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Analysis of the external benefit (Cost) of electric vehicles as an adaptation strategy for climate change

Teena Mariya Saju, Therese Thomas, Fathima Rinsha PM, Lekshmi S and Muraleedharan S

Abstract

This paper studies the external benefit -initial cost ratio of electric and fuel vehicles, pointing out the necessity of transitioning to electric vehicles (EVs) as an adaptation strategy due to global greenhouse gas (GHG) emissions from fossil fuels. With India's GHG emissions growing faster than the global average, the study tries to identify the environmental and economic implications of vehicle choices. The research employs a benefit-cost ratio framework based on the external benefit-cost dimension to achieve the objective. The comparative analysis evaluates the carbon emissions and savings, operational costs, and environmental impact of EVs versus internal combustion engine (ICE) vehicles based on the TATA Tiago XT (EV) and Tiago XTA (petrol) models. Along with this, data from surveys and thematic reviews are used to assess consumer preferences and the barriers to EV adoption. The study found that there is a statistically significant association between gender and average fuel cost, with a p-value 0.007398845. The findings underscore long-run and short-run dynamics of environmental and economic impacts of electric and fuel vehicles. The study argues that EV is a better option for traffic jam of the urban areas in Kerala.

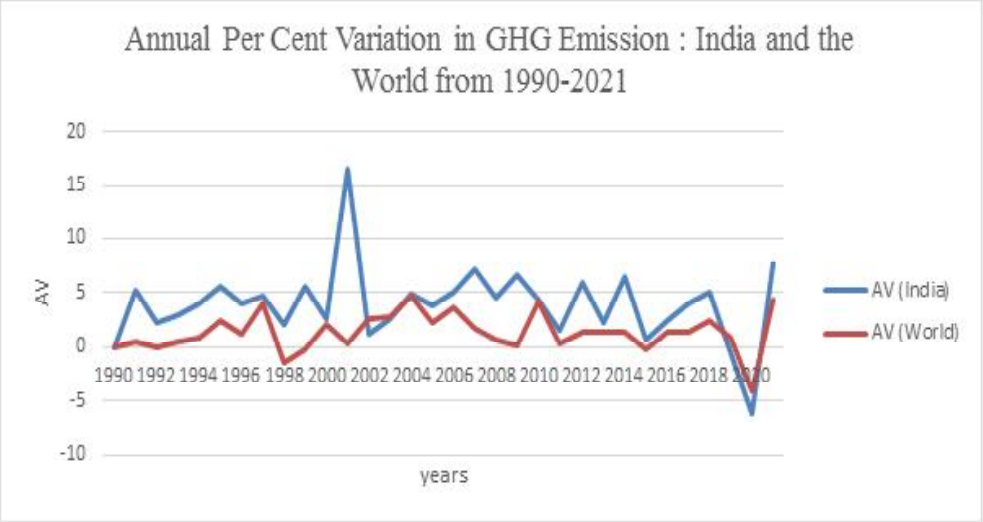
Keywords: *Electric Vehicle, Carbon Emission & Saving, Consumer Preference and Economic & Environmental Impacts*

1. Introduction

The history of motor vehicles dates to the 1800s. In the 1830s, immediately after the development of the first electrical machines, the first electric cars were built. The world faced major environmental and health problems from the horse manure because all vehicles at that time were horse-drawn. The methane gas released from the horse manure had four times the greenhouse gas effect of carbon dioxide. In this context, the real need for the first engine-based transportation emerged. Two major vehicle options of that time were steam and electrical vehicle. Among these, people preferred electric cars because they didn't smell and had no noise or vibration like steam cars. Most importantly, they were easier to operate and had a simple gear system. During this period, advancements happened in the field of internal combustion engines (ICE). The first gasoline- fuelled engine was built in 1876 in Germany. During this period, advancements happened in the field of internal combustion engines (ICE). The first gasoline- fuelled engine was built in 1876 in Germany. Carl Benz began the first commercial production of motor vehicles. Meanwhile, the electric car production peaked in 1912. However, in the later years, electric cars began to lose their share of the vehicle market. It was mainly due to the developments of ICE cars, along with the Texas crude oil boom, which led to tremendous economic change and the growth in the USA. Due to the sharp fall in gasoline prices, ICE cars were cheaper to own and maintain for the average consumer. But during the 1960s and 1970s, the petrol prices permanently increased. The most serious shock to the oil market occurred in 1973 when OPEC declared the global oil restriction. In addition, the ICE-related air pollution also began to draw attention. The 1990s saw the reemergence of electric vehicles. The electrical transportation is the way to a sustainable future for humanity (Szabo and Lulia, 2022). Globally, India ranks among the top 10 automotive markets (Sreenath, 2022). As of 2023, there are 2.27Cr vehicles registered in India. Among these, 1.8Cr are petrol vehicles, around 24 lakh are diesel vehicles, and around 14 lakh are electric vehicles. The number of electric vehicles is increasing year by year; along with this, the number of petrol vehicles is also increasing. In the year 2022, the number of petrol vehicles was 1.7 Cr (PIB, 2024). So, there is an increase of 2,39,468 vehicles in 2023. The registered electric vehicles also showed an increase of 4,08, 427 in 2023. From this, it is understood that people are realizing the need for the electric vehicles. Even though there is an increase in the registered electric vehicles in India, many people are reluctant to buy electric vehicles due to various reasons. It is important to know why people choose fuel vehicles over electric vehicles.

Before examining the reasons for such behaviour, it is apposite to check the historical GHG emissions from India relative to the world, whereas the discussion of EVs has become significant in the country. The Annual Variation (AV) in Historical GHG Emission in the world and India is shown in Figure 1.

Figure 1:



Source: computed based on Climate Watch, 2024

Figure 1 represents the annual percentage variation in ghg (Greenhouse gas) emissions of India and the world from 1990 to 2021. Annual variation of India's historical emission was high in 2001 with 16.55%, and the annual variation of world ghg emission was high in 2007 (7.09 %). Both India and the world showed a diminution (-6.19 and -4.11, respectively) in the historical emission during the covid time (2020). The average historical emission of India and the world is 2146.71 MtCO2e1 and 39459.12 MtCO2e, respectively, between 1990 and 2021. The coefficient of variation is higher for India, with a fluctuation of 37.92%. The decadal average of ghg emission of both India and the world stood at 3053.26 and 45793.66 MtCO2e respectively, during the previous decade, and it has been the highest mean value since 1990 (Table- 1).

Table 1 - India's Share in Global GHG Emission

Year	India	World	Share (%)
1990	1025.63	31552.5	3.25
1995	1246.36	32870.6	3.79
2000	1500.33	34713.74	4.32
2005	1973.75	39321.04	5.02
2010	2582.36	43486.55	5.94
2015	3043.88	45335.3	6.71
2020	3176.03	46109.75	6.89

Source: computed based on Climate Watch, 2024

Table 1 highlights the share of India in global ghg emission in the selected years. India's share is higher in 2020 with 6.89 percent compared to 3.25 percent in 1990.

The growth rate of ghg emission in India was high during 1990-2007. It was partly due to the low base effect. In short, both cases of growth rates came down after 2008 but, India's emission rate continued to be higher than that of the world. The significant difference is verified with the t-test as shown in (Table 2).

Table 2 - Results of t-test for growth rate of GHG Emission in India and World

YEAR	INDIA (GR %)
1990-2007	4.57
2008-2021	2.89
	t = 4.4469 d.f = 30 p-value=0.0001105

YEAR	WORLD (GR %)
1990-2007	1.58
2008-2021	1.06
	t = 2.306 d.f = 30 p value = 0.0282

Source: Computed based on climate watch

This paper attempts to fix the external benefit/external cost analysis of electric and fuel vehicles and tries to raise awareness regarding the global greenhouse gas emissions from fossil fuels and the urgent need for the adoption of electric vehicles. The main objective of the paper is to compare electric vehicles to fuel vehicles. External benefit/ cost ratio which is a measure of cost-benefit analysis is used for this purpose.

The paper is divided into five sections. The first section deals with the introduction, review of literature, conceptual framework, objectives and method study. The second section deals with the data analysis and its interpretation. In the next section average annual carbon emission from a typical passenger car is calculated for selected kilometres and gives a brief overview of noise pollution from EVs and ICEs. The concerned section also gives a general overview regarding the estimation of expenses of both electric and fuel vehicles. Further, the external benefit/external cost ratio and fuel vehicle are calculated to compare electric vehicles to fuel vehicles. The Final part evaluates the data collected through Google Form among the electric and fuel vehicle users and connects it with the themes of the review of literature. The paper is concluded by explaining the results obtained from the study. Review of literature is arranged in six themes which are presented in the ensuing section.

Electric vehicle as an adaptation strategy in the context of climate change

Climate change, defined as long-term shifts in temperature and weather patterns, has both natural and anthropogenic drivers (UN, 2024). Houghton and Woodwell (1989) emphasized that human-induced emissions of greenhouse gases (GHGs) such as carbon dioxide (CO?) and methane (CH?) are significantly altering Earth's climate. Their review underscored the urgent need for mitigation measures to address the escalating environmental damages, such as GHG emissions, disrupting the ecosystem. Adedeji et al. (2014) further elaborated on the implications of GHG emissions, projecting an average temperature increase of 0.2°C per decade, potentially reaching 2°C above pre-industrial levels by 2050. They highlighted the disproportionate contribution of developed nations to global CO? emissions and emphasized that addressing climate change is crucial for achieving global developmental goals. They suggested the adoption of electric vehicles to face the challenges related to climate change. Alanazi (2023) explored the benefits and challenges of EVs, emphasizing their potential to reduce GHG emissions and fossil fuel dependency. The study projected a significant increase in EV users by 2030, highlighting the efficiency of EVs compared to internal combustion engine vehicles (ICEVs) and their role in creating sustainable urban environments.

Hawkins, Gausen, and Stromman (2012) investigated the environmental implications of EVs through lifecycle assessments (LCA). Their study revealed that while EVs offer significant potential for reducing transportation-related emissions, their benefits depend on cleaner electricity generation and improved battery recycling practices. The study by Choma and Ugaya (2017) also emphasized that the reliance on thermal electricity can undermine the advantages of electric vehicles. They focused on the Brazilian context, analysing the performance of battery electric vehicles (BEVs) against ICEVs (Internal combustion engine vehicles). The study revealed that BEVs perform better in categories like global warming potential and ozone layer depletion but noted that reliance on thermal electricity generation can undermine these advantages. In the Indian context, Palaniswamy et al. (2022) explored the social, economic, and environmental impacts of EVs. The research emphasized the potential of EVs to enhance urban mobility and reduce air pollution.

According to an official website of the United States government (EPA.gov), the average gasoline car on the road drives around 11,500 miles per year. That is, 18507.46km per annum. Sun et al. (2017) analysed the feasibility of EV adoption in Beijing, China, emphasizing the importance of policies, charging infrastructure, and technical support. The study revealed that policies like "No traffic restrictions for EVs", the availability of charging stations, and technical support are critical in shaping user perceptions and satisfaction. Langbroek et al. (2018) examined how EV adoption influences travel patterns, noting that range limitations can lead to increased reliance on public transport or changes in trip purposes, such as cancellations of shopping trips.

Additionally, Hwang et al. (2021) provided insights into the adoption of fuel cell electric vehicles (FCEVs) in South Korea, identifying pathways such as increased hydrogen stations and government subsidies.

Policy assistance and infrastructure requirements for EVs

Fazeli et al. (2017) developed a framework to evaluate fiscal policies for EV adoption in Iceland, comparing five incentive scenarios using multi-criteria decision analysis. Their findings identified the "feebate + tax" model as the most effective policy for reducing GHG emissions and promoting EV adoption. The authors Choma and Ugaya (2017) emphasized the importance of integrating public policies to address the environmental drawbacks of EVs. Further, Hwang et al. (2021) provided the perception that government subsidies act as a pathway for the adoption of fuel cell electric vehicles (FCEVs) in South Korea. Later, Singh et al. (2021) analysed EV trends in India highlighting government initiatives such as the Automotive Mission Plan (AMP) and National Electric Mobility Mission Plan (NEMMP). Along with this a strength weakness opportunity and challenge (SWOC) analysis is performed and found that high cost, battery concerns, and lack of access to recharging stations are the limitations that affect the adoption of EVs.

Das and Bhat (2022) explored the global and Indian EV policy landscape focusing on the relevance of initiatives like FAME 1(Faster Adoption and Manufacturing of Electric Vehicles), FAME 2, and the vehicle scrappage policy. They highlighted the challenges of lithium-ion battery disposal and reprocessing, emphasizing the need for sustainable solutions to support EV adoption in India. Palaniswamy et al. (2022) also emphasized the ambitious targets of the Government of India in the adoption of EVs. More, Alanazi (2023) noted the rapid growth of EV markets in Europe, the United States, and China, where policy initiatives aim to achieve substantial market penetration Delacrétaz et al. (2021) demonstrated the significance of infrastructure development in influencing consumer behaviour and accelerating EV adoption. Another study conducted by Hwang et al. (2021) identified increased hydrogen stations as a pathway for the adoption of EVs. Additionally, Palaniswamy et al. (2022) highlighted challenges such as battery manufacturing impacts and inadequate charging infrastructure in popularizing EVs.

EVs and noise annoyance

A study by Salleh et al. (2013) observed a difference of 20 dB (Decibel) between the noise of EV and ICE when the vehicle is in an idle state or at low-speed running and this difference decreases as the speed of the vehicle increases. In addition to this as the EV accelerates to 30-40 km/h, tire and wind friction become leading noise sources, making the vehicle more obvious to road users and bringing its noise level closer to that of ICE vehicles. The study suggests that at slow speeds, EVs remain much quieter than ICE vehicles.

Similar results were obtained by Iversen in 2015 who also suggested that EVs can contribute to quieter urban environments at low speeds. They used Citroën Berlingo and Nissan Leaf (both are EVs) and Citroën Berlingo and VW Golf Variant (both are diesel) for the comparison and vehicles were tested at various steady speeds, as well as during acceleration and deceleration. When Citroën Berlingo (EV vs. ICE) were tested under the steady speed measurements, Berlingo EV was 5 dB quieter than Berlingo ICE at 10 km/h and as the number of km increased to 20 and 30 km/h, the noise difference decreased to 1.5 dB and there was no significant difference in the latter. Under the various steady speed Nissan Leaf and VW Golf were also tested and it was found that at 20 km/h Leaf was 4 dB softer than Golf and the noise level difference reduced to 1.5 dB at 60 km/h. when deceleration (engine braking) is considered EVs were quieter (2-3 dB) than the ICE vehicles. The study concluded EVs have the probable to reduce noise levels at constant speeds below 20 km/h but the noise level difference descent at higher speeds. Also, the differences between these vehicles weakened as tyre or road noise became the dominant sound source.

The study by Schweizer et al. (2023) goes in line with the mentioned researche. The study examined the noise levels of seven EVs and seven ICEs in Switzerland using three measurements, such as constant speed, acceleration, and stop-and-go and concluded that EVs can significantly reduce noise, especially during acceleration and stop-and-go circumstances. At constant speed (on the low noise road surface) EVs were only somewhat softer than ICE vehicles with a slight difference of -0.2 dB in maximum noise levels. EVs showed a substantial noise reduction, averaging -5.2 dB compared to ICE vehicles when acceleration is considered and EVs were quieter by an average of -3.4 dB under stop-and-go conditions. The study further observed that tyre/road noise is a significant contributor to overall noise, particularly at constant speeds.

Further, Berge, Evensen and Olsen (2024) observed both M1 (passenger cars) and N1 (light commercial vehicles) classes under both urban and highway conditions and found out that there are no significant differences in maximum noise levels between the three engine types (EV, petrol, and diesel). As the above studies mentioned this study also supported that tyre/road noise is the leading source of road traffic noise, mostly at speeds above 30 km/h and there is no significant difference between the noise level of EVs and ICE at this point so a changeover from ICE to EV will not produce noise benefits.

The ensuing section presents the method of the study.

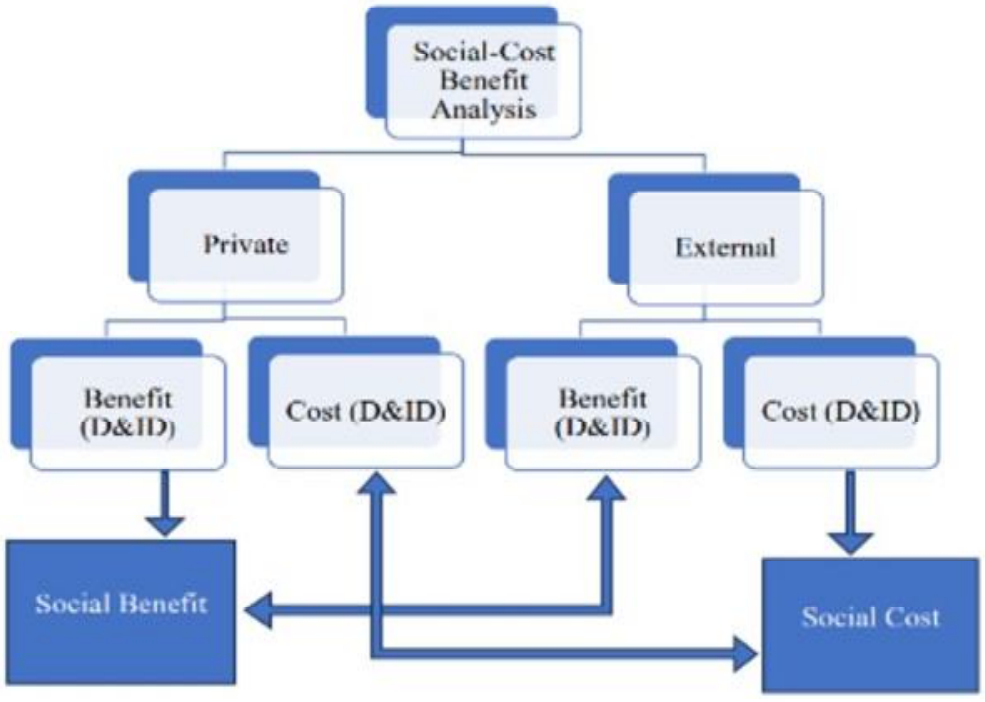
II. Method of study

This study attempts to compare electric vehicles to fuel vehicles. The study uses the external benefit/cost ratio, which is a measure of cost-benefit analysis to check which vehicle is viable. Both primary and secondary data were used in this study. For calculating average carbon emission from a typical passenger car, the authors relied

on secondary data sources. For the estimation of expenses of both fuel and electric vehicles, details were procured from the TATA showroom in Angamaly. Primary data is collected via a Google Form (mainly focused on Ernakulam and Thrissur districts) to know the behaviour of people regarding both vehicles. T-test were used in the introduction part of the study. Benefit-cost ratio is an important measure in cost-benefit analysis. Studies which specifically examine the benefit-cost ratio of electric and fuel vehicles within the same car brand and model are limited in Kerala. Therefore, this study aims to address this gap by comparing the benefit-cost ratio of electric and fuel vehicles of the same brand and model. Also, the study initially endeavoured a social cost-benefit analysis of both electric and fuel vehicles. However, External benefit (cost) analysis is conducted using the external benefit initial cost ratio (benefit-cost ratio) due to the unavailability of private benefit data. The conceptual framework of the study is given in the following section.

III. Conceptual framework

Fig: 2



Source: Musgrave and Musgrave (1989), Malmgren (2016), Laver and Parsha (2021), Schriver Christensen and Ernst Christensen (2021) and Vardakoulias, 2023

***D - Direct cost and ID - Indirect cost**

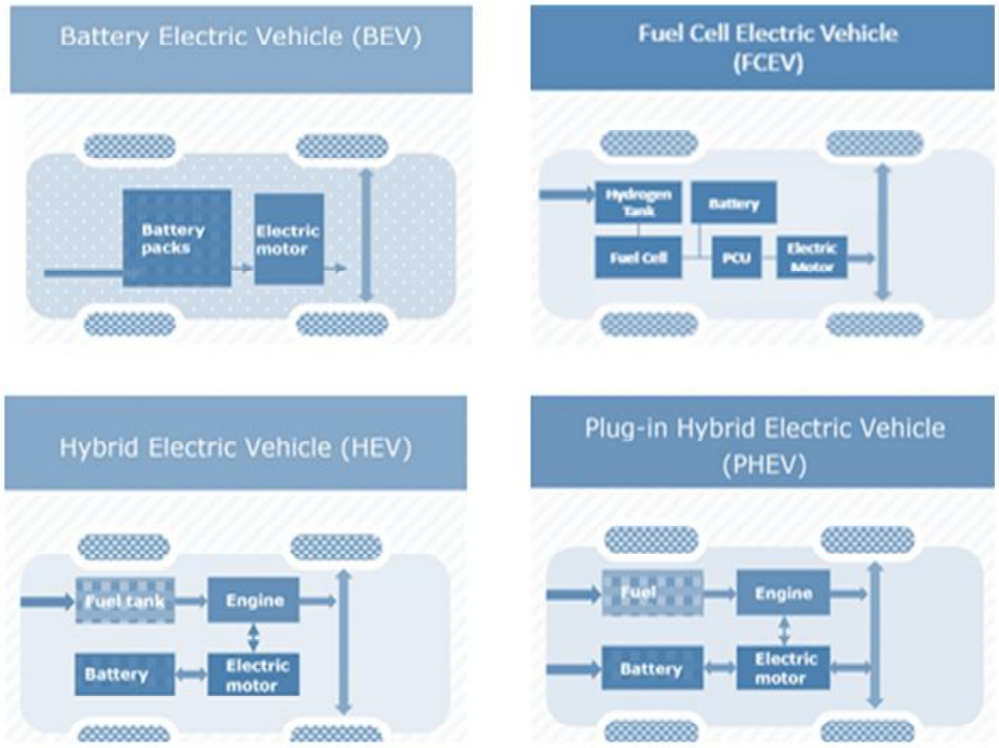
Social Cost-Benefit Analysis (SCBA) is an expansion of economic cost-benefit analysis by including social and environmental impacts (Vardakoulias, 2023). Research by Schriver Christensen and Ernst Christensen (2021) compared an electric vehicle to a diesel vehicle (Renault) and found that the social costs over their times were nearly equal, with the electric vehicle being slightly less costly. Malmgren (2016) further analysed EVs by quantifying seven benefits, including fuel savings, reduced CO2 emissions, improved health from lower PM2.5 levels, improved national security through decreased fossil fuel reliance, and economic development from transportation electrification. The current study calculates CO2 emissions for distances of 500 km (kilometre), 750 km, and 2000 km monthly and assessing economic viability of both electric and fuel vehicles. Laver and Parsha (2021) conducted a cost-benefit analysis of policy tools to promote plug-in electric vehicles, considering excess purchase costs, subsidies, charging infrastructure investments, and taxation models for company cars. In SCBA, benefits and costs can be real or pecuniary; real benefits are those derived by final consumers of public projects. All real benefits and costs are included in cost-benefit analysis (Musgrave and Musgrave, 1989). The present study uses the benefit-cost ratio as a measure of cost-benefit analysis. External benefits and costs are accounted for in the study. Both Direct (D) and indirect (ID) costs and benefits are also considered in this study. The direct cost in this study is the initial investment of both fuel and electric vehicles, and their operating costs. The indirect costs are the spillover effects that were caused by the carbon emissions from the fuel vehicles. The direct benefit is the amount of carbon saved due to the use of electric vehicles, and the indirect benefit is that their use will reduce global warming and mitigate climate change. This paper is an attempt to conduct an External benefit (cost) analysis of both electric and fuel vehicles and cross paths with the above-mentioned concepts. The subsequent section gives an outline of electric and fuel vehicles.

