhanced grant-in-aid is crucial to accelerate Kerala's progress and ensure its equitable development. Some of the implications of high infrastructure costs on Kerala's overall development is described below.

1. **Slower Pace of Infrastructure Development**

Kerala's elevated infrastructure costs have a direct and detrimental impact on the pace of its development. Unlike many other states, Kerala faces significant challenges in translating budgetary allocations into tangible infrastructure assets. The higher costs associated with land acquisition, labour, materials, and regulatory compliances result in a prolonged project cycle. As a consequence, Kerala's infrastructure development lags behind the national average. This slower pace of development is particularly evident in sectors such as transportation, where road and rail networks are crucial for economic growth. The increased time required to complete projects leads to delays in reaping the benefits of improved connectivity, hindering industrialisation, trade, and tourism.

Moreover, the slow pace of infrastructure development exacerbates existing bottlenecks, such as traffic congestion and inadequate public transportation. This, in turn, affects the quality of life for citizens, reduces productivity, and hampers the state's competitiveness.

2. **Reduced Allocation of Funds for Other Essential Sectors**

The exorbitant costs associated with infrastructure development in Kerala have a cascading effect on other crucial sectors. As a significant portion of the state's budget is diverted towards building roads, bridges, and other infrastructure, the allocation of funds for social sectors such as education, health, and social welfare is inevitably compromised. This reduced allocation can have severe consequences. Quality education, essential for human development and economic growth, may be compromised due to a shortage of funds for building new schools, hiring qualified teachers, and providing adequate infrastructure. Similarly, the healthcare sector may suffer from a lack of investment in

hospitals, equipment, and medical personnel, impacting public health outcomes. Moreover, reduced spending on social welfare programs can undermine the state's efforts to reduce poverty and inequality. Essential safety nets for vulnerable populations may be weakened, leading to social unrest and instability.

3. **Increased Financial Burden on the State Government**

The elevated costs associated with infrastructure development in Kerala have placed an immense financial burden on the state government. The disproportionately high expenditure on construction projects has constrained the state's fiscal space, limiting its ability to undertake other development initiatives. To fund the escalating infrastructure costs, the state government is compelled to either increase its revenue through new taxes or borrowings, both of which have their own set of challenges. Raising taxes can adversely impact the state's economy and erode public morale, while increased borrowings can lead to a debt trap and limit future fiscal flexibility.

The financial strain caused by high infrastructure costs also impacts the state's ability to service its debt obligations, meet its expenditure commitments, and provide essential public services. A significant portion of the state's budget is diverted towards infrastructure projects, leaving limited resources for other critical areas such as education, healthcare, and social welfare. This financial burden hampers Kerala's overall development and its capacity to achieve its development goals. To alleviate this pressure and ensure the state's fiscal sustainability, an enhanced grant-in-aid is imperative.

4. **Potential for Reduced Competitiveness and Investment**

The elevated infrastructure costs in Kerala pose a significant threat to the state's competitiveness and its ability to attract investments. High infrastructure costs translate into higher operational expenses for businesses, making the state less attractive for industrial and commercial establishments compared to other regions with lower costs. Investors are drawn to locations with efficient and affordable infrastructure. When infrastructure costs are exorbitant, it discourages new investments and hinders the expansion of existing businesses. This can lead to a vicious cycle, as a lack of investment further hampers infrastructure development.

Moreover, high infrastructure costs can distort the level playing field for businesses operating in Kerala. Compared to their counterparts in other states with lower infrastructure costs, Kerala-based businesses face a competitive disadvantage. This can erode the state's industrial base and lead to job losses. To overcome these challenges and enhance Kerala's competitiveness, it is imperative to reduce the cost of infrastructure development. An enhanced grant-in-aid can significantly contribute to achieving this goal.

5.5 How Enhanced Grant-in-Aid Can Alleviate Kerala's Financial Burden

The unique geographical, demographic, and economic conditions in Kerala necessitate a higher level of public infrastructure investment than in other states. The elevated costs of infrastructure development in Kerala have placed significant strain on the state's finances, impeding its overall development trajectory. An enhanced grant-in-aid is essential to bridge the infrastructure gap and ensure equitable development in Kerala. By providing additional financial resources, the central government can assist the state in overcoming the challenges posed by high

infrastructure costs. This support will enable Kerala to invest in critical infrastructure projects, create employment opportunities, and improve the overall quality of life for its citizens. Furthermore, an enhanced grant-in-aid will help Kerala to align its development goals with the national priorities of inclusive growth and infrastructure development. By investing in Kerala's infrastructure, the central government can contribute to the country's overall economic prosperity.