IV. An overview of electric vehicles and fuel vehicles

"An EV is defined as a vehicle that can be powered by an electric motor that draws electricity from a battery and is capable of being charged from an external source" (Vermont statutes, 2024). Battery electric vehicle (BEV), hybrid electric vehicle (HEV) plug- in hybrid vehicle (PHEV), and fuel cell electric vehicle (FCEV) are the four types of electric vehicles. Among this BEV is fully powered by electricity and is the most efficient compared to the other types (Figure 3).

The main benefit of an electric vehicle is the zero tailpipe emissions and lower fuel costs. It improves the fuel economy, progresses public well-being & the environment, and contributes to a robust transportation system (US Department of Energy, 2025).

Fig: 3



Source: e-amrit.niti.gov.in

Fuel vehicles use different types of fuel. Diesel, petrol and CNG are the most commonly used fuels in India. But there are also vehicles that use Liquid petroleum gas (LPG), Bio- diesel and Ethanol (TATA AIG, 2024). But most of these fuel vehicles have tailpipe emission and it is harmful to the environment and lead to rapid climate change. While electric vehicles also create some amount of carbon emission during the manufacturing process of vehicles and charging of vehicles, it has relatively low emissions compared to fuel vehicles, and their comparative advantage is growing (MIT Climate Portal, 2022). For a comparative study, Tata Tiago is selected because it is the vehicle brand that provides cars at the lowest cost and has both electric and fuel vehicles of the same variant, which has the lowest cost. Hence, Tiago XTA (Automatic, petrol variant) and Tiago XT (Automatic, EV) are chosen for the comparison.

An overview of electric and fuel vehicles is discussed. The subsequent section deals with the computation of average annual carbon emission from a typical passenger car and addresses the noise pollution from EVs and IECVs.

V. Data analysis and interpretation

Air, water and sound pollution are the three major kinds of pollution that exist today. These pollutions are the key sources of negative externalities. The present study focuses on addressing air and noise pollution which are contributed by passenger cars.

Average annual carbon dioxide (CO2) emissions of a typical passenger car

The average gasoline car on the road is driven around 11,500 miles per year (EPA.gov). That is 18507.46 km per annum. A typical passenger car emits about 4.6 metric tons of CO2 per year. So, when a passenger car is driven around 18507.46 km yearly, it emits about 4.6 metric tons of CO2 (5.0706306 tons; EPA.gov, 2023). To calculate the money value of CO2 emission, $20 is taken as a standard rate (Harris and Jonathan, 2013). The average emission of CO2 per km from the typical passenger car is 0.000273978 ton2. Table 3 shows the average monthly carbon dioxide emission of a typical passenger car that is driven 500km,750 km and 2000 km in monetary terms. Here, the emission per month is calculated by multiplying the given km by the average emission of CO2 per km. The money value is calculated by multiplying the CO2 emission by the standard money value of $20 (Harris and Jonathan, 2013). $20 is converted into Indian rupee (Rs. 1718.4) (USD/INR rate for 08-01-2025). Within the third row (column 2) of Table 2, the CO2 emission of a car that is driven 500 km is given. It is found by multiplying the given km by the average CO2 emission per km, which was found by dividing the total emission by the total distance. Here the CO2 emission when a passenger car is driven for 500 km is 0.13698886 ton (500*0.000273978). The money value of this emission is Rs 235.402 (0.13698886 ton*1718.4). Other values are also calculated by using the same procedure (Table-3).

Table 3 : Monthly Average CO2 Emissions of a Typical Passenger car

Average km a passenger car drives around monthly	CO2 Emission per Month	Money Value (Rs)
500 km	0.13698886 ton	235.402
750 km	0.20548329 ton	353.102
2000 km	0.54795544 ton	941.607

Source: Computed from 1. EPA.gov.in and 2. Inch calculator

From Table 3, it can be observed that as the number of kilometres a car rides increases, the CO2 emissions also surge. Along with this, the monetary value of emissions also rises.

Noise pollution from EVs and ICEs

As discussed in the review, the authors Salleh et al. (2013), Iversen (2015), Schweizer et al. (2023) and Berge et al. (2024) suggested that EVs remain quieter than ICE vehicles at slow speeds. Urban areas in Kerala are famous for slow-moving vehicles due to the traffic congestion. Also, air pollution is high in slow running ICE vehicles as they consume more fuel during low speed, but EVs do not have this problem and noise pollution is relatively low for EVs then. Because of these reasons, EVs are more appropriate in the urban context of Kerala.

In this section the average CO2 emission from a typical passenger car is computed and interpreted. Along with this, noise pollution in the case of both EVs and ICEVs is also discussed. The following section gives a general overview of the total cost of electric and fuel vehicles.

A general overview regarding the estimation of expenses and economic viability of both electric and fuel vehicles

As mentioned earlier, Tiago XTA (petrol) and Tiago XT(EV) are chosen for the comparison throughout the study. Table 4 shows the purchasing price and the operational cost of the vehicles under consideration.

Table 4 - Price List of Selected Vehicles

Vehicle	Tiago Petrol Auto	Tiago EV
Variant	XTA	XT
On Road Price	7,77,192/-	10,92,689/-
Running Cost (Per Km)	6 Rs	1.3 Rs
Service Cost (1 Yr)	6000/-	2000/-
Battery Cost	6000/-	600000/-

Source: Collected from Tata Showroom, Angamaly

The expense is estimated using the on-road price and the operational cost of both vehicles. The estimated km is computed by converting the monthly kilometres into 9 and 15 years. Running cost is calculated using this estimated km. For example, running cost of EV per km is Rs 1.3 and running cost for 1,84,680 km is 1,84,680*1.3 = 2,40,084/- (table 4). Regarding the battery cost, EV batteries have a warranty of 8 years, and

The average expense of both electric and fuel vehicle is estimated based on table 4. Tables 5 and 6 exemplify the average expenses of electric and fuel vehicles for those who drive around 1710 km and 990 km per month for 9 and 15 years respectively (these two kilometres were chosen through trial-and-error method at the point where EV becomes economically viable).

Table 5 - Estimated Expense for 9 Years (1710 km/month)

Vehicle	Tiago XT(EV)	Tiago XTA (petrol)
On road price (Rs)	10,92,689	7,77,192
Estimated km for 9 years	1,84,680 km	1,84,680 km
Running cost (Rs)	2,40,084	11,08,080
Service cost (Rs)	18,000	54,000
Battery cost (Rs) 8 yrs and 4 yrs	6,00,000	12,000
Total (Rs)	19,50,773	19,51,272

Source: Based on table 4

Table 6 - Estimated Expense for 15 Years (990 Km/Month)

Vehicle	Tiago XT(EV)	Tiago XTA (petrol)
On road price (Rs)	10,92,689	7,77,192
Estimated km for 15 years	1,78,200 km	1,78,200 km
Running cost (Rs)	2,31,660	10,69,200
Service cost (Rs)	30,000	90,000
Battery cost (Rs) 8 yrs and 4 yrs	6,00,000	18,000
Total (Rs)	19,54,349	19,54,392

Source: Based on table 4

fuel vehicle batteries have a warranty of four years. So, for the calculation, it is assumed that the EV battery is changed one time in both the period and fuel vehicle battery is changed 2 times in nine years and 3 times in 15 years. Therefore, the battery cost of EV remains the same and Battery cost of a fuel vehicle is Rs 12000 and Rs 18000 for 9 and 15 years, respectively. The total expense is computed by adding the on-road price and operating expenses. When the expenses were computed for nine years authors came to know that EV is economically viable if it drives around 1710 km in a month, and when the expense is calculated for fifteen years, EV is economically viable if it drives around 990 km/month.

Battery costs in tables 5 and 6 are calculated by taking the warranty years (8 & 4 yrs for EV and Fuel, respectively) under consideration. The EV battery warranty expires after 8 years of use or after 160000 km. So, this 160000 km should also be considered while calculating the total expense. It is understood that the warranty of the fuel vehicle battery expires when the vehicle is used for 4 years or when it completes 74,030.184 km. This quantity is obtained by multiplying the average distance a car drives around in a year (18507.546) by 4. There is no change in the total expense (for 9 yrs) of both vehicles when the warranty (in distance) of batteries is considered. Table 7 presents the total expense of both electric and fuel vehicles by taking the battery warranty when it expires at 160000 km and 74,030.184 km, respectively (Table -7)..

Table 7 - Estimated Expense for 15 Yrs (998 Km)

Vehicle	Tiago XT EV	Tiago XTA (Petrol)
On Road Price (Rs)	10,92,689	777192
Estimated Km for 15 Years	179640	179640
Running Cost (Rs)	233532	1077840
Service Cost (Rs)	30000	90000
Battery Cost (Rs)		
(160000 Km and 74,030.184 Km)	600000	12000
Total (Rs)	19,56,221	1957032

Source: Based on table 4

** See the first paragraph in section 5. As per that a fuel vehicle requires two batteries to cover a distance for 74,030.184*2 = 1,48,060.368 km*

When the expense is calculated for 15 years, the total expense changes. The EV becomes economically viable when the car runs around 998 km per month. Initially, expenses were estimated for both EV and petrol cars at 990 km per month by considering the distance covered (160000 km and 74,030.184 km, respectively). However, EV is not economically viable at 990 km because when battery warranty based on distance covered (160000 km for EV and 74,030.184 km for petrol) is considered, the battery cost of petrol vehicle decreases from Rs 18000 to Rs 12000. Though it is noted that battery cost is not the reason for the economic viability of EV at 998 km per month, since it is the same for both 990 km and 998 km. Therefore, the economic viability of EVs is caused by the lower running cost of EVs.

From this, EV is economically viable when it is frequently used (Table 7). Otherwise, a fuel vehicle is economically viable. The main factor of increased expense is the battery cost of electric vehicles. It is important to promote the use of EVs because it is

environment friendly, but the cost of vehicle stand as a hindrance to this. The government should adapt policies to reduce the cost of EV batteries. Along with tax credits, subsidies should also be given to reduce the cost burden of the battery. The government should also allocate more funds for the research and development (R&D) of EV batteries. R and D should develop strategies to increase the lifespan of EV batteries. This will postpone the disposal of used batteries and also will reduce the battery cost, there by increasing the demand for EVs.

The present section provides a general overview of the expenses of electric and fuel vehicles. The following section compares electric to fuel vehicles using the benefit-cost ratio.

Benefit-cost ratio

To compare electric vehicles to fuel vehicles Benefit-cost ratio is used. The benefit-cost ratio is a measurement of cost-benefit analysis. Here benefit-cost ratio of both electric and fuel vehicles is calculated. For the calculation of the benefit-cost ratio, external benefit and external cost are used.

The formula for calculating the benefit-cost ratio

Benefit-cost ratio = B/C*100

B = Total present value benefit and C = Total cost

Before using the formula, the present value of the external benefit and cost should be calculated. Here present value for 9 years is calculated at 7% of rate of interest, and it is calculated from the present value tables.

→ **Benefit-Cost Ratio of EVs**

Here carbon saving (implies absence of carbon emission) is the external benefit and the on-road price of Tiago XT (EV) in Kerala is the initial cost. To get the present value for nine years external benefit is multiplied by values taken from the present value table (ICFAI, 2004) (at 7%). Money value of carbon saving is Rs 8713.372 a year (5.0706306*1718.4). After finding the total present value (which is taken as total external benefit) the formula of benefit-cost ratio is used. For example, if Rs 8713.372 is the carbon saving and 0.9346 (at 7%) is the present value factor then present value of the first year is Rs 8713.372*0.9346 = 8143.517. Remaining present values are also calculated in the similar manner (Table -8).

Table 8 - Present Value of Carbon Saving

Year	Carbon saving (Rs)	PV factor	Present value (PV) in Rs
1	8713.371623	0.9346	8143.517119
2	8713.371623	0.8734	7610.258776
3	8713.371623	0.8163	7112.725256
4	8713.371623	0.7629	6647.431211
5	8713.371623	0.713	6212.633967
6	8713.371623	0.6663	5805.719512
7	8713.371623	0.6227	5425.81651
8	8713.371623	0.582	5071.182285
9	8713.371623	0.5439	4739.202826
		Total PV	**56768.48746**

Source: computed using present value table

Benefit-cost ratio = B/C*100 = 56768.48/1092689*100 = 5.20

The benefit-cost ratio of an electric vehicle is 5.2%. It means that when a person buys an electric vehicle 5.2% of the cost of the vehicle is its external benefit.

→ **Benefit-Cost Ratio of Fuel Vehicle**

In the case of fuel vehicle there is no external benefit but external cost is involved. The carbon emission in monetary terms is treated as the external cost and the on-road price of Tiago XTA (petrol) in Kerala is the initial cost. For computation of cost, carbon emission is considered. To get the present value for nine years external cost is multiplied with values taken from the present value table (at 7% rate of interest). Money value of carbon emission is Rs 8713.372 a year. After finding the total present value (which is taken as total external cost) the formula of benefit-cost ratio is used. Example for calculating total present value; if Rs 8713.372 is the carbon emission and 0.9346 (at 7%) is the present value factor. Then present value of the first year is Rs 8713.372*0.9346 = 8143.517. Remaining present values are also calculated in the similar manner. However, before computing the benefit-cost ratio it is important to note that there is no external benefit for fuel vehicles. So, the total present value of external cost is added to the on-road price.

Cost = total present value of external cost + on road price of Tiago XTA (petrol)

= 56768.48746 + 777192 = Rs 833960.487

It is to be noted that fuel vehicles in this context have no external benefit but to facilitate the computation facility the benefit is taken as a token amount of one. Hence the benefit-cost ratio of fuel vehicle = 1/833960.487*100 = 0.00012

The benefit-cost ratio is interpreted in three ways.

Benefit-cost ratio = 1, benefit=cost

Benefit-cost ratio > 1, benefit >cost

Benefit-cost ratio < 1, benefit <cost

The benefit-cost ratio of fuel vehicle is 0.00012 percent which means external cost exceeds the external benefit. From an externality point of view, fuel vehicle possesses a large amount of negative externality. The benefit-cost ratio of electric vehicle is greater than one (5.2%) which means external benefit exceeds external cost. It can be concluded that from an externality point of view EVs are beneficial.

Findings from the survey conducted among fuel and electric vehicle users

As mentioned in the introductory part, a survey is conducted via google form to know the response of 70 people regarding the use of electric and fuel vehicles. Among these 62 respondents own a fuel vehicle, 2 of them have electric vehicles and 6 of them have both. The survey was conducted in Ernakulam and Thrissur districts (Table-9).

Table 9 : Driving Licence

Type of vehicles	Do you have driving licence				
	Yes		No		Total
	M (Male)	F (Female)	M	F	
Electric	2	0	0	0	2
Fuel	31	25	1	4	61
Both	2	3	0	1	6
Total	63		6		69
Percent	91.30434783		8.695652174		100
Not responded	1 (F/Fuel)				

Source: primary data

Table 9 shows that 69 participants were responded to this question. Among this 91% have driving licence. This study shows that there is a significant number of females have driving license (85 %) (Table - 10).

Table 10: Purpose of Using Vehicles

Type of vehicles	Purpose of using vehicles						
	Job oriented		Personal use		Others		Total
	M	F	M	F	M	F	
Electric	0	0	2	0	0	0	2
Fuel	2	6	27	22	2	2	61
Both	1		1	3		1	6
Total	8	56	5	69			
Percent	11.594202898550		81.159420289855		7.246376812		100
Not responded	1(M/Fuel)						

Source: primary data

Purpose of using vehicles by each respondent is shown in table 10. 81% of respondents use their vehicle for personal use. Remaining 11.5% are job-oriented users and 7% uses their vehicle for other purposes. Tables 11 to 14 and figures 4 to 6 show the responses of fuel vehicle users.

Table 11: Average Distance Travel by Fuel Vehicle Users

Type of vehicles	If you have a fuel vehicle, what is the average distance you travel in a month							
	Below 500		500-1500		1500-2000		Above 2000	
	M	F	M	F	M	F	M	F
Fuel	13	21	14	8	2	2	2	0
Both	1	2	1	2	0	0	0	0
Total	37		25		4		2	
Percent	54.41176471		36.76470588		5.882352941		2.941176471	
Total	68							

Source: Primary data

Table 11 depicts the average monthly distance travelled a month by the fuel vehicle users. 54.41% of respondents travel below 500 km per month and 36.76% of them travel between 500-1500 km a month. Average distance travelled by males (803.03) is greater than female (550). As mentioned in the review of literature a typical passenger car is driven around 18507.46km per year. It means that a typical passenger car is

driven around 1542.25 km per month on average. But the average distance of a respondent is 672.79 km per month.

Table 12: Average Maintenance Cost

Type of vehicles	Average maintenance cost of vehicle in a month								
	Below 1000		1000 - 2000		2000 - 3000		Above 3000		Total
	M	F	M	F	M	F	M	F	
Fuel	16	18	11	8	4	2	1	2	62
Both	1	3	0	1	1	0	0	0	6
Total	38		20		7		3		68
Percent	55.88235294		29.41176471		10.29411765		4.411764706		100
Not responded	2								

Source: Primary data

Table 12 highlights that the maintenance cost of 56% of respondents are below Rs 1000. More number of females (21) falls into this category than male (17). Only 4.41% spends above 3000. Average maintenance cost of male respondents (1205.882) is greater than that of females (1058.824). Average maintenance cost is 1132.353 per month. By comparing the average distance travelled (table 11) and the maintenance cost (table 12) of fuel vehicle users it is found out that both are positively (Table 13).

Table 13: Mileage of Vehicle

Type of vehicles	What is the mileage of your vehicle (Km/L)								
	Below 10		10 to 15		15 to 20		Above 20		Total
	M	F	M	F	M	F	M	F	
Fuel	0	1	13	11	9	6	10	10	60
Both	0	1	0	2	2	0	0	1	6
Total	2		26		17		21		66
Percent	3.03030303		39.39393939		25.75757576		31.81818182		100
Not responded	4								

Source: Primary data

Table 13 describes the mileage (in Km/L) of fuel vehicles. Many of the respondents (40%) are using moderately efficient vehicles as their vehicle's mileage ranges between 10-15. Average mileage of vehicle used by male and female are 17 and 16.4 respectively. The average of all respondents is 16.7 (Table 14).

Table 14 : Average Fuel Cost

Type of vehicles	What is the average fuel cost per month								
	Below 2500		2500 to 5000		5000 to 7500		Above 7500		Total
	M	F	M	F	M	F	M	F	
Fuel	12	21	15	7	4	1	1	1	62
Both	1	3	1	1	0	0	0	0	6
Total	37		24		5		2		68
Percent	54.411764705		35.294117647		7.352941176		2.941176471		100
Not responded	2								

Source: Primary data

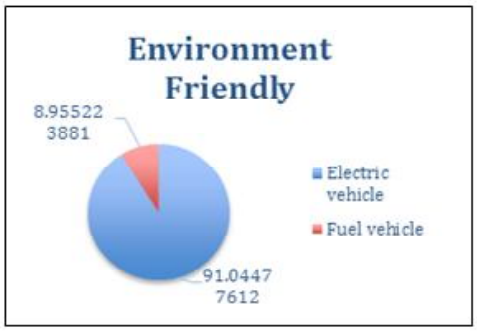
The average fuel cost per month according to the sample is 3014.705 (computed by splitting the classes into 0-5000 and 5000 to 10000). 89.7% of the respondents have an average fuel cost below 5000 (Table 14). Chi square test was conducted to identify if there is an association between gender and incurring of average fuel cost. For the purpose of conducting the test, the cost of fuel was divided into below Rs. 2500 and above Rs. 2500.

H0: there is no significant association between gender and average fuel cost.

H1: there is significant association between gender and average fuel cost.

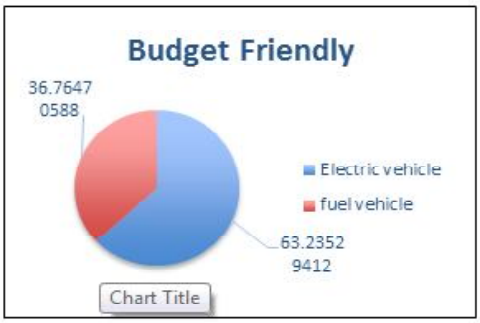
Since the p-value (0.007398845) is less than 0.05, the null hypothesis is rejected. That is, there is a statistically significant association between gender and average incurring of fuel cost.

Figure: 4



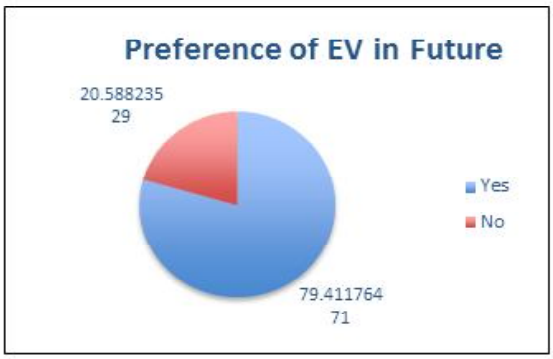
Source: Primary data

Figure 5



Source: Primary data

Figure: 6



Source: Primary data

Figures 4,5 and 6 depict the behaviour of respondents regarding electric vehicles. Even though a large portion of respondents agree that electric vehicle is environment friendly (91%) only 63.23% believes that it is budget friendly. Also 79% of respondents will prefer electric vehicle in future. Majority respondents (91%) know that EV is better for environment but 27.8% respondents among this choose fuel vehicle as budget friendly and 11.7% among this will not prefer EV for future use. However, according to think mobility (2025) a research report published by Google and BCG (Boston consulting group) opined one in three consumers considering EV as their future vehicle in India. 36% of the consumers are tending towards electric cars and 30 % are inclined towards electric two wheelers. It is more than 2/3 as per the present sample.

The ensuing part is the responses of electric vehicle users. As the responses were limited (EV users) the tables are not presented here. The survey asked about the

average distance travelled by the electric vehicle users. Out of 8 respondents 4 of them travel around 300-600 km per month. Average distance travelled by the respondents during a month is 375 km which is less than that of a fuel vehicle (672.79 km). Further the survey queried how the EV users charge their vehicle and the average maintenance cost of electric vehicle per month. Out of 7 respondents 4 of them charge their vehicle at home and remaining 3 rely on both charging station and home. In the case of maintenance cost all respondents have cost below 2500 Rs/-. While comparing with fuel vehicle (1132.353) the average maintenance cost of electric vehicle is high (1250). Also, 7 out of 8 respondents chose electric vehicle because it is environmentally friendly. By comparing it with figure 4 the authors came to a general conclusion that majority of the respondents agree that electric vehicle is environment friendly. Additionally, four respondents are not sure if electric vehicles are affordable or not. Comparing with fuel vehicle respondents (Figure 5) major portion of them (63.23%) responded that electric vehicle is budget friendly however the remaining respondents (36.76%) who choose fuel vehicle as budget friendly is also dominant. According to think mobility report (2025) 45% of costumers find High Acquisition Cost of EV as a major concern. Further, most of the respondents (5) are aware of the subsidies provided for electric vehicles. Final question was related to the availability of charging station. 5 out of 8 respondents have charging station available in their locality. The study published by Google and BCG (2025) found that 51% of the customers are concerned with the charging infrastructure facilities. This goes in line with the fifth theme of review of literature in this study. Infrastructure development has a momentous role in inducing consumer behaviour and fast-tracking EV adoption.

As the data presentation is over the next section provides the concluding remarks.

Conclusion

The research analysed external benefit (cost) of EV as an adaptation strategy for climate change. The monthly average CO2 emission of a passenger car was computed and came to know that as more distance a car runs, the CO2 emission surges along with the rise in its money value. EVs remain quieter than ICE vehicles at slow speed and ICEVs create greater air pollution during low speed therefore EVs are more appropriate in the urban context of Kerala. From the estimation of expenses, EVs are economically viable only in the long run. By comparing both vehicles' external benefit-cost ratio, authors came to know that fuel vehicle creates a large amount of negative spillover effects and EVs creates a positive externality. Based on the survey among the vehicle users' average distance of a typical passenger car is 672.79 km per month. Majority respondents (91%) know that EV is better for environment and , and 63.23% believes that they are budget-friendly. 79% of respondents will prefer EV in future. There is a statistically significant association between gender and the average fuel

cost incurred, with a p-value 0.007398845. The carbon footprint from the lithium-ion battery was not mathematically computed in the study but more research should be done on the carbon footprint of these batteries, as their manufacturing is also a major factor that creates a negative externality to the environment. It is suggested that, along with tax credits, subsidies should be also given to reduce the cost burden of the battery. Government should also allocate more funds for the research and development (R&D) of batteries. R and D measures should develop strategies to increase the lifespan of EV batteries. This will postpone the disposal of used batteries and also will reduce the battery cost, there by increasing the demand for EVs. So that EVs will become an efficient adaptation policy for mitigating climate change.

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However, errors, if any, rest with the authors.

■

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Localisation of Sustainable Development Goals: A Study of Multidimensional Poverty and Rural Development in Kerala

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Abstract

The present study attempts to understand the localization of Sustainable Development Goals (SDGs) under the purview of rural development and multidimensional poverty in Kerala. The study is based on secondary data. Results indicate that Grama Panchayats have a highly significant role in the development of rural areas by providing the basic amenities and implementing poverty alleviation programs, thereby contributing to the achievement of SDG Target 1.2. Even though Kerala made a remarkable progress in reducing Multidimensional Poverty compared to the national average, some indicators such as maternal health and child & adolescent mortality rate exhibit adverse trends between the latest two rounds of National Family Health Survey (NFHS). The study underscores the importance of well-designed and properly executed rural development programmes through a decentralised governance mechanism for achieving SDGs at the grassroots level.

Key words : *Sustainable Development Goals (SDGs); National Family Health Survey (NFHS); Multidimensional Poverty; Local governance; Rural development*

1. Introduction

Global Multidimensional Poverty Index shows that around 964 million rural population across 111 countries are still living in multidimensional poverty, almost 25 per cent of the Indian population is found to be multi-dimensionally poor, and around 33 per cent are in rural areas. As per the given index, India ranks in 62nd position among 107 countries (Gaur, 2020). Recognising the multidimensional nature of deprivation, the global development discourse has shifted from income-based poverty measurement towards broader indicators such as education, health, and standard of living.

In the Indian context, the localisation of SDGs assumes particular significance in light of the country's long-term vision of becoming a developed nation by 2047. Sustainable Development Goals are furthermore localised today and the panchayats are given more responsibility to achieve those goals in rural areas.

The adoption of the 73rd constitutional amendment marked a significant milestone in India's decentralisation process by devolving powers, functions and financial resources to local governments. Sustainable Development Goals (SDGs) are taken through the different themes which can be realised through the local self-governments. In Kerala, decentralised governance has been further strengthened through initiatives such as the People's Plan Campaign and the preparation of gram panchayat development plans (GPDPs). Poverty-free and enhanced livelihood village is one of the nine thematic approaches of the 17 SDGs adopted by the ministry of Panchayat Raj. The Ministry of Panchayat Raj had initiated the people's campaign as "Sabki Yojana Sabka Vikas", being launched in all states from 2021 to 2022, for ensuring people's participation and preparing the grama panchayat development plan (Economic Review,2021-22).

Rural development is highly connected with the development of the common people especially the people living below the poverty line. All developmental activities done at the local level benefit the rural population and rural areas. While Kerala has achieved notable progress in social development indicators, disparities persist across districts and different social categories. Therefore, the researcher intends to study the localisation of Sustainable Development Goals (SDGs) in Kerala by analysing multidimensional poverty patterns and the role of gram panchayats in rural development.

1.1 Objectives of the study

The objectives of the study as are follows:

1. To examine the status of multidimensional poverty in Kerala using multidimensional poverty indicators

2. To Analyse the district-wise distribution of multidimensional poverty in Kerala based on NFHS data
3. To assess the linkage between multidimensional indicators and selected SDGs, particularly SDG 1.2
4. To examine the role of gram panchayats in addressing multidimensional poverty through rural development initiatives

2. Literature review

Multidimensional poverty is one of the major barriers in attaining the SDGs, which can be clearly addressed with an effective local governance system. Sustainable Development Goals (SDGs) can be attained only through comprehensive rural development, for which Local Self Governments (LSGs) are responsible for ensuring rural development (Sarkar, 2021; Ramya, 2014). As the grama panchayats are very close to the people, they are more responsible for the needs of local people and so allocate resources accordingly (Jothiramalingam, 2020). Panchayats are the basic unit of the local governance system, which is duly responsible for rural development (Dhananjay, 2017). The coordination between two departments, such as rural development and panchayat raj needs to be more strengthened in such a way that several programmes focusing on the rural development are implemented in a time-bound manner. Effective implementation of these programmes has to be ensured within the framework of rural development. Strategies and interventions by each panchayat for implementing these programs are widely different in terms of functions and functionaries. Grama panchayats are the constitutional body to prepare the development plan in rural areas with a comprehensive plan of utilising the local resources and various flagship programmes like MGNREGS (Ministry of Panchayat Raj, Ministry of Rural Development, 2019). Creation of income as well as purchasing power, along with ensuring the livelihood security among the rural people, is an essential part of rural development. The Ministry of Rural Development is implementing several schemes in our economy for rural development, and grama panchayats take the cognizance of these schemes (Ministry of panchayat raj, Ministry of Rural Development, 2019). For achieving the aim of rural development, grama panchayats need to associate with various departments concerned for developing the integrated strategy of utilising the locally available resources through different flagship programmes like MGNREGS. In the panel data analysis of different states in India for the years from 2006 to 2021, rural household coverage under MGNREGS in Kerala is 27.2% (Turangi, 2022). Employment generation through centrally funded programmes like MGNREGS is a clear indication of income generation in village areas, so as to reduce the poverty in those areas. Local governments are playing a very critical role in

the transformation of SDGs from its global vision into a local reality. Sustainable Development Goals (SDGs) are taken through the different themes, which can be realised through the local self-governments. 'No poverty' is one of the Sustainable Development Goals (SDGs) that could be attained at the grassroots level (Localisation of SDGs in PRI, Report of Expert Group, Volume 1, 2021). For attaining the theme, each panchayats needs to formulate the grama panchayat development plan and execute the functions accordingly. Panchayats are very close to the people, and they can easily identify the development needs of people. Improved living conditions and quality of life of the rural poor helps to obtain SDGs (Adamowicz, 2020; Singhal, 2016). However, the majority of them are suffering from different types of deprivations like educational deprivations, health deprivations and deprivations in standard of living (Chathukulam,2021; Chandran, 2020; Alkire, 2018). The decentralised governance mainly intends to provide the basic amenities of a common man, thereby achieving rural development. Rural development is highly connected with the development of the common people, and it is imperative for the improvement of the quality of life and standard of living of the people living in sparsely populated rural areas (Economic Review, 2021-2022). Recently, the Kerala government launched comprehensive programmes to eradicate extreme poverty with the help of local self-governments. A state wide survey was conducted to identify the extremely poor families with the intention of poverty eradication. It is observed that around 81% of the extremely poor are living in village areas, which reflects the intensity of rural poverty (Economic Review,2022). As per the survey, Malappuram district stands the highest with 8553 poor families, which accounts for the 13.4% of the total poor families in the State. Leaving no one behind is the special emphasis of the SDGs, and the MPI was constructed in line with the SDGs. Global MPI offer a reference point for multiple actors seeking to identify and redress the situation of those being left behind in multiple SDGs (Jahan, 2018). Reducing global poverty at least by half the proportion of men, women and children of all ages living in poverty is one of the key goals of SDG. The MPI value of India has declined from 24.85% in 2015-16 to 14.96% in 2019-21. This significant decline the multidimensional poverty is a major contribution towards the achievement of SDGs. Similarly, the intensity of poverty has also been reduced from 47.14% to 44.39% during the period 2015-16 to 2019-21.

2.1 Conceptual Framework: Multidimensional Poverty and SDGs

Multidimensional poverty refers to overlapping deprivations experienced by individuals as well as households across multiple dimensions such as education, health and standard of living. The Multidimensional Poverty Index (MPI) developed by UNDP and Oxford Human Development Initiative is the most widely used tool for measuring

poverty in its multidimensional aspects, rather than the income and expenditure method. It is an international measure of acute multidimensional poverty covering over 100 developing countries. This is the most innovative tool for evaluating households and individuals in terms of different dimensions of poverty. Each indicator of the multidimensional poverty index is connected to the SDGs. SDG Target 1.2 is the particular mission to reduce poverty in all its forms by at least half by 2030. The MPI captures these deprivations using ten indicators under three dimensions. SDG 1.2 explicitly aims to reduce multidimensional poverty by at least half by 2030, making MPI a vital policy tool for monitoring progress towards SDG achievement.

2.2 Theoretical Framework

The study encompasses the theories of decentralisation and participatory governance. The theory of decentralisation explains that the service delivery would become more efficient if it is provided by the local self-governments because of their connections with the local needs of people through gram sabhas. These frameworks provide an analytical basis for examining the role of gram panchayats in poverty reduction and localisation of SDGs.

3. Methods

The study is mainly based on secondary data, and the fundamental information is given from the Ministry of Panchayat Raj, Grama Panchayat Development Plan, Ministry of Rural Development, MPI progress review 2023, latest rounds of National Family Health Surveys and latest Economic reviews. District-wise analysis of multidimensional poverty has been done on the basis of the latest two rounds of NFHS.

4. Results

Some of the SDGs are connected with the indicators of multidimensional poverty and as per the report, some important facts of multidimensional poverty in relation to SDGs in Kerala are given here. Most importantly, households having an improved source of water belong to SDG 6, which is recorded as only 57% in 2019. Similarly, electrification of households and usage of clean cooking fuel to related to SDG 7, of which household electrification is 100%, but at the same time, households using clean cooking fuel is only 58.9%. The following Table shows the censored head count ratio in MPI indicators on the basis of the National Family Health Survey in the latest two rounds held in 2015-16 and 2019-20 (Table -1).

Table 1. Global MPI : Details of indicators and dimensions

Dimensions of poverty	Indicator	Deprived if..	SDG Area	Weight
Health	Nutrition	Any person under 70 years of age for whom there is nutritional information is undernourished	SDG 2	1/6
	Child mortality	A child under 18 has died in the household in the five-year period preceding the survey	SDG 3	1/6
Education	Years of schooling	No eligible household member has completed six years of schooling	SDG 4	1/6
	School attendance	Any school-aged child is not attending school up to the age at which he/she would complete class 8	SDG 4	1/6
Living standards	Cooking fuel	A household cooks using solid fuel, such as dung, agricultural crop, shrubs, wood, charcoal, or coal	SDG 7	1/18
	Sanitation	The household has unimproved or no sanitation facility or it is improved but shared with other households	SDG 6	1/18
	Drinking water	The household's source of drinking water is not safe or safe drinking water is a 30-minute or longer walk from home, roundtrip	SDG 6	1/18
	Electricity	The household has no electricity	SDG 7	1/18
	Housing	The household has inadequate housing materials in any of the three components: floor, roof, or walls	SDG 11	1/18
	Assets	The household does not own more than one of these assets: radio, TV, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck	SDG 1	1/18

Source: Author's own compilation based on secondary data

Table 2. Status of multidimensional poverty based on two rounds of NFHS (censored headcount ratio) (%)

		India		Kerala	
		NFHS 4	NFHS 5	NFHS 4	NFHS 5
1	Nutrition	19.79	11.90	0.56	0.45
2	Child & Adolescent mortality	1.87	1.18	0	0.01
3	Maternal Health	14.64	9.35	0.15	0.20
4	Years of schooling	10.67	6.63	0.18	0.17
5	School attendance	5.22	3.63	0.22	0.06
6	Cooking fuel	23.03	12.30	0.58	0.43
7	Sanitation	21.2	9.25	0.30	0.09
8	Drinking water	5.05	2.23	0.13	0.11
9	Electricity	8.28	1.84	0.20	0.12
10	Housing	20.48	12.07	0.40	0.38
11	Assets	8.84	4.72	0.32	0.28
12	Bank Account	5.36	1.09	0.17	0.14

Source: MPI, Progress review 2023

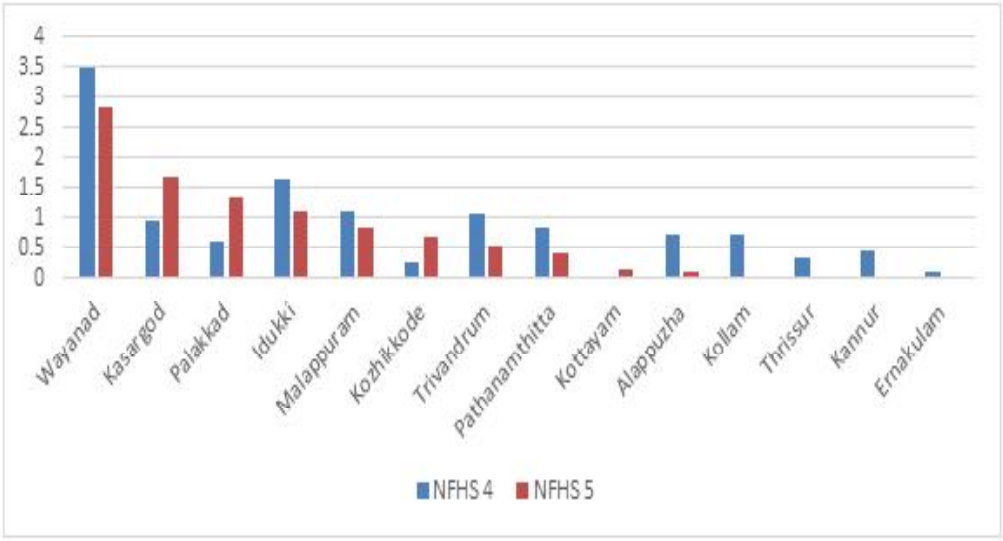
From Table 2, it is seen that compared to all India, Kerala shows the lowest deprivations in all indicators of MPI. It is also noted that there is a significant decline in the different deprivations of multi-dimensional poverty in Kerala. However, in the case of child adolescent mortality and maternal health, deprivation has increased in Kerala while it has declined in all India. This indicates the poor performance of Kerala in addressing the issues of child and adolescent mortality. This would adversely affect the path of attaining SDG3, as it is connected with child mortality. Another observed fact is nutritional deprivation which, stands as the highest deprivation indicator of multidimensional poverty in Kerala, being recorded as 0.56% and 0.45% in 2015-16 and 2019-20, respectively, but in all India, it is cooking fuel which contributes around 12.30% in 2019-20. Hence, the grassroots level intervention is very much required to address the issue of nutritional deprivation in Kerala to attain SDG 2. The percentage of the population who are multi dimensionally poor in each district is given in Table 3.

Table 3. District wise distribution of multidimensional poverty in Kerala (%)

District	NFHS 4	NFHS 5	Relative change
Wayanad	3.48	2.82	-18.9655
Kasargod	0.94	1.70	80.85106
Palakkad	0.62	1.34	116.129
Idukki	1.65	1.11	-32.7273
Malappuram	1.11	0.85	-23.4234
Kozhikkode	0.26	0.68	161.5385
Trivandrum	1.08	0.52	-51.8519
Pathanamthitta	0.83	0.42	-49.3976
Kottayam	0	0.14	
Alappuzha	0.71	0.10	-85.9155
Kollam	0.72	0.04	-94.4444
Thrissur	0.33	0.03	-90.9091
Kannur	0.44	0.03	-93.1818
Ernakulam	0.10	0	-100

Source: MPI, Progress review 2023

Fig.1 District wise distribution of multidimensional poverty in Kerala



From the district-wise analysis of multidimensional poverty in two different rounds of National Family Health Survey (NFHS 4 & NFHS 5), it is clear that the percentage of multidimensionally poor population has declined in the districts except some districts such as Kasargod, Palakkad, Kozhikkode, and Kottayam. Among these districts, Kozhikkode district shows the highest increase being recorded as 161%, followed by Palakkad and Kasargod, being 116% and 81% respectively. Another observed fact is that Kottayam had zero multidimensional poverty in the 4th round of NFHS 2015-16, but it increased to 0.14% in the 5th round of NFHS 2019-20. Ernakulam became a zero multidimensional poverty district as per the 5th round of NFHS.

4.1 Role of grama panchayats in addressing multidimensional poverty and rural development

As the 70% of total population in India lives in rural areas, grassroots level functioning is required for attaining the SDGs. In the local governance system, grama panchayats are the lowest tier of panchayat raj institutions, which are supposed to act as a catalyst for the rural development. Social and economic development of the rural population is the major objective of the panchayat raj system. In villages, the grama panchayats have a wider role in the redressal of poverty in different dimensions of education, health and standard of living. Grama panchayat is the basic unit of the decentralised system of local governance, and the development plan of each grama panchayat is formulated by considering the basic needs of people in the particular locality. In a decentralised democratic society like Kerala, local governance plays a pivotal role in the development of rural areas and boosting the standard of living of poor people in village areas. The main aim of rural development is to break the vicious circle of poverty through ensuring a better standard of living for the rural poor. Panchayats implement several development programmes through centrally sponsored schemes with an aim of achieving rural development and the eradication of poverty in rural areas. The Department of Rural Development is implementing several schemes in association with the Grama Panchayat for the amelioration of the rural population. The main aim of these programmes is to reduce the poverty and creat employment opportunities in the rural areas, thereby improving the well-being of the rural population. The major schemes include Livelihood Projects, Mahatma Gandhi National Rural Employment Guarantee Scheme, Pradhanmantri Awas Yojana-Gramin, Saansad Adarsh Gram Yojana and District Rural Development Agency (DRDA), which are sponsored by the ministry of Rural Development. The coordination between two departments, such as rural development and panchayat raj, needs to be more strengthened in such a way that several programmes focusing on the rural development are implemented in a time- bound manner. Effective implementation of these programmes has to be ensured within the framework of rural development.

Strategies and interventions by each panchayat for implementing these programms are widely different in terms of functions and functionaries.

5. Discussion

From the study, it is seen that panchayats have a significant role in the development of rural areas by providing the basic amenities to the village people and enabling them to get rid of multidimensional poverty and attain the particular target of SDG 1.2. Even though Kerala made a remarkable progress in the Multidimensional Poverty Index (MPI) in all India, some indicators of MPI such as maternal health and child & adolescent mortality rate showed an increasing trend across the two rounds of NFHS (NFHS 4&5). Another observed fact is that nutritional deprivation is the highest contributing indicator leading to the multidimensional poverty in Kerala. As these deprivations like nutrition and child mortality are linked with SDG 2 & SDG 3, utmost care should be taken to address those issues in all villages.

6. Conclusion

From the district-wise analysis of multidimensional poverty in two different rounds of the National Family Health Survey (NFHS 4 & NFHS 5), it is clear that the multidimensional poverty in Kerala has declined in the districts except for some districts such as Kasargod, Palakkad, Kozhikkode, and Kottayam. Well-designed and properly executed rural development programmes at the grassroots level is the only way out to address the problem of multidimensional poverty and achieve sustainable development goals. Hence, the detailed decomposition analysis of multidimensional poverty with the help of primary data from these districts is the future scope of study, and it would be helpful for policy formulation.

■

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Social sector expenditure and Human Development : A Study of Indian States

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Abstract

This paper examines the correlation between social sector expenditure and the Human Development Index (HDI) across 24 Indian states over three decades, spanning from 1991 to 2021. It explores various research questions, notably investigating the presence of a long-run equilibrium between social sector spending and HDI scores, and assessing the comparative impact of expenditure per capita on education versus per capita income (GSDP) on the education index. Furthermore, it examines the allocation and effectiveness of public funds in education and health across states with divergent HDI standings. Employing a methodological framework encompassing panel data analysis, cointegration assessment, fixed effect regression modeling, and a comparative study of Kerala and Bihar, the research reveals a significant association between social sector expenditure per capita and HDI, underlining the pivotal role of public investment in nurturing human development. Findings from the regression analysis underscore the substantial influence of both education expenditure per capita and per capita GSDP on the education index. Through comparative analysis, the paper reveals the significance of decentralized governance and grassroots empowerment in driving heightened HDI levels, as exemplified by Kerala, while also elucidating the obstacles confronting states such as Bihar in achieving balanced development outcomes.

Key words : *Social sector expenditure, Human Development Index (HDI), Decentralized governance, Cointegration analysis*

1. Introduction

The relationship between social sector expenditure and Human Development holds profound significance within the realm of development economics, particularly in the context of emerging economies like India. This research is dedicated to exploring the interplay between government spending on essential services and its subsequent impact on human well-being and development indicators. India, characterized by a burgeoning population and a diverse socio-economic landscape, grapples with various challenges in ensuring equitable access to healthcare, education, and other essential services. Understanding the relationship between social sector expenditure and the Human Development Index (HDI) is thus imperative for policymakers and economists alike.

Over the span of three decades, this study examines data pertaining to social sector expenditure and HDI outcomes across 24 Indian states. By doing so, it aims to explore the fundamental patterns and discern the factors influencing human development indicators. Newly formed states and Union Territories i.e., those which were formed post 1991 were excluded due to data unavailability, discontinuities and structural differences, ensuring a balanced panel and reliable long-term comparisons. The motivation behind this research stems from recognizing social sector expenditure as a pivotal instrument for promoting inclusive growth, sustainable development, and poverty alleviation. Despite concerted efforts by governments to allocate resources efficiently towards education, healthcare, and other vital sectors, regional disparities persist, underscoring the crucial need to comprehend the relationship between expenditure patterns and development outcomes.

Moreover, the significance of conducting a state-wise analysis lies in its capacity to provide a deeper understanding of the factors contributing to variations in human development outcomes across different regions. States grappling with challenges such as low HDI scores stand to gain valuable insights from the experiences of states that have successfully improved their social indicators. By closely examining the strategies and policies implemented by high-performing states, policymakers in less developed regions can contribute to enhanced human well-being, thereby fostering the narrowing of development disparities.