The rationale for an enhanced grant-in-aid is rooted in the exceptional circumstances Kerala faces in infrastructure development. The additional financial support will enable the state to overcome its challenges, accelerate growth, and contribute effectively to the nation's progress. By augmenting the state's resources, benefits such as reduced fiscal strain, accelerated infrastructure development, debt reduction, investment in human development, and enhanced competitiveness can be realized.

Additional financial support would help offset increased infrastructure project costs, alleviating pressure on the state's budget and preventing the diversion of funds from other essential sectors. With increased financial resources, Kerala can expedite infrastructure projects, reducing the time required to complete critical projects and improving connectivity and accessibility. The additional grant-in-aid can be utilized to reduce the state's debt burden, freeing up fiscal space for future investments and reducing interest payments. By easing the financial constraints on infrastructure development, the state can allocate more resources to social sectors such as education, health, and social welfare, thereby improving the overall quality of life for its citizens. An enhanced grant-in-aid can help Kerala create a more conducive business environment by reducing infrastructure costs and improving connectivity. This can attract investments, create jobs, and boost economic growth. In essence, an enhanced grant-in-aid

would provide Kerala with the necessary financial cushion to overcome the challenges posed by high infrastructure costs and accelerate its development trajectory. The main points are as follows:

1. Accelerate Infrastructure Development

An enhanced grant-in-aid to Kerala can serve as a catalyst for accelerated infrastructure development. The additional financial resources can be strategically allocated to address the state's unique infrastructural challenges. Kerala's geographical and climatic conditions necessitate greater investment in infrastructure than in other states. An increased grant-in-aid can help bridge this infrastructure gap by funding critical projects such as road expansion, bridge construction, and flood control measures. Improved connectivity is essential for economic growth and development. Enhanced grant-in-aid can be utilised to expand the road and rail network, improve airport infrastructure, and strengthen digital connectivity. This will facilitate the seamless movement of goods and people, thereby boosting trade and tourism.

Kerala's commitment to environmental sustainability can be further strengthened with additional financial resources. The grant-in-aid can be used to promote green infrastructure projects, such as renewable energy sources, public transportation systems, and waste management facilities. Kerala's growing urban population demands robust infrastructure. Enhanced grant-in-aid can support the development of affordable housing, efficient public transport systems, and improved water and sanitation facilities in urban areas. Kerala is prone to natural disasters, making it imperative to invest in resilient infrastructure. The additional funds can be used to strengthen disaster preparedness

and response capabilities, including early warning systems, evacuation shelters, and disaster-resistant infrastructure.

2. Improve Connectivity and Accessibility

Kerala's unique geographical terrain, characterised by hills, Western Ghats, and a vast coastline, poses significant challenges to infrastructure development. Constructing roads, railways, and other transportation networks is considerably more expensive compared to other states. The additional financial resources can be utilised to adopt innovative engineering solutions and advanced technologies to construct roads and bridges in challenging terrains. This will enhance connectivity between remote and hilly regions, improving accessibility to essential services like healthcare, education, and markets. Kerala's extensive coastline offers immense potential for economic growth through fisheries, tourism, and trade. However, the state faces infrastructure bottlenecks in port development, coastal road networks, and disaster management.

An efficient public transportation system is crucial for reducing traffic congestion, improving air quality, and ensuring equitable mobility. Enhanced grant-in-aid can be invested in expanding metro rail networks, strengthening bus services, and developing water transport options. This will provide affordable and reliable transportation choices for the public, reducing reliance on private vehicles. In today's digital age, connectivity is essential for economic development, education, and healthcare. An enhanced grant-in-aid can be used to expand broadband internet access, especially in rural and remote areas. This will bridge the digital divide and create opportunities for online businesses, education, and telemedicine. By investing in improved connectivity and accessibility, Kerala can unlock its economic potential, reduce

regional disparities, and enhance the overall quality of life for its citizens.

3. Create Employment Opportunities

Infrastructure development is a significant driver of employment generation. Kerala's elevated infrastructure costs have limited the state's ability to invest in large-scale projects, resulting in a relatively lower potential for employment generation compared to other states. Increased funding for infrastructure projects will lead to a surge in demand for skilled and unskilled labour. This will create employment opportunities across sectors such as construction, engineering, transportation, and allied industries. Infrastructure development often fosters the growth of SMEs that cater to the project's needs. An enhanced grant-in-aid can encourage the establishment of local businesses, thereby creating employment opportunities and boosting the local economy.