Review of literature

The nexus between social sector expenditure and economic growth has emerged as a pivotal topic within the realm of development economics. This relationship has drawn substantial attention both in academic discourse and among policymakers worldwide. In India, a significant portion of the population relies on government-provided essential services. The government has demonstrated a commitment to investing in the social sector, including education, healthcare, skill development, housing, sanitation, and more.

Before the 1990s, the World Bank emphasized income as the main factor that influences human development. However, Amartya Sen's (1993-2000) Capability Approach changed this view. Sen argued that human development shouldn't just be about income or economic growth. Instead, he believed that income, utilities, resources and wealth were tools for achieving human development, not the ultimate goals. Jha, Biswal, and Biswal (2000) analyzed public spending on education, health, and development initiatives in India to assess their impact on poverty reduction. Using unbalanced panel data techniques with NSS data, they found that investments in these sectors contributed significantly to alleviating poverty.

The results from the panel data analysis conducted by Ramesh Chandra Das, Chhanda Mandal, and Arun Kumar Patra (2021) in their study, which investigates the linkages between social sector's spending and HDI, show that social sector spending and human development have with long-run associations. A study by Priti Agarwal (2015) shows that per capita real income is comparatively more important than 'share of social sector expenditure in development expenditure'. The paper by Meraj Alam and Dastgir Alam found that there is a positive relationship between social sector expenditure and human development in the states.

The study by Madhumita Ray and Minaketan Sarangi (2021) emphasizes the substantial impact of social sector spending on India's economic growth. The causal relationships underscore the interdependence of economic development and social sector investment, suggesting that economic growth prompts increased social spending, which, in turn, contributes to further development.

The findings of Kaur and Misra (2003) revealed that public spending in the education sector had positive impacts on enrolment ratios, particularly in terms of female education. However, they observed that expenditure in the health sector had turned out to be ineffective, indicating a need for better allocation and utilization of resources to address healthcare challenges effectively.

Numerous studies indicate a limited connection between government spending on education and actual educational achievements. However, some research suggests that educational attainment can improve positively through education spending if we account for factors like quality and efficiency (Gallagher, 1993). Similarly, in the realm of healthcare, several studies reveal a weak link between healthcare expenditure and health outcomes, such as infant mortality (Filmer and Pritchett, 1997; Kim and Moody, 1992). Income seems to be a more critical factor influencing health outcomes compared to public spending. In India, this situation often arises from insufficient allocation of resources to healthcare and ineffective targeting, resulting in much of the healthcare expenditure not reaching primary healthcare services (Kaur and Misra 2003).

Arya and Ashwani's (2014) findings indicated that the benefits of social sector expenditures on human development are not immediate and are realized over a few years thereby suggesting the necessity for higher public spending in social services to achieve sustainable growth and development outcomes. Chakrabarty and Joglekar's (2006) findings revealed that income had a significant impact on education expenditure at all levels. Mallick and Dash (2015) highlighted a long-run relationship between educational expenditure and economic growth.

Several authors, including Dev and Mooij (2004), Joshi (2006), and Ghosh (2011), have noted the prevalence of education as the primary focus of social sector expenditure by both state and central governments. However, a comprehensive assessment of the education sector indicates that the attained quality and quantity of education remain unsatisfactory, despite some advancements. Persistent rural-urban and inter-state disparities, as well as gender gaps, continue to prevail (Ghosh, 2011).

In a recent study focusing on specific Indian states, Mohanty and Bhanumurthy (2018) evaluated the efficiency of utilization of public funds in the education and healthcare sectors while considering governance indicators. Their findings showed that states demonstrated better efficiency in spending resources on education compared to healthcare. They also found that good governance is of statistical significance.

Therefore, while government spending plays a vital role in fostering human development outcomes, challenges persist in ensuring efficient allocation and utilization of resources across various sectors.

Research Gap

The rationale behind this study emerges from a recognized gap in existing research, particularly concerning the enduring impacts of social sector expenditure on developmental outcomes. While prior studies have explored the immediate effects of such investments on human development indicators and economic growth, there remains a notable absence of comprehensive analysis into their long-term sustainability. This research aims to fill this void by investigating how social sector spending influences developmental outcomes over extended periods, thereby shedding light on its enduring significance.

A review of existing literature reveals the presence of disparities in the allocation and effectiveness of social sector expenditure across states and sectors, notably within healthcare and education. Despite this recognition, further research is warranted to uncover the underlying factors contributing to these disparities and to devise targeted interventions to mitigate them effectively. Moreover, while numerous studies have explored the broader relationship between social sector spending and the Human Development Index (HDI), there remains a significant gap concerning the prioritization

of education. Given the pivotal role of education in contemporary society, this research aims to address this gap by focusing specifically on the influence of education expenditure and income on educational outcomes. In an era where knowledge and skills are increasingly recognized as critical drivers of economic growth and social progress, understanding the interplay between education expenditure, income, and educational outcomes holds paramount importance.

Data and Methodology

The Data used in this research is secondary data. The sub-national Human Development Index data which is a crucial metric for assessing human development is collected from the Global Data Lab. Detailed data pertaining to social sector expenditure and GSDP of the 24 selected states for the years 1991 to 2021 is obtained from the Economic and Political Weekly (EPW) website. The per capita social sector expenditure and per capita GSDP is calculated by using the population data which is also obtained from the EPW website. The literacy rates data is extracted from www.indiabudget.gov.in. Other data pertaining to sex ratio, infant mortality rate, maternal mortality rate etc of Kerala and Bihar is collected from the NFHS surveys.

To explore the potential long-term associations between social sector expenditure and Human Development Index (HDI), we employ cointegration analysis using the per capita social sector expenditure and HDI scores. In the next section, a component wise analysis is made where the education index is taken as the dependent variable and education expenditure per capita and per capita income as independent variables to explore the relative influence of these variables on the education index. In the third section, two states are selected - one that has the highest HDI (Kerala) and the other with the lowest (Bihar)-over the years and the possible reasons for this disparity are investigated. By combining panel data analysis, comprehensive regression models, and a robust comparative framework, our research aims to throw light on the interplay between social sector expenditure and HDI in Indian states.

General trends

The analysis of the data over the thirty year period yields significant results thereby providing a detailed perspective on the interplay between social sector expenditure per capita and Human Development Index scores across the states. This approach highlights how different states have evolved in terms of their investment in social infrastructure and its impact on human development metrics (Figure 1 & Figure 2).

Figure 1: Average state-wise social sector expenditure per capita over the three decades

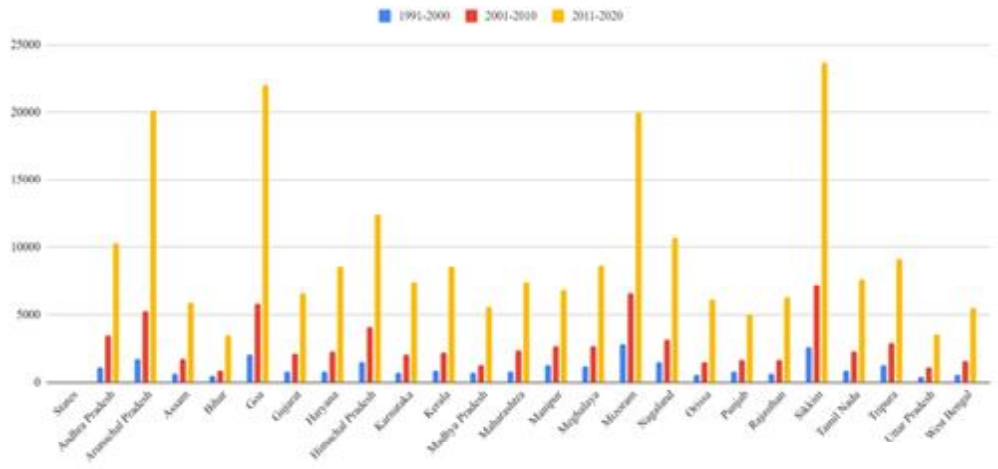
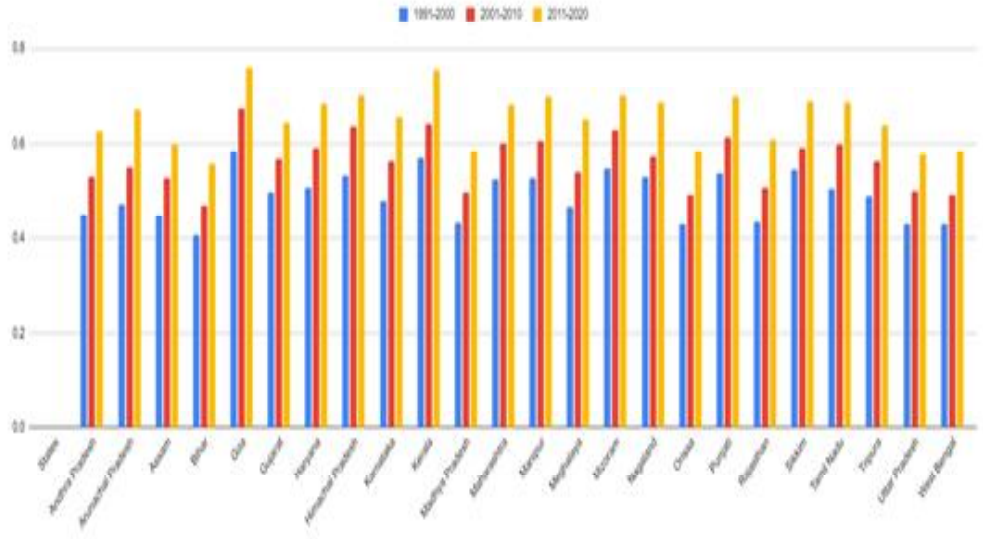


Figure 2: Average state-wise HDI scores over the three decades



The data has been analyzed by dividing the thirty year period into three periods of ten years each. The initial period is 1991-2000 and the subsequent periods are 2001-2010 and 2011-2020.

Mizoram, notable for its highest social sector expenditure per capita in the initial period, showed significant investment levels. This high expenditure likely facilitated improvements in various aspects of social welfare within the state. In subsequent periods, Sikkim took the lead with the highest expenditures, showcasing remarkable growth rates in its public spending. From the initial period to the middle period, Sikkim's expenditure increased by over 182% and then by approximately 229% in the last decade. This aggressive investment strategy significantly boosted the state's social and developmental indicators, aligning with its high HDI scores. Other states with high social sector spending per capita in the last period i.e., 2011-2020 are Goa, Arunachal Pradesh and Mizoram.

In contrast, Uttar Pradesh, which had the lowest social sector expenditure in the initial period, demonstrated modest increases in spending that did not translate effectively into HDI improvements. The percentage increase in Uttar Pradesh's social expenditure was significant, but the low starting base meant that even these increases were not enough to substantially address its developmental challenges. In the subsequent periods, Bihar witnessed the lowest social sector expenditure per capita which is mirrored in its persistently low HDI scores. This correlation underscores the critical impact of social investments on development outcomes, suggesting that insufficient funding can hinder progress in key human development areas. Other than Uttar Pradesh and Bihar, states such as Punjab, West Bengal and Madhya Pradesh witnessed relatively low social sector expenditure per capita in the last period (2011-2020).

In examining the states with the highest HDI, Goa and Kerala stand out with the most consistent high scores. The states' success can be attributed to its effective utilization of social sector investments, translating into superior living conditions and quality of life for its residents. This contrasts sharply with Bihar, which not only struggles with low social sector investment but also with the lowest HDI scores, highlighting a significant gap in development that demands targeted policy interventions to foster growth and improvement. Other than Kerala and Goa, states which exhibit high HDI scores in the last period i.e., 2011-2020 are Himachal Pradesh, Mizoram and Manipur. States which exhibit relatively low HDI scores in the last period i.e., 2011-2020 include Madhya Pradesh, Orissa and West Bengal.

Rationale for public expenditure on human development

Public expenditure on human development is fundamental for fostering inclusive and sustainable societies. Firstly, investing in essential services like education, healthcare, and social welfare enhances human capital, thereby improving productivity and

unlocking opportunities for socio-economic advancement. By providing access to quality education and healthcare, governments can empower individuals to realize their full potential, leading to increased workforce participation, innovation, and economic growth.

Secondly, public expenditure on human development plays a crucial role in reducing inequality and addressing social disparities. By prioritizing spending on marginalized communities and regions, governments can mitigate the effects of poverty and exclusion, promoting social cohesion and stability. Moreover, targeted investments in education and healthcare can break the cycle of intergenerational poverty, empowering future generations to break free from systemic barriers and achieve upward mobility.

Moreover, public expenditure on human development is essential for building resilient and sustainable societies. By investing in preventative healthcare, early childhood education, and social safety nets, governments can mitigate the adverse effects of crises and shocks, ensuring that vulnerable populations are protected and supported during times of uncertainty. Additionally, fostering participatory governance and community engagement in decision-making processes can enhance the effectiveness and accountability of public spending, leading to better outcomes for all members of society.

Human development and economic growth

The interdependency of economic growth and human development is a significant aspect of global progress. Economic growth serves as a catalyst for enhancing human development by providing resources, opportunities, and infrastructure that enable individuals and societies to thrive. Conversely, human development, which encompasses various dimensions such as health, education, and living standards, contributes to sustained economic growth by fostering productivity, innovation, and social cohesion.

At its core, economic growth fuels human development by generating income and employment opportunities, thereby lifting people out of poverty and improving their living standards. Increased income levels enable individuals to access essential goods and services, such as healthcare, education, and housing, which are critical for enhancing well-being and quality of life. Moreover, economic growth creates a conducive environment for investment in social infrastructure and public services, leading to improvements in healthcare systems, educational institutions, and social welfare programs.

Conversely, human development plays a crucial role in sustaining economic growth by cultivating human capital, promoting innovation, and fostering social stability. Investments in education and healthcare enhance the knowledge, skills, and

productivity of the workforce, driving technological advancements, entrepreneurial activities, and economic diversification. Moreover, improvements in health outcomes, such as increased life expectancy and reduced mortality rates, contribute to a more productive and resilient labor force, ultimately boosting economic productivity and competitiveness.

Human development initiatives, such as poverty reduction programs, social safety nets, and gender equality measures, contribute to social cohesion, political stability, and inclusive growth. By addressing disparities in income, access to opportunities, and social rights, human development fosters a more equitable distribution of wealth and resources, thereby reducing social tensions and promoting sustainable development outcomes.

Social sector expenditure and human development

Social sector expenditure

Social sector expenditure refers to government spending allocated specifically to certain sectors that directly contribute to the well-being and development of its citizens. These sectors primarily encompass areas like education, health, urban and rural development, nutrition, sanitation, water availability and other protective and promotional measures.

Spending on the social sector is critical as it tends to benefit the poor relatively more than the rich and because it significantly enhances the human capital of the economy, which can produce direct growth effects for the rest of the economy. In the case of India- as with many other developing economies- the Government's expenditure on the social sector assumes importance on three accounts. The first being the magnitude of deprivation in the country being too large to be left to the market forces alone to tackle. Secondly, the proportion of poor households utilizing Government services is higher as compared to the richer households and thirdly, to ensure clearly articulated outcomes in social sectors such as the Sustainable Development Goals (SDGs).

Public Expenditure on Social Sector of India including health & education is a major concern to improve the Human Development Index rank of the country. The education and health status of a vast majority of the population continues to remain poor even after a decade of reforms (Joshi 2006). Though the Union Government assists the States by providing funds through different Centrally Sponsored Schemes (CSS) & Central Sector Schemes, it is also the responsibility of the States to prioritize as well as make best allocation of their resources available. Social sector expenditure plays a fundamental role in enhancing human development, reducing inequality, stimulating economic growth, poverty alleviation etc. This study aims at investigating the extent to which social sector expenditure influences HDI. This makes it important to know about the evolution of HDI.

Education sector

The role of education in driving social and economic development is widely acknowledged in India, with the right to education enshrined as a fundamental right in the Constitution of India. The government's commitment to providing free and compulsory education for children aged six to fourteen is depicted by a steady increase in literacy rates rising from 65.38% in 2001 to 74.04 in 2011. Despite this progress, a number of challenges persist in ensuring the delivery of quality education, particularly in primary and secondary education. It is also necessary to address problems such as poor learning outcomes and high dropout rates, especially among marginalized groups.

Health sector

Despite some notable achievements in the health sector like eradication of certain diseases, glaring failures still remain a concern. The present healthcare system predominantly caters to urban populations, with a disproportionate focus on curative programs over preventive, socio-economic, and educational aspects. Access to and benefits from public health services vary significantly between better-endowed and vulnerable sections of society, particularly affecting women, children, and socially disadvantaged groups.

Other challenges include inadequate public health spending and reliance on out-of-pocket payments reflecting the disparities in access to healthcare services. Addressing these challenges is crucial to ensure equitable access to quality healthcare for all segments of society.

States play a crucial role in improving the health and education sectors in India, given the decentralized nature of governance and the diversity of the socio-economic landscape across regions. In the realm of healthcare, states play a pivotal role in the delivery of healthcare services, including the establishment and management of primary healthcare centers, district hospitals, and other healthcare facilities. Moreover, states have the authority to design and implement specific initiatives to address local health challenges, such as disease outbreaks, maternal and child health issues, and endemic diseases. Similarly, in the education sector, states play a crucial role in ensuring equitable access to quality education by addressing regional disparities, promoting inclusive education for marginalized communities, and improving the overall educational outcomes. A substantial proportion of funding for the education and health sectors in India is provided by the states. By prioritizing expenditure on education and health, states demonstrate their commitment to improving human development outcomes and addressing the needs of the people.

Human development index (HDI)

HDI is a composite statistical measure developed by the United Nations to assess and

compare the level of human development across different countries and regions. It serves as a summary indicator of a region's overall well-being and development by considering multiple key dimensions of human life.

The HDI is calculated as the geometric mean (equally-weighted) of life expectancy, education, and GNI per capita. The education dimension is the arithmetic mean of the two education indices (mean years of schooling and expected years of schooling).

Higher values of HDI indicate a higher level of human development. The individual dimension scores are then combined to create an overall HDI score, providing a comparative measure of human development across regions. HDI is crucial in measuring human well-being, fostering equity, and tracking development progress. It informs policies, highlights disparities, and guides efforts to enhance health, education, and living standards worldwide.

India, as the world's most populous and diverse nation, has made significant strides in its journey towards development and progress. In 1991, India witnessed substantial economic reforms aiming at liberalization, privatization and globalization that resulted in very significant changes in the Indian economic landscape. However, these reforms did not give much attention to the issue of regional disparities prevailing in the country. Also, they underscored the importance of human development within the nation.

With time, the policymakers recognized the need to ensure that economic growth benefits all sections of the society. This created a situation where efficient allocation of resources to the social sectors, encompassing education, health care and social welfare was inevitable.

The data reveals substantial variation in social sector expenditure per capita across Indian states over the study period. While all states experienced an increase in social sector spending in absolute terms, the pace of growth differed significantly. The dispersion of expenditure widened over time, indicating increasing divergence in per capita social spending across states.

Human Development Index values also exhibit notable cross-state variation over the study period. Although HDI improved for all states, the degree of improvement was uneven, resulting in persistent differences in development outcomes. States that initially recorded higher HDI values continued to maintain their relative positions over time, while states starting with lower HDI levels showed improvements but did not fully close the gap. This persistence suggests stability in relative human development rankings across states.

A preliminary comparison of social sector expenditure per capita and HDI trends indicates that movements in the two variables display broadly similar directional patterns over time. Periods of higher growth in public social spending coincide with phases of improvement in HDI, although the strength of this association varies across states. These observed patterns provide a descriptive basis for examining whether a

stable long-run relationship exists between social sector expenditure per capita and human development, which is formally tested using cointegration analysis.

While India has made substantial advancements, regional disparities in development still remain as a challenge. Variations in social sector spending, implementation of policies, and the inability of states to harness resources for human development have contributed to these disparities. To investigate the evolution of such regional disparities, it becomes necessary to take into consideration the HDI across all Indian states.

For doing so, we employed the Augmented Dickey-Fuller (ADF) test to check for stationarity of the variables. The ADF test is a common statistical procedure used to test for the presence of a unit root, a characteristic that indicates non-stationarity in time series data. The presence of a unit root suggests that shocks to the time series have a permanent effect, whereas the absence of a unit root (stationarity) implies that the series reverts to a long-run mean over time.

The results suggest that the Social sector expenditure per capita time series is not stationary at the 5% significance level and that the HDI time series is stationary, implying that it does not exhibit persistent shocks and is likely to revert to a long-term mean. Since SOC is non-stationary and HDI is stationary, we employed the Johansen-Procedure for cointegration which yielded significant results indicating a long-term relationship between social sector expenditure per capita (SOC) and Human Development Index (HDI) (Table 1).

Table 1 Cointegration results

Eigenvalues (lambda):				
0.73233731 0.05455749				
Values of test statistic and critical values of test:				
	test	10 pct	5 pct	1 pct
r<=1	38.54	6.5	8.18	11.65
r=0	944.03	15.66	17.95	23.52
Eigenvectors normalized to first column:				
	diff_soc.12	pdata.HDI.12		
diff_soc.12	1	1		
pdata.HDI.12	-531.454	-531207.7		
Weight w:				
	diff_soc.12	pdata.HDI.12		
diff_soc.d	-2.29E+00	6.40E-03		
pdata.HDI.d	-2.37E-06	3.50E-07		

Source: Author's calculations

The results suggest that changes in social sector expenditure per capita have a statistically significant association with variations in the Human Development Index. In this context, the presence of cointegration between social sector expenditure per capita and Human Development Index indicates that these variables move together over time, with any deviation from their long-term relationship eventually being corrected. This implies that, in the long run, changes in social sector expenditure are associated with changes in the Human Development Index.

Therefore the cointegration results suggest that investments or disinvestments in social sector expenditure can have lasting impacts on human development outcomes, influencing factors such as education, healthcare, and overall well-being. Recognizing and understanding this cointegration relationship is crucial for policymakers and researchers, as it reflects the importance of sustained investments in social sectors to promote long-term human development and socio-economic progress.

Regression analysis

In this section of our study, we focus on analyzing the impact of social sector expenditure, particularly education expenditure, on a non-income dimension of the Human Development Index (HDI) by employing a component-wise approach. The education expenditure data pertains to the corresponding state finances. The education index, which is a crucial component of the HDI, serves as our dependent variable in this analysis. It is primarily constructed using the mean years of schooling of the adult population, which is calculated by converting the highest level of education completed into standardized years of education, along with indicators of school attendance across different age groups covering primary, secondary, and tertiary levels. These measures capture the accumulated stock of education as well as current educational participation, and providing a comparable measure of educational development across states.

We chose the education index as the dependent variable because education plays a significant role in human development, influencing individuals' capabilities, economic opportunities, and overall well-being. By focusing on the education index, we aim to understand the extent to which investments in education contribute to improvements in the HDI across Indian states.

Education outcomes are indeed influenced by various socio-economic and institutional factors other than education expenditure and per capita income. In this study, the influence of such unobserved factors is accommodated through the use of a fixed effects regression model, which controls for time-invariant state-specific characteristics. Moreover, the education index itself is a composite measure which implicitly capture the effects of past policies and structural conditions. The inclusion of per capita income further takes into account the economic conditions affecting educational outcomes.

This model's significance lies in its ability to assess the specific impact of education expenditure per capita and per capita income on the education index. By examining these variables separately, we can understand the relative importance of investments in education compared to broader economic factors in driving educational outcomes and, consequently, overall human development. This approach provides a deeper understanding of the mechanisms through which social sector expenditure influences key development indicators, thereby offering valuable insights for policymakers and economists aiming to improve human development outcomes in India.

The modeling is done using fixed effect regression with the education index as the dependent variable and education expenditure per capita and per capita GSDP as the predictor variables.

The regression results indicate that both the log of education expenditure per capita and the log of state GDP per capita have a statistically significant positive association with the education index (Table-2).

Table 2: Regression results

	Dependent variable:
	Edu_index
log_Edu_exp_percapita	0.054***
	(0.004)
log_SGDP_percapita	0.049***
	(0.005)
Observations	732
R^2	0.487
Adjusted R^2	0.464
F Statistic	332.450*** (df = 2; 699)
Note:	*p<0.1; **p<0.05; ***p<0.01

Specifically, for every one percentage increase in education expenditure per capita, the education index is estimated to increase by approximately 0.054 units, holding other variables constant. Similarly, for every one percentage increase in GSDP per capita, the education index is estimated to increase by approximately 0.049 units, holding other variables constant.

These findings suggest that higher education expenditure per capita and higher state GDP per capita are associated with higher education index scores, indicating the importance of both financial investment in education and overall economic prosperity in promoting educational outcomes.

The model also demonstrates a relatively high explanatory power, with an adjusted R-squared value of 0.46404, indicating that approximately 46.4% of the variance in the education index can be explained by the predictor variables included in the model.

Comparative study: Kerala and Bihar

In India's socio-economic landscape, Kerala and Bihar depict two contrasting cases. Kerala is often hailed as a beacon of progress with consistently high levels of Human Development Index (HDI). On the contrary, Bihar struggles with a lot of challenges which resulted in low HDI levels throughout the years.

The following table presents various indicators related to demography, income, education, and health for the states of Bihar and Kerala over different years(Table 3).

Table 3 : Socio-Economic Indicators - Bihar vs. Kerala

INDICATORS			
DEMOGRAPHY			
S.No.	Indices	Bihar	Kerala
1	Total Population - 2001	84386000	31972000
2	Total Population - 2011	105057000	33502000
3	Sex Ratio - 2001	919	1058
4	Sex Ratio - 2011	918	1084
INCOME			
1	GSDP per capita - 1991	2656.158	9718.177
2	GSDP per capita - 2001	7330.305	30694.04
3	GSDP per capita - 2011	23524.75	108664.5
4	GSDP per capita - 2021	52378.69	264974

5	Percentage of population below poverty line - 1993	60.5	31.3
6	Percentage of population below poverty line - 2004	54.4	19.7
7	Percentage of population below poverty line - 2011	33.74	7.05
	EDUCATION		
1	Literacy rate - 1991	37.49	89.81
2	Literacy rate - 2001	47	90.86
3	Literacy rate - 2011	61.8	94
4	Literacy rate - 2022	70.9	96.2
5	Gross Enrollment Ratio (%) Elementary schools - 2021	96.2	101
6	Gross Enrollment Ratio (%) Secondary schools - 2021	64.9	97.9
7	Gross Enrollment Ratio (%) Sr. secondary schools - 2021	35.9	85
	HEALTH		
1	Life expectancy at birth (2014 - 2018)	69.1	75.3
2	IMR 1992	89.2	23.8
3	IMR 2005	62	15
4	IMR 2019-2021	46.8	4.4
5	MMR 2010-2012	22.8	3.3
6	MMR 2015-2017	16.9	1.9
7	MMR 2018-2020	11.2	0.9

Figure 3: HDI trends of Bihar and Kerala

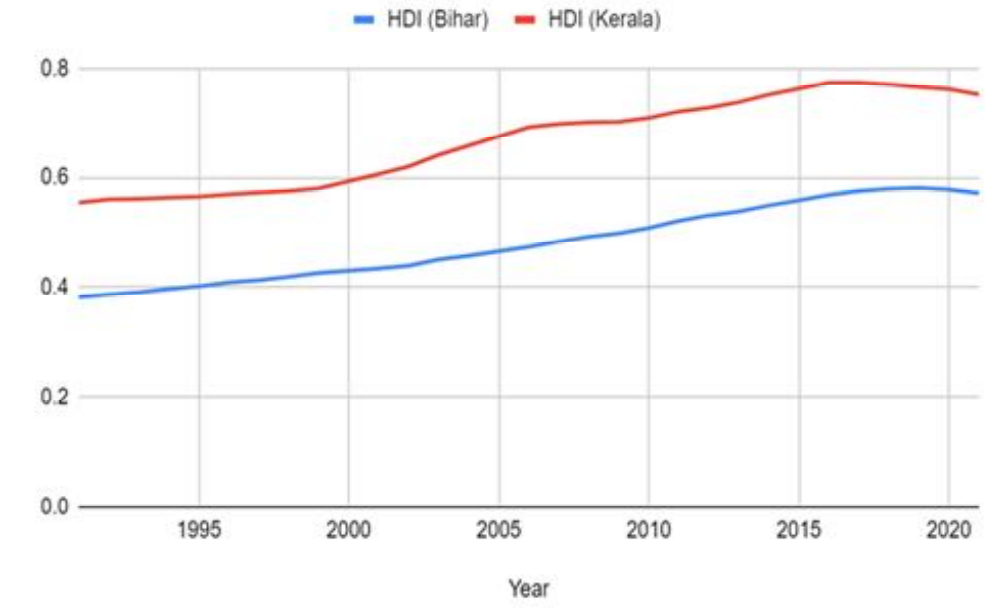


Figure 4: Social sector expenditure per capita trends of Bihar and Kerala

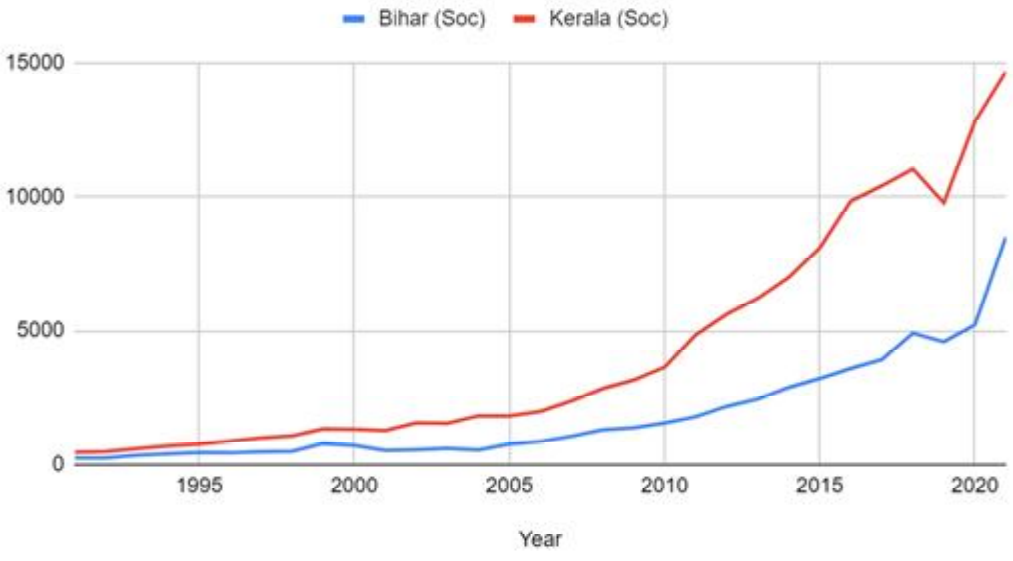


Figure 3 depicts the Human Development Index (HDI) trends of Kerala and Bihar from 1991 to 2021. Throughout the entire period, Kerala consistently maintains higher HDI levels compared to Bihar. This is depicted by the clear gap between the HDI scores of the two states, indicating a persistent disparity in human development outcomes.

Figure 4 illustrates the trends in social sector expenditure per capita in Kerala and Bihar from 1991 to 2021. Kerala consistently maintained higher levels of social sector expenditure per capita compared to Bihar throughout the entire period. The gap between the two states gradually widened until 2005, after which Kerala's per capita expenditure witnessed a substantial surge, thereby widening the disparity between the two states.

Kerala's journey towards high HDI can be attributed to a combination of factors that led to its socio- economic advancement. Central to this advancement is its commitment to decentralized governance and grassroots empowerment. This has empowered the local governments, thus fostering greater participation of people in, which processes which further ensures that development initiatives are adopted in such a way that they meet the specific needs of every region. Kerala has fostered a culture of participatory democracy through initiatives like the People's campaign.

The People's Campaign, launched by E.M.S. Namboodiripad, the first Chief Minister of Kerala, was a pioneering initiative aimed at fostering grassroots democracy and participatory governance in the state. Launched in the early 1990s, the campaign sought to decentralize the planning process, empowering local communities to actively participate in decision-making and development initiatives. At the heart of the People's Campaign was the concept of decentralized planning, wherein local bodies, such as panchayats and municipalities, were entrusted with the responsibility of identifying local development priorities and formulating plans to address them. The People's Campaign represented a radical departure from traditional top-down approaches to planning, placing the power of decision-making squarely in the hands of the people. Under the People's Campaign, Kerala witnessed a remarkable transformation in its approach to governance, with decentralized planning becoming a cornerstone of the state's development strategy.

Grassroots organizations such as neighborhood groups, women's collectives, and youth forums have served as catalysts for community empowerment, social mobilization, and grassroots innovation. One such organization is Kudumbashree, a women-oriented self-help group movement launched by the Government of Kerala in 1998, which has played a pivotal role in empowering women at the grassroots level, fostering economic independence, and promoting community development through various income-generating activities, micro-enterprises, and social welfare programs.

Moreover, a greater focus on social welfare programs and development of human capital has been instrumental in improving education and health outcomes. Kerala's

robust education system which is a result of high public spending in the education sector along with literacy campaigns have reduced illiteracy levels in the state. Kerala's healthcare infrastructure, complemented by robust economic support, has elevated its health status to levels on par with many developed nations. Extensive primary and community health centers, reaching even remote rural areas by the 1970s, contributed to significant improvements. Key indicators like crude death rate and infant mortality rate showed remarkable declines, reflecting the state's commitment to public health. Traditional Ayurvedic practices, alongside European medical care introduced in the early 19th century, further enriched Kerala's healthcare landscape, fostering impressive gains in life expectancy comparable to global benchmarks like Japan.

Despite its achievements, Kerala faces a lot of challenges in maintaining these high standards. The sustainability of its healthcare infrastructure amidst evolving demographic and epidemiological trends still remains a concern. Despite high literacy rates, one significant challenge is ensuring quality education, with issues like curriculum relevance and educational equity that demand continuous attention. Furthermore, Kerala's heavy reliance on remittances from the Gulf countries is also a risk factor due to their volatility. Addressing all these challenges will be crucial for Kerala to sustain its high levels of health and education indices in the long run.

In contrast to Kerala, Bihar's development journey is characterized by limited citizen participation in planning processes which has resulted in low HDI scores and lagging indicators of education and health. Despite substantial improvement in social sector expenditure per capita over the years, Bihar still struggles to bring about tangible improvements in human development indicators mainly due to factors such as inadequate infrastructure, limited healthcare access etc.

Bihar's historical underinvestment in education and healthcare, along with infrastructure gaps and unfavorable socio-political conditions have created obstacles in its journey towards high HDI levels. Decades of underdevelopment, and resulted from factors such as poor governance, inadequate spending in the social sector and lack of effective policy implementation have left Bihar in extreme poverty.

The state's education sector has been plagued by various issues like low literacy rates, inadequate school infrastructure and huge dropout rates. In spite of various efforts to improve educational outcomes such as the implementation of various schemes and initiatives, Bihar still struggles with educational disparities especially in rural areas where access to quality education is limited.

Furthermore, other factors like corruption, political instability and ineffective governance worsened the situation. Political instability and frequent changes in leadership have contributed to policy paralysis which in turn hindered long term planning and development initiatives. Bihar's geographical vulnerabilities including susceptibility to droughts have worsened the situation.

Emphasizing investment in healthcare, education, and grassroots empowerment initiatives like Kudumbashree can further enhance Kerala's position and serve as a model for other regions. Also there is a need for diversified economic strategies to mitigate potential shocks. Meanwhile, Bihar must prioritize reforms addressing poverty, healthcare, and education, alongside fostering decentralized governance and community participation, to uplift its citizens and narrow the gap with states like Kerala. This calls for concerted efforts from policymakers, the citizens, and communities to build a more equitable society for all.

Conclusion

Firstly, this study has revealed the existence of a significant long-term relationship between social sector expenditure per capita and Human Development Index, highlighting the pivotal role of public spending in fostering human development. This reflects the importance of continued investment in vital services like education, healthcare, social welfare and the need for governments at both the state and national levels to prioritize public spending as a means to address problems such as regional disparities thereby achieving inclusive growth.

Secondly, this study has shed light on the influence of education expenditure per capita and per capita income on the education index, revealing that both factors play a crucial role in shaping the education index. While per capita education expenditure is an important determinant, target spending on education remains crucial for improving educational outcomes and enhancing human capital, improving productivity and unlocking opportunities for socio-economic advancement.

Further, the comparative analysis of Kerala and Bihar reflects the importance of people's participation in decision making, decentralized governance, grassroots empowerment, and effective policy implementation in driving high HDI levels. Kerala's success story, characterized by robust social welfare programs and grassroots empowerment serves as a model to other states for effective human development strategies. On the contrary, the challenges faced by Bihar, ranging from historical underinvestment in vital sectors and governance issues to socio-economic and political vulnerabilities, highlight the urgent need for comprehensive reforms to improve various social indicators.

Overall, this research provides empirical evidence and policy insights for promoting human development and well-being in India. It is important to address regional disparities, enhancing public service delivery, and foster participatory governance, to achieve more equitable, resilient, and sustainable societies.

Fostering collaborations between government agencies, civil society organizations, and local communities is essential for maximizing the impact of social sector spending and ensuring that development initiatives are tailored to meet the specific needs of

diverse populations. Through continuous monitoring, evaluation, and adaptation of policies, India can navigate the complexities of its development landscape.

However, it is essential to acknowledge the limitations of this study, including the complexity of establishing causal links between expenditure per capita and HDI, the influence of external factors beyond the scope of this analysis, and the evolving nature of development challenges. By fostering multi-stakeholder collaboration, we can collectively strive towards achieving the vision of a society characterized by inclusive and equitable growth. Future research should aim to further refine our understanding by exploring innovative policysector and leveraging data-driven approaches to advance human development goals in India.

Implications

The main finding of the thesis is that there exists a significant positive association between social sector expenditure and Human Development Index (HDI) across Indian states, highlighting the crucial role of investment in social sectors for enhancing human development outcomes. The following policies can be thought about and implemented:

- Prioritize targeted investment in education, particularly in states with lower literacy rates and gross enrollment ratios, to enhance human capital formation and drive sustainable development.
- This implies strengthening public investment in primary, secondary, and higher education, with a focus on reducing dropout rates, improving school infrastructure, and ensuring equitable access to quality education across rural and urban regions. Due to the cumulative nature of the education index, sustained investment rather than short-term spending increases is essential to generate long-term improvements in human development outcomes.
- Adopt the best practices and learn from states with high development outcomes to inform policy decisions and initiatives aimed at improving social sector performance.
- The findings highlight the importance of institutional learning and policy diffusion across states. Successful experiences from high-performing states-such as effective decentralization, community participation, and prioritization of social welfare-can be adapted by lagging states while accounting for regional socio-economic conditions and administrative capacity.
- Strengthen decentralized governance structures and empower grassroots communities thereby ensuring effective implementation and delivery of services.
- This can be done by enhancing the fiscal and administrative autonomy of local

governments, encouraging participatory planning, and strengthening local institutions. Grassroots empowerment can improve targeting efficiency, accountability, and responsiveness of social sector programs, thereby improving the translation of expenditure into human development gains.

- Establish robust monitoring and evaluation mechanisms to track the progress of social sector programs and initiatives, enabling evidence-based decision-making and continuous improvement. Regular assessment of program performance can help identify gaps in implementation, reduce leakages, and ensure that public resources are aligned with development objectives, thereby enhancing the overall effectiveness of social sector spending.
- The existence of a long-run relationship between social sector expenditure and HDI suggests that the benefits of public spending materialize gradually over time. This highlights the importance of sustained and predictable investment in education, health, and social welfare rather than short-term or ad hoc increases, enabling states to build durable human capital and development outcomes.

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■

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Do Government funded health insurance schemes reduce out of pocket expenditure? Evidence from Kerala State.

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Abstract

India's state health systems differ greatly in terms of spending, availability of healthcare personnel and overall health outcomes. States differ in how much the government spends on health care per person (Per capita health spending). Per capita health spending (PCH) is typically higher in southern states in India, suggesting comparatively stronger public sector health investments. Kerala continuously ranks among the Indian states with the highest per capita public health spending. Conversely, larger northern states in India with lower per capita health spending include Madhya Pradesh, Uttar Pradesh and Bihar. But, among all Indian states, Kerala had the highest OOPE[1] expenditure. Based on data published in the National Health Accounts 2016-17, household out-of-pocket expenditure in Kerala constituted approximately 58.7%. By analysing the data of the Indian economy, it was inferred that about 12% of the rural as well as 8% of the urban households fell into the below poverty line category due to the health care expenses (Peter Berman and Rajeev Ahuja, 2004)[2]. (Pattayat, Parida, & Awasthi, 2022)[3]. Therefore, ensuring strong financial protection becomes a crucial policy imperative to move toward universal health coverage (UHC) and reduce catastrophic health expenditures (CHE).

This study thus evaluated the effectiveness of publicly funded health insurance schemes in Kerala, particularly their role in improving access to health care and reducing out of pocket expenditure (OOPE) and the incidence of catastrophic health expenditure (CHE) using data from NSSO of 71st and 75th Round of Health Survey. In line with the approach of Garg et al.(2020)[4], (Ranjan et al., 2020)[5] to evaluate PMJAY in Chhattisgarh, this study explores the extent to which the enrolment in the earlier government funded health insurance scheme-prior to the introduction of AB-PMJAY contributed to improved access to hospital utilisation and reduced OOPE in Kerala.

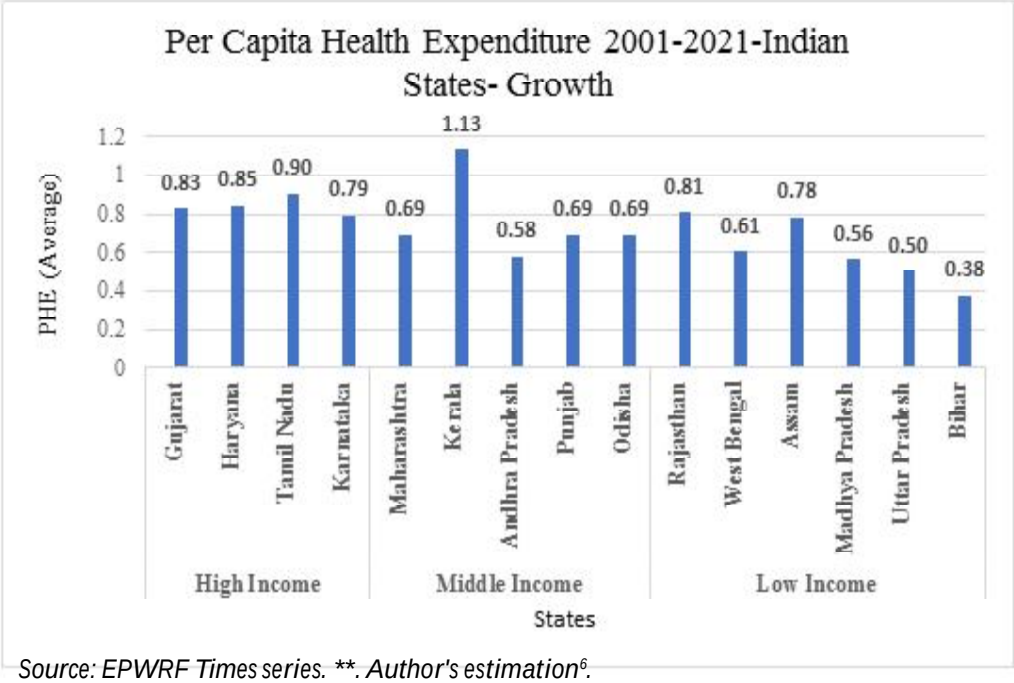
Keywords: *Universal health coverage (UHC),Health Insurance,Catastrophic health expenditure (CHE), RSBY, AB-PMJAY.*

1. Introduction & Back ground:

The differences in health spending and physical infrastructure facilities between states highlight a basic difficulty for effective implementation of any national health protection program: that is; finding a balance between ensuring equitable progress in important health outcomes. Therefore, allowing sufficient flexibility to adjust to local needs while simultaneously aiming for comparable health outcomes across India's various states is the primary challenge for the national health protection scheme.

Southern states display higher levels of per capita health expenditure, reflecting stronger public investment in the health sector. The State of Kerala has consistently retained one of the highest levels of per capita public health spending both before and after COVID-19. It also relates to its strong decentralized health system, substantial social sector allocations and long standing policy commitment to public health. Larger northern states like Madhya Pradesh, Uttar Pradesh and Bihar have lower per capita health expenditure, probably because of their large populations and relatively lower levels of income. This suggests that resource constraints could be a reason for the observed differences in health outcomes (Figure 1).

Figure 1- Indian States Per Capita Health Expenditure. (Decadal Average)



*Source: EPWRF Times series. **. Author's estimation[6].*

The average growth of per capita public health expenditure (PHE) in selected Indian states over the course of two decades, divided into high, middle and low- income groups, is depicted in Figure 1. In PHE, Karnataka lags (0.75) Gujarat (0.82) and Tamil Nadu (0.90) among high-income states. There are notable differences among middle-income states, with Kerala (1.14) showing the fastest growth in per capita health spending. Kerala (a better-performing state) shows a strong commitment to healthcare, while low-income states emphasize the need for increased public health spending to ensure equitable access to healthcare services.

While states differ widely in per capita health expenditure, intergovernmental transfers-particularly through Centrally Sponsored Schemes (CSS)remain an important mechanism supporting state level health financing irrespective of these spending levels.

A major part of the conditional transfers from the central government to the states is in the form of CSS, which include health insurance programs like Rashtriya Swasthya Bima Yojana(RSBY),AB-PMJAY etc. Although these programs are intended to address national priorities, their efficacy frequently hinges on each state's administrative and financial capabilities.