Investing in infrastructure often requires developing a skilled workforce. The additional funds can be utilised to enhance vocational training and skill development programs, thereby equipping the youth with the necessary skills to participate in the growing job market. Kerala has witnessed significant out-migration due to limited employment opportunities. By creating jobs through infrastructure development, the state can retain its talented human capital and prevent skilled workers from leaving. An enhanced grant-in-aid can play a crucial role in addressing Kerala's unemployment challenges by stimulating job creation, supporting SMEs, developing human capital, and reducing out-migration.

4. Enhance the State's Economic Competitiveness

Kerala's elevated infrastructure costs pose a significant challenge to the state's economic competitiveness. Adequate infrastructure is essential for attracting investments and businesses. By providing additional financial resources, the state can invest in world-class infrastructure, such as industrial parks, transportation networks, and digital connectivity. This will create a conducive business environment that encourages domestic and foreign investment. Efficient infrastructure is vital for smooth trade and commerce. An enhanced grant-in-aid can be used to develop modern ports, airports, and logistics facilities, thereby reducing transportation costs and improving the state's export competitiveness.

6. Policy Implications

Determining the exact financial burden on Kerala due to elevated infrastructure costs is a complex task. However, a preliminary estimation can be derived from available data. A comparison of infrastructure expenditure, as measured by capex, between Kerala and other states revealed insights into the disproportionate financial burden borne by Kerala. Because a major portion of the state's funds is allocated to social sector schemes, such as education, health, and social welfare. While these are essential, they reduce the fiscal space available for infrastructure investment.

Given the financial burden from elevated infrastructure costs, the 16th Finance Commission taken into consideration the following from Kerala's perspective.

- Given the increased strain of population density and difficult topography, including hilly areas or narrow land strips, these areas should be given additional funding because these factors raise the land acquisition cost, the costs of building and maintaining infrastructure. As per the 15th Finance Commission tax share determination,

'area' was given 15% weightage. We propose that the 16th Finance Commission consider reworking the weightage and allot 10% for 'area' and 5% for 'population density.

- The state had been contributing significantly to maintaining the region's green cover. Kerala's abundant biodiversity and ecosystems are safeguarded by strict environmental restrictions. This results in an infrastructure deficiency. Moreover, deforestation may significantly reduce the state's non-tax revenue, as revenue from the forestry sector was reported at Rs 289 crore in 2022-23 (Economic Review, 2023).

There is a need of grant-in- aid as well to makeup the costs incurred by Kerala due to higher road construction, land acquisition, and other material costs compared to the national average.

To calculate the total additional cost, we use the following formula:

- Construction cost:

Total Additional Construction Cost = (Kerala's Cost per km − National Average Cost per km) × Total Kilometres Planned

- Land Acquisition Costs:

Total Additional Land Acquisition Cost = (Kerala's Cost per acre− National Average Cost per acre) × Total Acres Needed

- Labor and Material Costs:

Total Additional Labor and Material Costs = (Kerala's Labor and Material Costs per km − National Average Labor and Material Costs per km) × Total Kilometres Planned

Hence, as illustrated above, the national average cost of constructing 1 km of highway is 30 Cr, whereas in Kerala it is 100 Cr. There is a mammoth difference of 70 Cr in the construction of 1 km of national highway. As of July 2023, the National Highways Authority of India (NHAI) has built around 160 kilometers of national highway in Kerala over the past five years.

Nevertheless, we have illustrated and explained the infrastructure development of road connections, noting the additional costs incurred by Kerala due to higher road construction, land acquisition, and other material costs compared to the national average. As part of infrastructure development, it includes rail connectivity, bridge and tunnel construction, etc., which may also affect costs; therefore, an enhanced grant-in-aid is crucial to address the state's infrastructure challenges and ensure equitable development.

In addition, a weighted funding model can be a more equitable and efficient way to allocate central infrastructure funding across states. This model should take into account various factors such as Land acquisition costs, Population density, Geographical challenges, and existing infrastructure deficiency.

7. Conclusion

Kerala's elevated infrastructure costs pose a significant structural challenge with profound and persistent fiscal implications. The state's unique combination of topographical complexity, population density, and environmental sensitivity means it must invest more to achieve infrastructure outcomes comparable to

those of other states. This study emphatically underscores the need for differentiated fiscal treatment and enhanced central financial support to uphold the principle of equity in infrastructure development. The formal incorporation of verified cost differentials into intergovernmental fiscal transfer mechanisms is essential for strengthening the principles of balanced regional development and cooperative fiscal federalism in India.

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