Smith, Dong, and Chhabra (2019),[7] NHA policy brief examined state-level disparities in the utilization of the PMJAY scheme in relation to indicators of health need such as poverty rates and disease burden. The brief revealed a paradoxical pattern: states with greater need, measured by higher poverty headcount and greater disease burden (e.g., Bihar and Uttar Pradesh), tended to show lower utilization of AB-PMJAY, while relatively better-off states like Kerala, Maharashtra and Karnataka recorded higher claims and better uptake of the scheme. The above study relied on early-stage data of AB-PMJAY. Building on this evidence, the present study seeks to explore whether the health insurance scheme -prior to the introduction of AB-PMJAY- has contributed to advancing UHC and reducing CHE[8] in Kerala by using secondary data from NSS health surveys. Since no household survey data were available for the period following the implementation of the AB-PMJAY scheme, the study relies on the two earlier rounds of the NSSO health surveys conducted during the period when the RSBY scheme was in operation.

II. Objective

To measure the effectiveness of the Government funded health insurance schemes (Prior to AB-PMJAY) in reducing out of pocket expenditure in Kerala.

III. Methodology

The literature on the evaluation of PFHI schemes, indicates that the estimation should ideally be based on data from multiple time points, one of which should be pre scheme implementation. Data for this study come from two rounds of repeated cross sections:

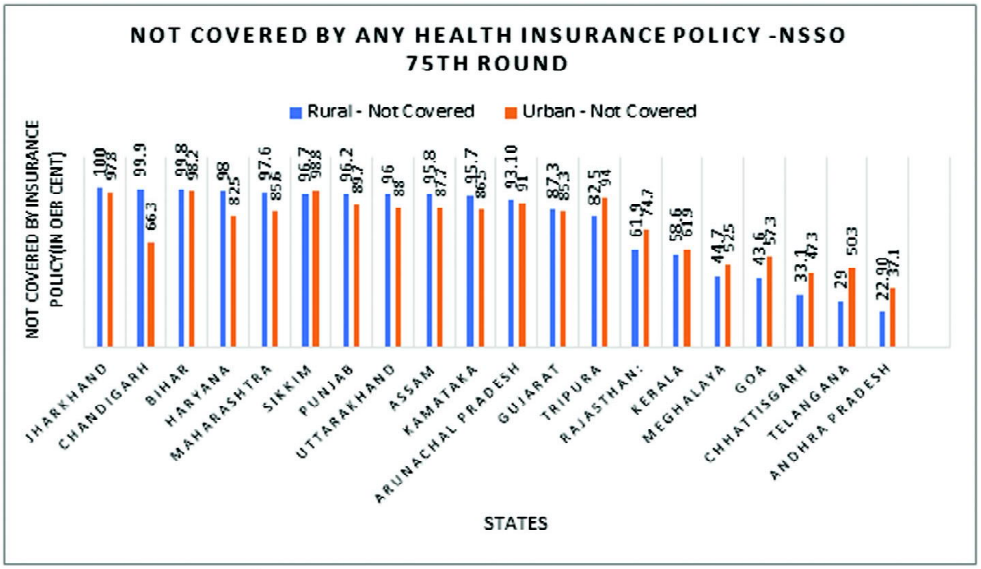
the 70th and 75th rounds of India's National Sample Survey (NSS) data. The 70th round has provided information on OOPE and hospital care in 2014, and the 75th round has presented similar data for 2017 and it is before the AB-PMJAY scheme was introduced. Thus, the NSS data captures the functioning of the earlier RSBY scheme. Financial protection measured here using the variable Catastrophic Health Expenditure (CHE), as developed by Wagstaff and van Doorslaer[9].

Out of Pocket Expenditure (OOPE) = Medical expenses + expenses on transportation+ other non- medical expenses incurred -deducting any cash reimbursements received by the patient.

IV. Results

To attain UHC in nations with middle class or lower income populations, the World Health Organisations (WHO) proposed a Social Health Insurance program. The following general categories of health insurance plans are offered in India to help with medical expenses: (i) sponsored by the government (such as PMJAY, RSBY, Arogya Sri, etc.) (ii) employed by the government or PSU (such as CGHS, government reimbursement, etc.) (iii) Employer sponsored health protection (like ESIS) that is not provided by the government or PSU (iv) Household insurance plans set up with insurance providers, and (v) Other plans.Despite recent progress, the NSSO 75th Round report on Key Indicators of Social Consumption in India: Health shows that a substantial share of the population is still not covered under any health insurance scheme.[10] (Figure 2).

Figure 2 - Not covered by any health insurance policy



Source: NSSO data of 75th round (2017-18). The author compiled.

India needs to focus on lowering OOPE and increasing service coverage to strengthen its healthcare system and make it more affordable and available to all its citizens.

According to the survey, many households are still dependent on paying for medical needs out of pocket, which makes them more vulnerable financially. Disparities in access to healthcare are exacerbated by the higher prevalence of uninsured people in rural areas and low-income groups. Additionally, the data show that although state specific programs and government funded health insurance schemes[11] like Rashtriya Swasthya Bima Yojana (RSBY - Centrally Sponsored Scheme-Health insurance before 2018) were implemented by the centre to lower OOPE, their effects differed by region and were less successful in low-income states.

Kerala has made great strides in implementing government-sponsored health insurance schemes. The State Government launched the Comprehensive Health Insurance Scheme (CHIS) in 2008 on the lines of the Centre's Rashtriya Swasthya Bima Yojana (RSBY) to cater to wider sections of society. It was extended to senior citizens years later. Subsequently, in 2018, the Kerala Government formulated Karunya Arogya Suraksha Padhathi (KASP) by integrating all the Government-sponsored health care schemes with Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana (PMJAY). The following table gives a summary of the PFHI scheme in Kerala (Table 1).

Table 1 - PFHI schemes and annual cover in Kerala State

Year	PFHI Scheme	Annual cover per family	Eligible group
2014	RSBY	INR 30,000 (USD 425)	BPL Families
2018	PMJAY-KASP[12] KBF	Rs.5 Lakh Per Family	Based on the deprivation and occupational criteria of Socio-Economic Caste Census (SECC)

Source: Author's Compilation. Ministry of Health and Family Welfare: Rashtriya Swasthya Bima Yojana (RSBY). Government of India. State Health Agency, Kerala, Karunya Arogya Suraksha Padhathi (KASP). Government of Kerala.

The Karunya Arogya Suraksha Padhathi (KASP) offers health coverage of up to Rs. 5 lakh per family each year for secondary and tertiary hospitalization. This scheme aims to help over 42 lakh poor and vulnerable families, which includes

about 64 lakh beneficiaries, from the bottom 40 percent of Kerala's population. The following table gives a summary of Karunya Arogya Suraksha Padhathi (KASP) scheme of Kerala (Table - 2).

Table 2 - AB-PMJAY KASP Features

Scheme's services	197 government hospitals and 364 private hospitals.	Treatment is provided without charging money from any of the selected institutions, regardless of whether they are government or private hospitals,	
Scheme covers	Medicines, related materials, tests, doctor's fees, operation theatre charges, ICU charges, and implant charges	KASP-PMJAY benefits 41.99 lakh poor and vulnerable families.	Implemented through the State Health Agency, the scheme has an annual premium of Rs.1050 per family.
Scheme includes	1667 packages across 25 specialties.	Additionally, free treatment is available from 89 packages provided by the government.	For treatments not included in the specified packages, unspecified packages can be used
Treatment costs	Three days before hospital admission and medicines required for 15 days post-discharge (as per the doctor's instructions) are provided under the scheme.	So far, Rs.337 crore has been distributed (2024-25)under the scheme.	

Source: Author's Compilation. State Health Agency, official website,Govt.of Kerala.

Details of enrollment under the KASP scheme (Kerala) is presented in Table 3.

Table 3 - Enrollment under KASP (Kerala)2021-2024

Year	Beneficiaries
20-21	1945914
21-22	10131
22-23	12428
23-24	5298
Total	1973771

Source: State Health Agency, Kerala.

As the Kerala Arogya Suraksha Padhathi (KASP) was introduced in 2018 and no subsequent NSSO health rounds survey has been released, the study is confined to the two rounds of NSSO survey data.

The information on responses for Kerala found from the NSSO data is presented in Table 4:

Table 4 - Responses and cooperation rates in household surveys-Kerala

Response	NSS 71st round (2014) Informants (%) N = (11299)	NSS 75th round (2017-18) Informants (%) N = (19801)
Co-operative and capable	10,382 (93.24)	19,047 (96.10)
Co-operative but not capable	779 (5.92)	647 (3.14)
Busy	46 (0.65)	57 (0.58)
Reluctant	22 (0.19)	50 (0.17)
Others	-	-
Total	11,229	19,801

Source: Authors' estimation using NSS unit level data of 70th round (2014) and 75th round (2017-18). Note: Percentage values in parentheses are sampling weighted.

Hospital care access improvement was examined by considering changes in hospital care use.

Kerala's PFHI enrolment rate has shown a steady increase over the years.

Table 5 and 6 shows scheme wise descriptive findings on enrolment and hospital utilization.

Table 5 - Sample and Percentage distribution of persons covered by various health insurance schemes in Kerala 2014-2018

PFHI scheme	71st (2014)	75th (2018)
PFHI	3,913	6,161
	(36.82)	(33.99)
Not PFHI	316	1,194
	(2.72)	(5.95)
Not Covered by any insurance	7,000	12,446
	(60.46)	(60.06)
Total	100.0	100.0

Source: Authors' estimation using NSS unit level data of 70th round (2014) and 75th round (2017-18). Note: Percentage values in parentheses are sampling weighted.

In each round of the survey, over 50% of the hospitalisations were in the public sector. It accounted for 55% of the hospitalisations in 2018. The rate of hospitalisations of the enrolled PFHI in the public sector decreased. Between 2014 and 2017, the proportion of PFHI enrolled individuals using private hospitals decreased, whereas private sector hospitalizations among the non-enrolled population rose (Table 6).

Table 6 - Percentage distribution of hospitalisation (365 days) with health insurance by hospital type in Kerala 2014-2018.

PFHI scheme	71st (2014)		75th (2018)	
	Public	Private	Public	Private
PFHI	62.46	33.76	54.49	30.49
Not PFHI	0.61	5.32	2.50	10.83
Not Covered	36.93	60.91	43.01	58.68
Total	100.0	100.0	100.0	100.0

Source: Authors' estimation using NSS unit level data of 70th round (2014) and 75th round (2017-18).

Kerala's hospitalization rate has shown an upward trend over the years, for both the PFHI enrolled and the non-PFHI enrolled individuals (Table -7).

Table 7 - Mean OOPE for Hospitalisation (365 days) Episodes (Rs) with 95% CI.

PFHI scheme	Type of hospital	71st (2014) RSBY	[95% C.I]		75th (2018) RSBY,CHIS	[95% C.I]	
PFHI	Public	2493	2029	2956	3210	2761	3659
	Private	14467	12705	16229	15596	13318	17873
Not PFHI	Public	4142	1108	7177	9057	2913	15202
	Private	16577	11177	21978	13969	11211	16727
Not Covered	Public	4244	3247	5240	3772	3242	4302
	Private	28143	24479	31807	23875	21822	25928
Total	Public	3216	2723	3709	3552	3195	3908
	Private	22891	20545	25238	20535	19074	21995

Source: Authors' estimation using NSS unit level data of 70th round (2014) and 75th round (2017-18).

Note: CI denotes Confidence Interval. OOPE amounts for 2014 and 2018 have been adjusted to 2014 prices using the 2011 Consumer Price Index.

The mean OOPE for private hospitals was several times that of public hospitals, which was true for both the PFHI enrolled and the non PFHI enrolled individuals (Table 8).

Table 8 - Median OOPE for Hospitalisation (365 days) Episodes (Rs)

PFHI scheme	Type of hospital	71st (2014) RSBY	75th (2018) RSBY,CHIS
PFHI	Public	1020	1515
	Private	7620	7621
Not PFHI	Public	5140	1771
	Private	8500	6604
Not Covered	Public	1490	1437
	Private	9250	11731
Total	Public	1200	1484
	Private	8500	9649

Source: Authors' estimation using NSS unit level data of 70th round (2014) and 75th round (2017-18).
Note: OOPE amounts for 2014 and 2018 have been adjusted to 2014 prices using the 2011 Consumer Price Index.

The median OOPE in the private sector was estimated to be many times higher compared to that observed in the public sector (Table 8). Descriptive statistics indicate that the median OOPE in the PFHI enrolled unit residing in private hospitals was 17% lower than OOPE for the non-enrolled unit in any scheme.

Table 9 - Proportion of incurred CHE 25 for Hospitalisation (365 days) Episode (%)

PFHI scheme	Type of hospital	71st (2014)	75th (2018)
PFHI	Public	57.97	48.14
	Private	28.02	25.79
Not PFHI	Public	0.00	2.45
	Private	3.51	5.35
Not Covered	Public	42.03	49.4
	Private	68.47	68.86
Total	Public	5.92	8.74
	Private	94.08	91.26

Source: Authors' estimation using NSS unit level data of 70th round (2014) and 75th round (2017-18).
Note: CHE denotes Catastrophic Health Expenditure.

The incidence of CHE25 was substantially higher for private sector hospitalizations than for those in the public sector. (Table 9).

V. Discussions:

The pattern of hospitalisation in the public and private sectors in Kerala reflects significant changes between 2014 and 2018, both in terms account of insurance coverage and to patterns of care seeking behaviour. Table 4 shows that among PFHI enrolled individuals, while the majority continued to rely on public hospitals, the share declined from 62.46 per cent in 2014 to 54.49 per cent in 2018, and that of private facilities also saw a marginal decline. In contrast, the proportion seeking care in private hospitals among non PFHI individuals increased substantially from 5.32 per cent to 10.83 per cent, indicating an increasing dependence on the private sector among those not enrolled in any government funded health insurance schemes. For the large uninsured group, nearly 60 per cent in both rounds, the preference for private hospitals remained consistently high with 60.91 per cent choosing private facilities in 2014 and 58.68 per cent in 2018. These utilisation patterns are closely aligned with the distribution of health insurance coverage, where PFHI schemes covered roughly one third of the population, non PFHI coverage expanded slightly and the uninsured consistently formed the largest segment. The sample distribution of people covered under different health insurance schemes in Kerala shows a pattern of relative stability from 2014 to 2018, with only marginal changes in the distribution across coverage categories.

In Kerala, there is a clear difference in how people use public and private hospitals based on their insurance coverage. Households facing catastrophic health expenditures during hospital stays were much more common among those with private health insurance who went to public hospitals compared to those who went to private hospitals. It stood stands at 57.97% in 2014 and went down to 48.14% in 2018, compared with 28.02% in 2014 and 25.79% in 2018 in private hospitals. This indicates that even though PFHI provides partial financial protection, hospitalisation in public facilities results in a substantial share of households with catastrophic spending.

For the non PFHI insured, it remained low in public hospitals in 2014 and 2018 but increased modestly in private facilities from 3.51% to 5.35%, reflecting higher cost burdens associated with private care even for the non PFHIs. For the uninsured, the financial risk was considerably higher especially in private hospitals, where more than two thirds of households suffered CHE in 2014 and 2018 while public hospitalisation led to a lower but still significant risk of 42.03% in 2014 and 49.4% in 2018.

Overall, the numbers show that, in 2014 and 2018, private hospitals accounted for 91.26% of CHE cases. It has to be pointed out that private sector hospitalization continues to remain the prime driver of catastrophic health spending in Kerala. These results underscore the persistence of households financial vulnerability, especially of the uninsured and underpin the fact that PFHI coverage merely reduces but does not eliminate the risk of catastrophic expenditure, especially when care is sought in the private sector.

VI. Conclusion:

The data indicates that the private sector still dominates inpatient care across all coverage groups, particularly among the uninsured and non PFHI insured in Kerala. The state's high private sector utilization is sustained by persistent structural and preference driven factors, as evidenced by the fact that insurance coverage has not substantially changed hospitalization patterns toward public hospitals.

However, PFHI enrolment saw a steep increase in the post KASP PMJAY period. As no household survey data have been published yet since the 75th round, it is not empirically feasible so far to determine how the pattern of hospitalization has changed during the post-KASP period. A more detailed analysis of whether the enhanced cover under KASP has made any measurable difference in the utilization of public and private hospitals in Kerala can be done when newer survey data become available.

■

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End Notes

1 Note: OOPE means all direct payments by individuals for healthcare services, such as consultation fees, medicines, diagnostics and hospitalization, excluding pre-paid mechanisms like insurance or government subsidies.

2 Berman, P., & Ahuja, R. (2008). Government health spending in India: Getting the priorities right. National Commission on Macroeconomics and Health, Ministry of Health and Family Welfare, Government of India. (World Bank document.)

3 Pattayat, S. S., Parida, J. K., & Awasthi, I. C. (2022). Reducing rural poverty through non-farm job creation in India. The Indian Journal of Labour Economics, 65, 137-160. https://doi.org/10.1007/s41027-022-00359-9

4 Garg, S., Bebarta, K. K., & Tripathi, N. (2020). Performance of India's national publicly funded health insurance scheme, Pradhan Mantri Jan Arogya Yojana (PMJAY), in improving access and financial protection for hospital care: Findings from household surveys in Chhattisgarh state. BMC Public Health, 20(1), 949. https://doi.org/10.1186/s12889-020-09107-4

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5 Ranjan, A., Dixit, P., Mukhopadhyay, I., & Reddy, K. S. (2020). Performance of India's national publicly funded health insurance scheme, Pradhan Mantri Jan Arogaya Yojana (PMJAY), in improving access and financial protection for hospital care: Findings from household surveys in Chhattisgarh state. BMC Health Services Research, 20, 949. https://doi.org/10.1186/s12913-020-05694-0

6 Note: Health Expenditure includes Revenue Expenditure, Capital Expenditure and Loans and Advances. It included only Medical & Public health and Family Welfare expenditure. **States are ranked higher, middle- and low-income states based on GSDP per capita for the year 2021-22.

7 Smith, O., Dong, D., & Chhabra, S. (2019). PM-JAY across Indian states: Need and utilization (Policy Brief No. 2). National Health Authority, Government of India. Retrieved from https://AB-PMJAY.gov.in/sites/default/files/2019-10/Policy%20Brief%202_Need%20and%20Utilization _Web.pdf

8 Note: CHE means out of pocket health spending which is in excess of a threshold of a household's income or consumption that pushes it towards financial distress.

9 Wagstaff, A., & Van Doorslaer, E. (2003). Catastrophe and impoverishment in paying for health care: With applications to Vietnam 1993-1998. Health Economics, 12(11), 921-933. https://doi.org/10.1002/hec.776

10 Ministry of Statistics & Programme Implementation. (2019). Key indicators of social consumption in India: Health (NSS 75th Round, July 2017-June 2018). Government of India.

11 Government-funded health insurance refers to health insurance schemes where the government covers the premium either fully or partially for individuals or households. These plans typically focus on helping the poor, vulnerable and marginalised groups.

12 Note : KASP (Karunya Arogya Suraksha Padhathi (KASP) scheme of Kerala**.**

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An Empirical Analysis of Gendered Pricing and Consumer Perception: Exploring the Pink Tax

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Abstract

This study investigates gender-based pricing disparities in the personal care market, focusing on deodorants and razors sold on two major e-commerce platforms: Amazon and Nykaa. Through price analysis using ANOVA, the study identifies significant platform-based price differences, particularly on Nykaa, but found no consistent evidence of gender-based price discrimination within platforms. A consumer survey was conducted to examine awareness, attitudes, and behavioral responses toward gendered pricing. Cluster analysis revealed three distinct consumer segments based on pricing perception and purchase behavior. Further, regression analysis showed that purchase intention and consumer attitude significantly predicted actual behavior, while awareness and fairness perception did not. These findings indicate that consumer behavior is governed more by underlying intent and resistance to marketing influences than by awareness alone. This study deepens the understanding of gender-based pricing in the online personal care market and highlights the behavioral forces that shape how consumers respond to such disparities.

Keywords: *Pink Tax, Gender-Based Price Discrimination, Consumer Behavior, Price Fairness Perception, Amazon, Nykaa, E-commerce, ANOVA, Cluster Analysis.*

1. Introduction

Gender-based price disparities in consumer products, often referred to as the "Pink Tax," have gathered increasing attention in economic and sociocultural research. The term describes the practice of charging higher prices for products marketed primarily to women than for similar or even identical products marketed to men (Wishart et al., 2024). This issue is especially evident in the personal care industry, which include everyday essentials such as deodorants, razors, shampoos, skin care products, etc. (Pramesti, 2024). Although these products serve the same functional purposes, differences in packaging, marketing strategies, and ingrained societal norms often lead to higher prices for products targeted at women (Duesterhaus, 2011).

Recent studies and social media campaigns like #Ax The Pink Tax have amplified public awareness of how these price disparities place an unfair financial burden on female consumers. Advocacy groups argue that the Pink Tax not only increases women's expenses but also reinforces gender-based stereotypes. International consumer rights organisations have been pushing for legal reforms that would prohibit businesses from charging higher prices for identical products based solely on gender, with some countries, such as Sweden, introducing measures to investigate and address this issue (Kardetoft & Heshmati, 2022). Public outrage has also led some companies to revisit their pricing strategies, with brands like Dove and Gillette making commitments to eliminate gender-based pricing in their product lines.

The growing spotlight on the Pink Tax has raised questions about its implications for consumer behaviour, particularly in the domain of online retail. While most research on gendered pricing has primarily focused on traditional retail markets, the rapid growth of e-commerce platforms offers new insights into how gendered marketing influences price disparities in digital spaces. Online platforms such as Amazon and Nykaa provide contrasting environments for investigating these pricing practices, the distinct strategies between these platforms offer a unique opportunity to examine how gender-based price disparities manifest in online market places.

This study aims to examine gender-based price disparities in the personal care product market, with a focus on deodorants and razors. The study further incorporates findings from a consumer survey to capture how individuals respond to and interpret these differences.

A brief review of the pink tax

The Pink Tax refers to the gender-based pricing phenomenon where products and services targeted toward women are often sold at higher prices than their male-

oriented counterparts. Its development reflects not just economic patterns, but also sociocultural influences, and evolving policy debates. Early activism exposed disparities, while later research quantified their scale and linked them to deeper systemic inequalities.

The concept first gained prominence in the 1990s in the U.S., when advocacy groups revealed that women frequently paid more for personal care items like razors and deodorants, as well as for services like haircuts and dry cleaning, even when men's versions were nearly identical (Lafferty, 2019). This growing awareness led to legislative responses, most notably the Gender Tax Repeal Act, which directly addressed gender-based pricing discrimination (Pramesti, 2024).

In the early 2000s, academic work expanded the debate, situating the Pink Tax within broader economic and sociological frameworks. Scholars highlighted how societal norms and marketing strategies reinforced consumer behaviours that sustained price disparities (Lafferty, 2019). Studies revealed that women also paid disproportionately more for services such as haircuts and vehicle maintenance, reflecting broader gendered economic burdens (Duesterhaus, 2011).

By the mid-2010s, empirical studies systematically measured the Pink Tax, finding that women's products cost, on average, 7% more, with razors, shampoos, and deodorants showing the widest gaps (Wishart et al., 2024). Policy debates at the time also addressed menstrual products, often taxed as luxuries, prompting countries like Kenya, India, Canada, and Germany to abolish the "Tampon Tax" (Pramesti, 2024).

International research further revealed that these disparities vary across contexts, shaped by cultural norms and gendered marketing. Case studies from Indonesia and Sweden demonstrated how rigid gender roles in consumption patterns (Bernadette et al., 2022;Kardetoft & Heshmati, 2022). Branding strategies were found to further inflate women's product prices despite only minor or negligible functional differences (Wishart et al., 2024).

Recent studies have analysed Pink Tax drivers using large-scale consumer data, in the consumer-packaged goods (CPG) sector, findings have been mixed: women were often charged more for deodorants, whereas men sometimes paid higher prices for razors (Bhatia et al., 2021). Such evidence suggests that pricing gaps may be driven more by market segmentation strategies than by deliberate discrimination (Vincent De Urquiza & Cooke, 2020).

Behavioural economic analyses that these disparities often arise from differentiation tactics and brand markups, rather than from explicit gender bias. (Barnes et al., 2022). While the Pink Tax traditionally highlights economic disadvantages faced by women, newer research reveals that men also face gendered

pricing, the phenomenon referred to as the "Blue Tax." Men's skincare, haircare, and apparel are frequently priced higher due to branding tied to ideals of masculinity (Xiong, 2024;Bhatia et al., 2021). This highlights that gendered pricing is a broader market phenomenon that affects women and men in differently.

Research methods

A mixed-methods approach was employed. The first phase focused on a quantitative price analysis of 16 deodorants for each gender and 10 men's and 6 women's razors across Amazon and Nykaa. The analysis is based on 16 product pairs selected using strict matching criteria, ensuring equivalence in brand, quantity, platform, and timing between male and female products. This controlled approach prioritises internal validity and minimises product heterogeneity, which is essential for accurately identifying gender-based price differences. The second phase incorporated a consumer perception survey using a structured questionnaire supported by cluster analysis and regression analysis

Price Analysis

The study applied one-way ANOVA tests to examine pricing disparities in deodorants and razors across the two e-commerce platforms. These tests were designed to compare both product types across platforms and gendered variants within each platform.

Cluster Analysis

To explore how consumers perceive and respond to gender-based pricing, cluster analysis was conducted using data collected from a structured survey (n=142). The survey consisted of Likert-scale items covering behavioural, attitudinal, and ethical dimensions of consumer responses to gendered pricing, including price awareness, product preference, fairness perception, and openness to alternatives. Eleven variables were used for clustering, each representing a specific aspect of consumer behaviour - such as price responsiveness, brand loyalty, comfort with cross-gender purchasing, and support for gender-neutral pricing. The responses were analysed using a clustering algorithm to group respondents based on similar patterns of answers.

Regression Analysis

To understand what drives consumer behaviour in response to gender-based pricing, a multiple linear regression analysis was conducted. It was aimed to determine which psychological and behavioural constructs could significantly predict whether a consumer would change their purchasing behaviour when faced with gendered pricing disparities.

The dependent variable was Actual Behaviour, representing real-life actions such as switching to cheaper, cross-gender, or gender-neutral alternatives. This was derived from survey items measuring the frequency of such behaviour. The independent variables were five constructs identified through exploratory factor analysis, which are: Pink Tax Pricing (awareness and attentiveness), Price Sensitivity. Price Fairness Perception, Consumer Attitude (towards branding and advertising), and Purchase Intention (openness to gender-neutral or cross-gender products).

The general model was structured as follows:

$$Y=\beta_0+\beta_1 X_1+\beta_2X_2+\beta_3X_3+\beta_4 X_4+\beta_5X_5+\varepsilon$$

Where,

Y = Actual Behaviour

X1=Pink Tax Awareness

X2 = Price Fairness Perception

X3 = Attitude Fairness Perception

X4 = Purchase Intention

X5 = Price Intention

ε = Error Terms

This analysis provided a foundation for interpreting behavioural responses in the context of awareness, fairness, and pricing logic, helping bridge the gap between consumer perceptions and real-world purchasing decisions.

Results

Gendered pricing patterns across E-commerce platforms

Descriptive statistics

The average price of men's deodorant on Amazon was Rs.188.38 and Rs.178.38 for women's. On Nykaa, the average were Rs.223 for men and Rs.221.44 for women. Women's deodorants showed high standard deviation on both platforms, indicating greater price variability. For razors, Amazon's mean price was Rs.171.3 for men and Rs.235 for women, while on Nykaa it was Rs.190.1 for men and Rs.290.33 for women. Nykaa's women's razors had the widest range, from Rs.98 to Rs.645. Normality tests (Shapiro-Wilk) showed most groups met assumptions, except Nykaa women's deodorants (p=0.0151), suggesting deviation from normality.

Table 1:- Descriptive Statistics

Group	N	Mean	Median	Mode	SD	Min	Max	Skewness	Kurtosis	Normality (p)
Amazon Deo Men	16	188.38	192.5	143	33.91	143	245	0.07	-1.38	0.1841
Amazon Deo Women	16	178.38	161.5	156	51.7	112	307	1.03	0.48	0.0882
Nykaa Deo Men	16	223	215.5	177	41.45	169	299	0.45	-0.97	0.2603
Nykaa Deo Women	16	221.44	210	177	54.39	169	369	1.32	1.32	0.0151
Amazon Razor Men	10	171.3	166	80	52.56	80	243	-0.12	-0.96	0.7366
Amazon Razor Women	6	235	208	88	162.13	88	470	0.33	-1.48	0.1298
Nykaa Razor Men	10	190.1	181	89	52.57	89	278	-0.1	-0.04	0.7332
Nykaa Razor Women	6	290.33	237.5	98	228.44	98	645	0.49	-1.22	0.1245

Source: Author's calculation

Statistical analysis of pricing differences

Eight one-way ANOVA tests were conducted to examine price differences across platforms: Amazon and Nykaa, and gender-specific product lines, men's and women's deodorants and razors

In the case of Cross Platform price differences,

The tests examined whether gendered products were priced differently across platforms. For men's deodorants, Amazon prices were significantly lower than Nykaa's ($F=6.689$, $p=0.0015$). Women's deodorants showed a similar pattern, with Amazon again lower ($F=5.270$, $p=0.0029$). In contrast, no significant platform differences were found for men's razors ($F=0.640$, $p=0.434$) or women's razors ($F=0.230$, $p=0.639$).

While Gender-Based comparison showed that,

For Amazon deodorants, no significant price difference was found between men's and women's products ($F=0.420$, $p=0.523$). Similarly, Amazon razors showed no significant difference ($F=1.360$, $p=0.263$). On Nykaa, deodorants also showed no gender-based

pricing gap (F=0.010, p=0.928). For Nykaa razors, the difference was again not significant (F=1.850, p=0.196).

Table 2:- ANOVA Results

Comparison	F-value	p-value	Significant
Amazon vs Nykaa - Deodorant (Men)	6.69	0.015	Yes
Amazon vs Nykaa - Deodorant (Women)	5.27	0.029	Yes
Amazon vs Nykaa - Razor (Men)	0.64	0.434	No
Amazon vs Nykaa - Razor (Women)	0.23	0.639	No
Men vs Women - Amazon (Deodorant)	0.42	0.523	No
Men vs Women - Amazon (Razor)	1.36	0.263	No
Men vs Women - Nykaa (Deodorant)	0.01	0.928	No
Men vs Women - Nykaa (Razor)	1.85	0.196	No

Source: Author's calculation

Consumer perceptions

The sample consisted of 142 respondents, with a higher representation of females (n=97) compared to males (n=45). In terms of educational attainment, most participants held a postgraduate degree (n=77), followed by undergraduate degrees (n=43) and high school qualifications or equivalent (n=22). Regarding to employment status, 66 participants reported being unemployed. However, this category included homemakers, students without income, or retirees without income. 37 participants reported to be employed full-time, 25 were self-employed, 8 were retired with income and 6 were employed part-time.

The majority of the residents resided in urban areas (n=106), with smaller portions from semi-urban (n=28) and rural regions (n=8).

The mean age of participants was approximately 35.76 years.

Identification of Consumer Segments

The analysis identified three distinct consumer segments among 142 respondents.

Each cluster represents a unique pattern of responses based on attitudes toward price sensitivity, brand loyalty, and openness to gender-neutral products.

Cluster Composition

- Cluster 1: Practical Egalitarians (n=43)

This group is highly engaged with pricing, often comparing gendered products and

making purchase decisions largely based on cost. They prefer products marketed to their own gender but remain open to gender-neutral options, supporting fair pricing practices. Their willingness to purchase cross-gender products is moderate, reflecting practicality balanced with brand alignment. They are skeptical of design-based price differences and moderately believe gendered pricing impacts equality.

- Cluster 2: Gender Neutral Advocates (n=76)

This is the most equality-oriented and price-conscious group. Price strongly drives their purchase decisions, and they readily act on disparities. They are highly open to gender-neutral or cross-gender products, often preferring them over gendered alternatives. They strongly reject price differences based on packaging or design, show little loyalty to own-gendered items, and score highest in ideological awareness, believing gendered pricing affects equality and supporting gender-neutral strategies.

- Cluster 3: Passive Brand Loyalists (n=23)

This cluster shows the least engagement with gender-based pricing. They rarely compare prices, and cost has little influence on their choices. They strongly prefer products marketed to their own gender and show low support for neutral options or gender-neutral pricing. Their willingness to buy cross-gender products is relatively high but likely stems from indifference rather than resistance to gendered pricing. They also show limited belief that pricing affects inequality, reflecting low ideological alignment with fairness concerns.

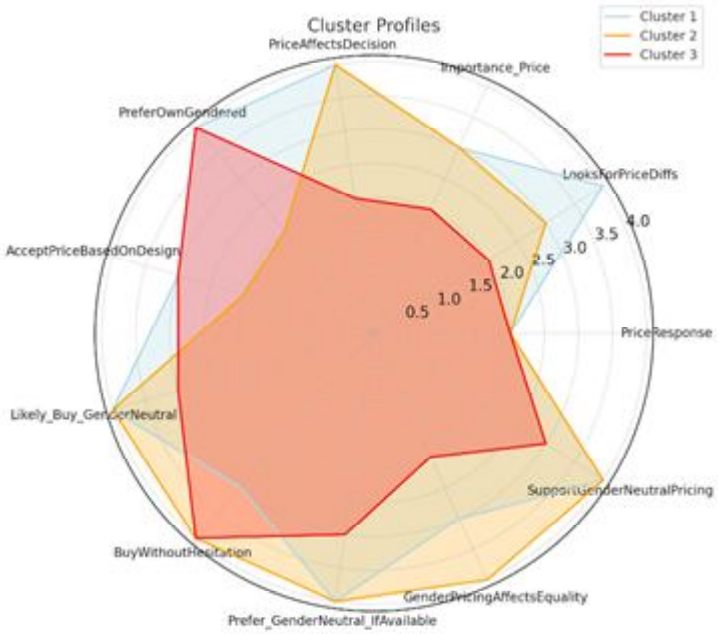
Table 3:- Final Cluster Centres for Consumer Segments

Variable	Cluster 1	Cluster 2	Cluster 3
Price Response	2	2	2
Looks For Price Diffs	4	3	2
Importance Price	3	3	2
Price Affects Decision	4	4	2
Prefer Own Gendered	4	2	4
Accept Price Based On Design	3	2	3
Likely_Buy_GenderNeutral	4	4	3
Buy Without Hesitation	3	4	4
Prefer_GenderNeutral_IfAvailable	4	4	3
GenderPricingAffectsEquality	3	4	2
Support Gender Neutral Pricing	4	4	3

Source: Author's Calculation

According to the ANOVA results, all clustering variables differed significantly across the three segments ($p<0.05$), confirming that the clusters are statistically distinct.

Figure 1:- Radar Plot of Cluster Profiles



Source: Developed by author based on cluster analysis of primary survey data

As seen in Figure 1, Cluster 2 scores highest across most dimensions, indicating stronger support for gender-neutral pricing and fairness. Cluster 1 shows moderate engagement, while Cluster 3 reflects lower sensitivity to price and fairness, with a stronger preference for gendered products.

Construct Derivation

Exploratory Factor Analysis was conducted to reduce the number of observed variables and group related survey items into meaningful constructs. A total of six factors were extracted using principal component analysis with eigenvalues greater than 1. Each factor explained a substantial portion of the variance, with all exceeding the 50% threshold individually. The retained items demonstrated strong loadings, ranging from 0.69 to 0.84, confirming the internal consistency of the constructs.

The summary of these factors is presented as shown below (Table - 4).

Table 4 :- Summary of Extracted Constructs

Variable	Cluster 1	Cluster 2
Pink Tax Pricing	A1, A2, A3, A4, A5	63.42%
Price Sensitivity	C2, C3, C4	53.41%
Price Fairness Perception	D1, D2	51.81%
Consumer Attitude	E1, E2, E3, E4	65.79%
Purchase Intention	F1, F2, F3	54.03%
Actual Behaviour	C1, G1	62.49%

Source: Author's Calculation

The six-validated constructs derived from the factor analysis were subsequently used as input variables in a multiple linear regression model to influence consumer behavior.

Drivers of Purchase Behavior

A multiple linear regression was conducted to test whether five constructs - Pink Tax Pricing, Price Sensitivity, Price Fairness Perception, Consumer Attitude, and Purchase Intention - predicted Actual Behaviour. The model was significant, with R=0.408, R2=0.166, and adjusted R2=0.135, showing that 16.6% of the variance in behaviour was explained. The regression was significant at F=5.416, p<0.001.

Purchase Intention emerged as the strongest predictor (β =0.324, p<0.001). Consumer Attitude also showed a significant positive effect (β =0.193, p=0.022), suggesting that consumers less influenced by gendered branding were more likely to alter their behavior.

In contrast, Price Sensitivity, Price Fairness Perception, and Pink Tax Pricing Awareness did not significantly predict consumer behavior in this model.

Table 5: Regression Coefficients for **Predicting** Actual Consumer Behaviour

Predictor	β(Standardised)	t-value	p-value	Significance
Price Sensitivity	-0.11	-1.261	0.21	Not Sig.
Price Fairness Perception	0.063	0.682	0.496	Not Sig.
Consumer Attitude	0.193	2.325	0.022	Sig.
Purchase Intention	0.324	3.664	< 0.001	Sig.
Pink Tax Pricing	-0.025	-0.3	0.764	Not Sig.

Source: Author's Calculation

Post-estimation diagnostic results

Multicollinearity was assessed using Variance Inflation Factor (VIF) and tolerance values. All VIF values range between 1.128 and 1.397, which are below the commonly accepted threshold of 5, indicating the absence of multicollinearity. Collinearity diagnostics further confirm that no condition index exceeds critical levels.

The Shapiro-Wilk test indicated that the regression residuals do not significantly deviate from normality (p=0.54), satisfying the normality assumption.

Heteroskedasticity was examined using the Glejser test. The regression of absolute residuals on the explanatory variables did not result in any statistically significant coefficients, indicating homoscedasticity.

Discussion

Price Disparities across platforms and gender

The ANOVA analysis revealed significant platform-based price disparities for deodorants, with both men's and women's variants costlier on Nykaa than Amazon. These results align with prior research showing that gender-focused platforms and premium branding often contribute to price inflation (Pramesti, 2024)(Wishart et al., 2024). Nykaa's gendered marketing and curated beauty-focused identity may intensify these disparities, even if they are not always directly tied to gender.

By contrast, no significant gender-based pricing differences were observed within either platform, challenging the assumption that the Pink Tax manifests uniformly across retail contexts. This diverges with earlier studies that consistently reported disparities in personal care products (Xiong, 2024)(Duesterhaus, 2011). Instead, these findings suggest gender-based pricing is mediated by platform strategies and specific product categories (Bhatia et al., 2021).

The absence of within-platform disparities may be explained by deliberate product matching and sampling, which minimized the likelihood of extreme price variations. Intense competition on both Nykaa and Amazon likely constrains gendered difference as well. In Nykaa's, higher prices may be better understood as part of its premium positioning rather that evidence of direct gendered pricing. These results may also reflect a gradual shift in the Indian market, where growing consumer awareness is encouraging more gender-neutral pricing in certain categories.

Consumer segmentation and behavioural patterns

Cluster analysis revealed three distinct consumer segments, each reflecting different attitudes and behaviours toward gendered pricing.

Practical Egalitarians were price-conscious and moderately supportive of gender-neutral options, though they still prefer gendered products.

Gender Neutral Advocates, the largest group, showed strong awareness on disparities and actively supported fairness-based choices, often selecting gender-neutral or cross-gender products.

Passive Brand Loyalists were least sensitive to pricing, strongly favouring gender-aligned products and accepting price differences justified by branding or design.

These findings align with prior research showing consumer responses range from active equality-driven choices to brand loyalty (Bernadette et al., 2022). Cluster 2 reflects studies where equity-oriented consumers adopt gender-neutral habits (Kardetoft & Heshmati, 2022). Variations across clusters also mirrors evidence that design and branding shape fairness perceptions, producing uneven reactions (Vincent De Urquiza & Cooke, 2020).

The emergence of these segments may stem from differences in awareness, exposure, and personal relevance in the Indian market. Some respondents were influences by education, urbanization, or digital awareness, while others prioritized brand familiarity or aesthetics over fairness. Sample gender balance and cultural norms around roles and consumption may also have influenced participant responses. This variation highlights how personal values, product perceptions, and habits intersect within an evolving consumer landscape.

Predictors of consumer behaviour

Regression results indicated that only Purchase Intention and Consumer Attitude significantly predicted Actual Behaviour. Respondents open to buying gender-neutral or cross-gender products and those less influenced by gendered branding or advertising were more inclined toward fairness-driven purchasing. This supports behavioural economic research suggesting that choices are guided more by intentionality and weaker brand attachment than by mere awareness or ethical beliefs (Barnes et al., 2022).

Conversely, Price Sensitivity, Pink Tax Awareness, and Perceived Fairness did not emerge as significant predictors. This points to an attitude-behaviour gap, where consumers support gender-neutral pricing in principle but rarely translate it into action - echoing findings from Bhatia et al. (2021) and Xiong (2024). Wishart et al. (2024) likewise argue that awareness alone, in the absence of accessible alternatives and social reinforcement, is insufficient to trigger behavioural change.

The stronger predictive role of Purchase Intention and Consumer Attitude likely arises from their direct, action-oriented nature. Intention and attitude link more closely to behaviour than abstract notions of awareness or fairness perceptions. While many consumers recognise gendered pricing as unfair, only those motivated to act and less bound by branding appeared willing to change their purchase patterns. This suggests that mindset and motivation are more powerful drivers of behaviours than awareness alone.

Directions for future research and conclusion

Future research could expand on this study by analysing a broader range of product categories beyond deodorants and razors, including clothing, cosmetics, or services where gender-based pricing may be more pronounced. Including, additional e-commerce platforms or physical retail stores would offer a more comprehensive view of pricing patterns across sales channels. The analysis is based on small number of product pairs selected using strict matching criteria, future studies can expand on more number of products. Moreover, future studies could examine the psychological influence of packaging, colour, and design in shaping perceptions of gendered pricing. Comparative research could also investigate the emerging phenomenon Blue Tax, analysing whether and how men are charged more for certain products, and how this contrasts with the Pink Tax across different categories and cultural contexts.

This study explored gender-based pricing in personal care products and examined how consumers perceive and respond to such disparities. While platform-based price differences were observed, direct gender-based pricing within platforms was not significant. The findings show that people's actions are influenced more by their intentions and attitudes rather than just being aware of the issue. Encouraging informed and value-based choices could help move towards fairer pricing practices for all consumers.

■

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Impact of Investments in Grass Root Sports Development of India

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Abstract

Sports contribute significantly to community development by engaging individuals, keeping them healthy, and stimulating the economy. In India, the sports landscape is evolving, with greater emphasis on engaging everyone rather than merely showcasing the best players. Initiatives such as Khelo India and CSR initiatives have established how significant funding for local sports is. But there are still a few challenges, such as poor infrastructure, inadequate quality of coaching, and unequal access to resources, making it challenging to develop grassroots sports. This research will explore how various investments in grassroots sport are impacting talent discovery, the development of facilities, and economic contribution. The present paper tries to evaluate the influence of funding from diverse sources, such as government funds, CSR donations, and specific sports programs, on the development of grassroots sports in India. Measuring advancement across participation rates, performance, policy implementation, and economic contribution through a Sports Development Index, the study provides an evaluation of progress. It is important for policymakers, corporations, and sports organisations to know these facets so that they can devise improved strategies and augment a more inclusive sports ecosystem. This paper also tries to evaluate the impact of investments in grassroots sports development. The methodology adopted for the study is secondary data, which was collected from reliable sources such as government documents, company information, and sports organisations. Key sources are the Ministry of Youth Affairs and Sports (MoYAS), the Ministry of Corporate Affairs (MoCA), and the Sports Authority of India (SAI). The outcome of the study reveals that Special Sports Initiatives significantly affect the Sports Development Index (SDI).

Keywords: *Sports Development Index; Special Sports Initiatives; Economic Growth.*

1. Introduction

Sports contribute significantly to society by unifying people, enhancing health, and driving economic growth. In India, the spotlight around sports has moved beyond merely the elite to promoting participation at the grassroots level and nurturing young talent. People can witness this change through initiatives such as Khelo India, coupled with investments from companies and public-private partnerships for talent development and facility improvement. Despite these measures, there are a few challenges as well, such as inadequate infrastructure, lack of quality coaching, and uneven resource distribution. Therefore, this study tries to closely examine how various types of investment, both from the government and private enterprises, are impacting grassroots sports.

This study is necessary because grassroots development of sports is enormous in India, and that's where we identify and build young talent and promote mass games participation. Despite government initiatives like Khelo India, CSR money and special sporting schemes, there is still a question mark on how effective these efforts are in infrastructure development, coaching and overall sporting development. This research will assist in assessing the effect of these investments, maximising resource allocation and determining bottlenecks that are restraining us. By looking at the relationship between funding sources and sports development indicators, the study will provide valuable inputs to policymakers, organisations, and stakeholders to plan their investments better.

Grassroots sports also play a big role in economic growth, employment generation and social inclusion and promote health and fitness across all regions of the country. Understanding these will help bridge the regional gaps in sports infrastructure and participation and create a more inclusive and sustainable sports ecosystem in India. The success of investments in India's grassroots sports development is uncertain. This study seeks to evaluate the impact of various investments on nurturing talent, enhancing infrastructure, and promoting participation in grassroots-level sports, which also contribute to the economic development of India.

2. Review of Literature

Grassroots sports events are increasingly recognised as a catalyst for urban economic development, with studies highlighting their role in boosting related industries. However, challenges remain in fully leveraging these events for urban growth, requiring concerted efforts from government, organisations, and individuals to ensure effective support and cooperation. (Hou, 2024)

Examine the impact of corporate sponsorship on Indian sports, highlighting its

role in boosting performance, player development, and infrastructure. While corporate investments have been transformative, concerns about ethics, urban-rural disparities, and athlete well-being remain. The study stresses the importance of transparent governance, grassroots development, and social responsibility for sustainable corporate involvement. (Assumi et al., 2024)

Attracting foreign direct investment (FDI) in sports development projects can significantly contribute to economic growth by fostering foreign trade and capital formation. This study highlights that favourable conditions, such as banking facilities, low-risk environments, and high returns, encourage FDI, reducing dependence on external debt and foreign aid. Such investments not only boost sports infrastructure but also strengthen the host country's economic resilience and global competitiveness. (Mohamed et al., 2024)

Government policies focusing on grassroots sports development are crucial for fostering talent and promoting widespread participation. Studies have shown that prioritising these programs can improve athletic performance at higher competitive levels. Athletes across various age groups and competitive levels have emphasised the need for such policies to enhance the sports ecosystem. (Farooq and Mughal, 2024)

Analyses the economic impact of sports in India, focusing on how different sports such as cricket, football, kabaddi, and badminton contribute to revenue generation, employment, and related industry stimulation. It also explores the impact of major events such as the IPL and Commonwealth Games on infrastructure, tourism, and social cohesion. The long-term benefits of sports, including talent development and global recognition, are emphasised as key factors for economic growth and policy development in India. (Shamim, 2024)

The effects of early involvement in talent promotion programs (TPPs) on athletic performance. Findings reveal that early TPP involvement improves short-term junior performance but negatively impacts long-term senior performance, with higher-performing junior athletes starting younger and higher-performing senior athletes starting older. The study highlights potential risks of early specialisation, including injury, burnout, and career termination, emphasising the need to balance early development with long-term athletic success. (Güllich and Barth, 2024)

The optimal investment strategy for Folk Sports Tourism Destination (FSTD) projects involves balancing public and private sector roles. Public capital focuses on infrastructure, while private capital provides services. Subsidies boost public investment and consumer demand but don't impact private investment or service prices. Public sector returns follow an inverted U-shape with subsidy levels, while

private sector returns increase steadily. Demand fluctuations further exacerbate return differences between subsidised and unsubsidised projects. (Lv et.al, 2024)

Studies suggest that sports stadiums often have limited economic impacts on metropolitan areas, with localised effects being insufficient to justify public subsidies. The relocation of a professional sports team to a new stadium-anchored development in Cobb County showed a small, statistically insignificant increase in taxable sales, with a significant portion of the spending merely shifting from other local activities. These findings reinforce previous conclusions that sports venues are not effective economic development investments. (Bradbury, 2024)

Funding is a critical yet contentious factor influencing elite sports performance. This study utilised a non-experimental descriptive method, drawing on secondary data from public service websites, yearbooks, and entities linked to elite sports in Chile. By analysing funding through the SPLISS model's pillar 1 framework, it was concluded that while funding is essential, a consistent increase in financial resources alone does not guarantee improved performance in elite sports. (Venegas-Yazigi et al., 2023)

Sports development in Odisha, focusing on underprivileged areas like Bhubaneswar's slums. Their study highlights barriers to participation, including a lack of facilities, poverty, and the need for external support like free coaching. They emphasise that providing infrastructure and community support can significantly boost sports engagement in disadvantaged communities. (Misra and Panda, 2023)

Sports tourism, FDI inflows, and the organisation of mega sports events positively impact economic growth in Arab Gulf nations. Alcohol consumption does not directly correlate with economic growth but shows a positive relationship with sports tourism. Allowing alcohol consumption during sports tourism events could potentially enhance economic development. However, policy decisions should consider the cultural and social implications of alcohol consumption in the region. (Elfakharani and Albaheth, 2023)

This study examines the influence of funding from different sources on the development of grassroots sports in India, such as CSR donations, specific sports programs, government funds, etc.

3. Objectives of the Study

1. To identify the factors affecting grassroots sports development in India.
2. To evaluate the impact of investments in grassroots sports development.

4. Methodology

Secondary data were used for this study. The study spans 17 years from 2008 to 2025, capturing the impact of investments in grassroots sport on India. Government funding, companies' contributions through CSR initiatives and special schemes like Khelo India are included in the data. The research draws data from reliable sources such as government documents, company information, and sport organizations. Key sources are the Ministry of Youth Affairs and Sports (MoYAS), the Ministry of Corporate Affairs (MoCA), and the Sports Authority of India (SAI). These give information regarding budgets, policy, and infrastructural development. The research paper also has a look at Corporate Social Responsibility (CSR) reports of the public and private sector companies mandated by law to disclose their grassroots sports investment. Additionally, speciality programs such as Khelo India and Public-Private Partnership projects provide additional information about sports development activities to the public.

This research examines data to identify how investments have influenced grassroots sport development in India across a period of 17 years, from 2008 until 2025. It applies descriptive statistics to present trends in funding, growth in infrastructure, and rates of participation to provide insights into trends in investments. A Vector Auto Regression (VAR) model facilitates the examination of how various funding sources, such as government budgets, CSR funds, and specific sport initiatives, influence the Sports Development Index (SDI) in the long term.

The research employed a blend of tools for data analysis and collection. Microsoft Excel - Employed for data cleaning, initial descriptive analysis, and organisation, as well as for the construction of the Sports Development Index (SDI). Python - Employed for sophisticated statistical analysis, specifically in conducting Vector Auto Regression (VAR) modelling. The research employs stats models for time-series forecasting, pandas for preprocessing of data, and matplotlib and seaborn for visualisation. This study takes a look at how funding affects grassroots sports in India by using existing secondary data. It looks at how different sources of funding relate to sports development outcomes.

5. Results and Discussion

The study applies descriptive statistics, correlation, regression, and Vector Auto Regression (VAR) modelling in an investigation of the interlink between sources of funds and the Sports Development Index (SDI). Study applies graphs, tables, and trend analysis to interpret results and provide valuable insights. The Sports Development Index (SDI) is a method of measuring the development and

advancement of sports in a country, nation, or particular group. It considers various factors influencing sports participation, facilities, finance, and performance. India lacks a Sports Development Index (SDI); for the sake of the study, an SDI index for India is developed.

5.1 Construction of Sports Development Index (SDI)

The Sports Development Index (SDI) is a composite measure designed to evaluate the overall progress of sports in a region based on key performance indicators. A framework for calculating the Sports Development Index (SDI) was referred from ASEAN magazine published in January 2023 as a special issue. The score is figured out using five main areas: Participation (23%), Infrastructure (23%), Performance (23%), Policy & Governance (14%), and Economic Impact (17%). Each area looks at certain things, like how many people play sports at schools, how easy it is to access facilities, how many medals are won internationally, government policies, and the money sports bring to the economy. Every specific item gets a certain weight, and scores are given from 0 to 10. These scores are then turned into a final score out of 100, with higher numbers showing better results. The final Sports Development Index score is made by adding up all these indicators, giving a clear picture of how sports are developing over time.

Table : 1 SDI Calculator

Category	Indicators	Weight (%)	Score (Out of 10)
Participation (23%)	% of school students in sports	8	Higher % = Higher Score
	Gender & rural inclusivity	7	Balanced = Higher Score
	% of para-athletes & special sports initiatives	8	Higher % = Higher Score
Infrastructure (23%)	State-wise access to sports facilities	23	Better Access = Higher Score
Performance (23%)	Olympic & Asian Games medal tally	14	Higher Tally = Higher Score
	World rankings in key sports	9	Higher Ranking = Higher Score
Policy & Governance (18%)	Implementation of sports policies	8	Effective Policies = Higher Score
	Presence of sports academies & coaching institutes	6	More Academies = Higher Score
	Anti-doping compliance & sports ethics policies	4	Strong Compliance = Higher Score
Social Impact (13%)	Employment generation in sports sector	13	More Jobs = Higher Score

(Source: theaseanmagazine.asean.org)

Table : 2 Sample data of SDI calculation

2024	2024P	2023	2023P	2022	2022P	2021	2021P	2020	2020P	2019	2019P	2018	2018P
4	0.32	5	0.4	4	0.32	4	0.32	6	0.48	7	0.56	7	0.56
7	0.49	7	0.49	7	0.49	7	0.49	6	0.42	5	0.35	5	0.35
9.5	0.76	8	0.64	8	0.64	8.5	0.68	8.5	0.68	8	0.64	6.5	0.52
8	1.84	6	1.38	6	1.38	10	2.3	5.5	1.265	7.5	1.725	6.5	1.495
6.5	0.91	7.8	1.092	9.5	1.33	9	1.26	10	1.4	9.5	1.33	9.5	1.33
7.4	0.666	8	0.72	8.8	0.792	8.2	0.738	8	0.72	7.8	0.702	7.6	0.684
9.5	0.76	9	0.72	9	0.72	8.5	0.68	2	0.16	9	0.72	8.5	0.68
4.5	0.27	4.5	0.27	4.5	0.27	4.5	0.27	6.5	0.39	6.5	0.39	7	0.42
8	0.32	6	0.24	6	0.24	5	0.2	8	0.32	1	0.04	5	0.2
10	1.3	9	1.17	6.5	0.845	6	0.78	5	0.65	9	1.17	8	1.04
74.4	7.636	70.3	7.122	69.3	7.027	70.7	7.718	65.5	6.485	70.3	7.627	70.6	7.279

(Source: Compiled sources of Annual Reports of SAI- Sports Authority of India 2009-2024, www.paralympic.org, static.pib.gov.in, www.nriol.com,www.simplysports.in, www.icc-cricket.com, www.fifa.com, www.badmintonindia.org, https://sportsrankings.world/media-release and Annual Reports of MoYAS)

Table : 3 SDI of India

PARTCULAR	TOTAL POINTS	WEIGHTED SCORE	WEIGHTED SCORE IN 100
2024	74.4	7.636	76.36
2023	70.3	7.122	71.22
2022	69.3	7.027	70.27
2021	70.7	7.718	77.18
2020	65.5	6.485	64.85
2019	70.3	7.627	76.27
2018	70.6	7.279	72.79
2017	70.7	6.818	68.18
2016	64.9	6.256	62.56
2015	65.4	6.321	63.21
2014	55.7	5.663	56.63
2013	63.6	5.919	59.19
2012	65.3	5.915	59.15
2011	57.1	5.489	54.89
2010	53.4	5.366	53.66
2009	52.1	4.939	49.39
2008	51.7	5.023	50.23

(Source: Compiled sources of www.nriol.com and static.pib.gov.in)

Fig : 1 Summary of the results

```
  Summary of Regression Results
================================
Model:                         VAR
Method:                        OLS
Date:           Mon, 17, Feb, 2025
Time:                      12:41:26
--------------------------------------------------------------------
No. of Equations:         5.00000    BIC:                    36.4328
Nobs:                     16.0000    HQIC:                   35.0584
Log likelihood:          -363.389    FPE:                 1.89220e+15
AIC:                      34.9842    Det(Omega_mle):      3.84994e+14
--------------------------------------------------------------------
```

(Source: Output)

This research examines how sports grow over time with money invested in them using a method known as Vector Auto Regression (VAR). This is a way of analysing how various time-based data are related to each other. The research verifies whether private company support, government investment, and corporate social responsibility investments influence or not the aspects such as the Sports Development Index, rates of participation, and sporting infrastructure. VAR is different from standard regression models in that it treats all the variables as interdependent, thus providing a better representation of cause and effect. Policymakers have the ability to utilize the insights gleaned to make improved investment decisions that may be able to improve sports growth and participation in the long term.

5.2 Data Analysis Using VAR

The VAR results most likely support the idea that, with time lags and differing degrees of impact, government funding, CSR contributions, and special initiatives all work together to influence SDI. The necessity of consistent and well-thought-out investments in sports development would be highlighted by a clear causal link between budgetary allotments and SDI growth. Special Sports Initiatives have a crucial role in the enhancement of sports development when compared to other factors.

Fig : 2 R-Square Value

Coefficients	:	[-0.0018828 0.00491294 -0.14517757 0.04107033]
Intercept	:	50.07964801788781
R-squared	:	0.7572146734183156
R-squared Adjusted	:	0.6762862312244209
Mean Squared Error	:	27.650891537762536

(Source: Output)

A consistent commitment to promote sports is shown in the special sports projects, which have grown gradually from Rs.164 Cr in 2008 to Rs.815.32 Cr in 2024. Strong interdependencies between these financial parameters are identified by the VAR model, confirming that long-term sports development and performance are facilitated by a well-funded and carefully managed investment approach.

5.3 Data Set

This data examines 17 years of the Sports Development Index (SDI), between 2008 and 2024, as well as some key financial numbers such as government budgets, private and public CSR spending, and special sports programs. The SDI has trended upward in general, from 50.23 in 2008 to 76.36 by 2024. That indicates that there's been quite a lot of improvement in sports development. The investment levels are secondary source information (Table - 4).

SL NO.	YEAR	SDI	BUDGET (CR)	PUB CSR (CR)	PRIV CSR (CR)	SPECIAL INITIATIVES (CR)
1	2024	76.36	2811.53	285.83	16.21	815.32
2	2023	71.22	1907.69	61.51	28.83	795.76
3	2022	70.27	1993	61.84	13.72	749.43
4	2021	77.18	1313.4	56.43	33.05	599
5	2020	64.85	2000	65.85	52.71	612
6	2019	76.27	1381.52	67.83	12.04	615
7	2018	72.79	1393.21	86.34	9.46	395
8	2017	68.18	1078.15	105.02	11.01	495.73
9	2016	62.56	917.32	88.1	10.1	438.2
10	2015	63.21	771.58	56.86	3.35	345.82
11	2014	56.63	866.31	58.11	27.85	386.85
12	2013	59.19	593.16	59.44	14.49	356.45
13	2012	59.15	660.01	56.78	26.97	375.49
14	2011	54.89	2972.61	57.87	16.03	396.42
15	2010	53.66	3350.67	55.84	16.82	214.67
16	2009	49.39	1313.33	64.88	21.16	171
17	2008	50.23	1200	58.65	15.2	164

(Source: compiled sources of Annual Reports of SAI- Sports Authority of India 2009-2024, Annual Reports of MoYAS, Annual Reports of various organizations and www.csr.gov.in)

5.4 Interpretation of VAR Results

The VAR results most likely support the idea that, with time lags and differing degrees of impact, government funding, CSR contributions, and special initiatives all work together to influence SDI. The necessity of consistent and well-thought-out investments in sports development would be highlighted by a clear causal link between budgetary allotments and SDI growth. Special Sports Initiatives have a crucial role in the enhancement of sports development when compared to other factors.

Fig 3 - Equation for Index

Results for equation INDEX

	coefficient	std. error	t-stat	prob
const	28.328955	14.220766	1.992	0.046
L1.BUDGET (CR)	-0.000680	0.001642	-0.414	0.679
L1.PUB CSR (CR)	-0.015617	0.026946	-0.580	0.562
L1.PRIV CSR (CR)	0.062961	0.118766	0.530	0.596
L1.SPECIAL INITIATIVES (CR)	0.029498	0.013012	2.267	0.023
L1.INDEX	0.332889	0.268100	1.242	0.214

(Source: Output)

- H1a: There is a positive link between the central budget and the sports development index.
- H2a: There is a positive link between public company CSR funding and the sports development index.
- H3a: There is a positive link between private company CSR funding and the sports development index.
- H4a: There is a positive link between special sports initiative funding and the sports development index.
  - Impact of Government Budget on SDI:
    - p-value (not significant) = 0.679
    - Despite the negative coefficient (-0.000680), BUDGET has little or no impact on INDEX because of the high p-value.

- Effect of CSR Contributions (Public & Private):
  - Both Public and Private CSR have p-values greater than 0.05 (5% significance level) which are 0.562 and 0.596 respectively.
  - Even though private CSR shows a positive coefficient (0.062961) it does not affects the SDI directly.
- Role of Special Sports Initiatives:
  - p-value = 0.023 < 0.05 (Significant at 5% level)
  - The coefficient (0.029498) suggests that Special Sports initiatives are the only significant factor that positively impacts the SDI.

5.5 Correlation Heatmap

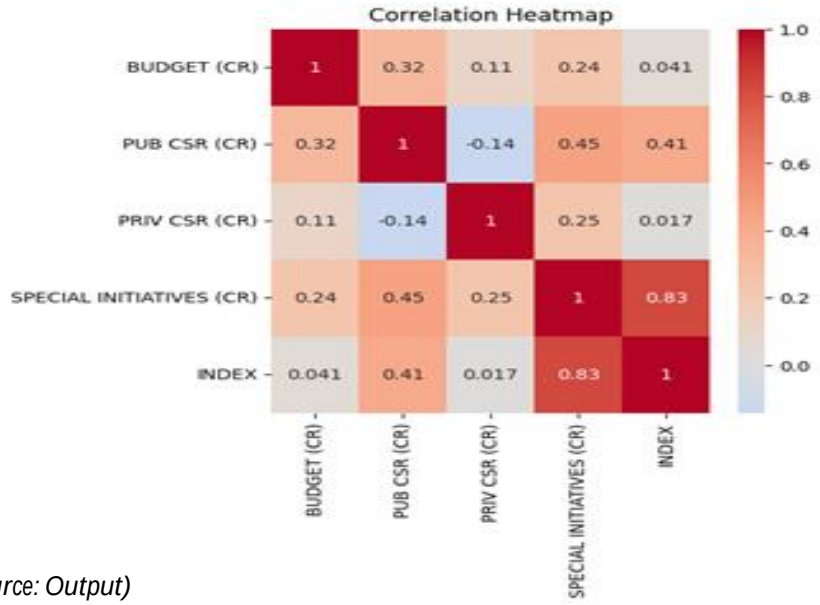
The correlation heatmap sheds light on the relationships between the various variables in the dataset. Of particular note is the very strong positive correlation (0.83) between Special Sports Initiatives and Sports Development Index (SDI), which indicates that as Special Sports Initiatives rise, the Sports Development Index (SDI) tends to rise significantly as well. This is consistent with the regression results, which showed that Special Sports Initiatives is the only variable that had a statistically significant impact on the Sports Development Index (SDI).

Public company CSR also showed a moderately positive correlation with Sports Development Index(SDI) (0.41), indicating that public company corporate social responsibility investments may have some influence on the Sports Development Index(SDI), although the regression analysis did not find it to be statistically significant; meanwhile, Central budget had a very weak correlation with Sports Development Index(SDI) (0.041), confirming the regression finding that budget does not significantly affect Sports Development Index(SDI).

The connection between private company CSR and the Sports Development Index (SDI),is the poorest (0.017), suggesting that private company CSR donations have little to no direct effect the Sports Development Index(SDI). Furthermore, Private company CSR and public company CSR have a somewhat negative association (-0.14), indicating that rising public CSR may not always coincide with rising private company CSR expenditure.

Overall, the heatmap demonstrates that Special Sports Initiatives have a significant impact on the Sports Development Index (SDI), whereas correlations between other variables are either weak or non-existent. Accordingly, future plans should concentrate more on Special Sports Initiatives rather than mainly depending on private company CSR, public company CSR, or the central budget to raise the Sports Development Index (SDI).

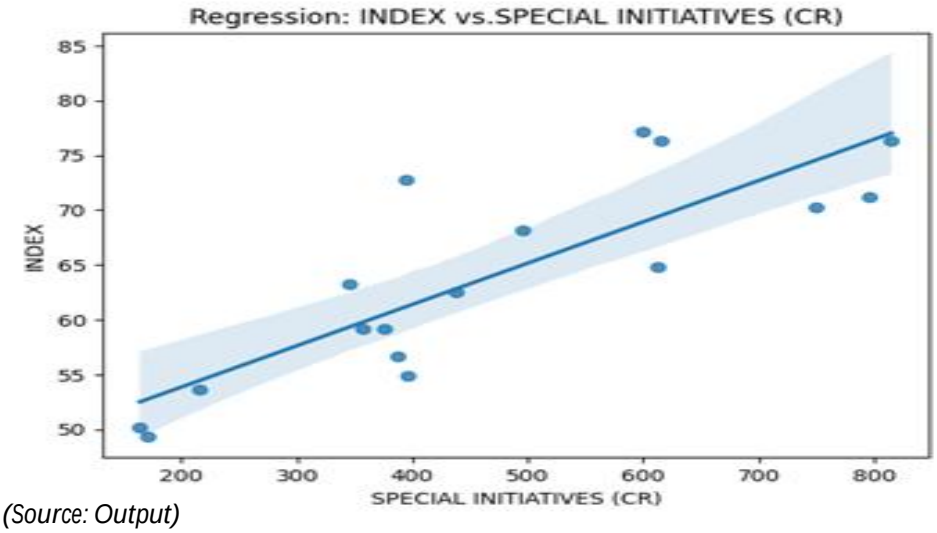
Fig : 4 - Correlation heatmap



(Source: Output)

5.6 Regression Line

Fig : 5.5 - Regression line



(Source: Output)

The regression analysis suggests a positive correlation between Special Sports Initiatives and the Sports Development Index (SDI), indicating that as spending on Special Sports Initiatives increases, the Sports Development Index (SDI) also tends to rise. The regression line shows a clear upward trend, suggesting a predictive relationship. However, the spread of data points around the line implies some variability, meaning other factors may also influence the Sports Development Index (SDI). The shaded confidence interval further highlights the uncertainty in predictions, with some outliers deviating significantly from the trend.

6. Conclusion

This study's theoretical framework examines the connection between grassroots sports development and financial investments, emphasizing the ways in which money affects long-term sports performance, athlete engagement, and infrastructure. It looks at important independent factors such as public funding, corporate social responsibility (CSR) expenditures, and private sector donations and how these affect the dependent variable, which is the expansion of grassroots sports. The foundations of the research are the Economic Growth and Sports Development Model, CSR Theory and Sports Development Theory explaining how systematic investments and policymaking enhance sports environments.

The factors affecting grass root sports development are Infrastructure Development, Performance, Participation, Employment generation and Policy of governments. The p-value = 0.023 (< 0.05) indicates that Special Sports Initiatives have a statistically significant impact on the other Sports Development Index (SDI). This suggests that targeted sports programs and investments directly contribute to grassroots sports growth. Central Budget, Public company CSR and Private Company CSR do not show a significant impact on SDI in the VAR model. This could indicate that while these factors are essential, their influence might be indirect or influenced by other unobserved variables. The R-squared value of 0.7572 means that 75.72% of the variation in SDI is explained by the independent variables in the model. This indicates a good fit, but some variation remains unexplained, suggesting other external influences on sports development. The regression equation found through the VAR model can be used to predict the Sports Development Index (SDI) in the future by considering other factors. The regression equation is;

$$\text{INDEX} = 50.0795 - 0.0018828 \times \text{BUDGET} + 0.00491294 \times \text{PUB CSR} - 0.14517757 \times \text{PRIV CSR} + 0.04107033 \times \text{SPECIAL INITIATIVES}$$

With a p-value of 0.023, the study finds that Special Sports Initiatives significantly affect the Sports Development Index (SDI), whereas other elements such as government policies, infrastructure, performance, participation, and employment creation do not directly exhibit statistical significance. Although special initiatives are important, other unconsidered factors may also have an impact on sports development, as indicated by the model's R-squared value of 0.7572, which shows that it explains 75.72% of the variation in SDI. These results highlight the necessity of more funding for focused sports initiatives as well as an all-encompassing strategy that incorporates infrastructure upgrades, regulatory changes, and athlete development tactics to guarantee grassroots sports' sustained growth.

Some of the recommendations of this research are to boost investments in grass root sports through special sports initiatives, such as increasing funding for infrastructure, coaching, and talent development, promote Public-Private Partnerships (PPPs) for corporate investment in sports academies and leagues and focus on underprivileged areas for equal opportunities. Another suggestion of this study is to optimise sports budget allocation through the way of distribute funds strategically for maximum impact use data-driven evaluation for effective spending, and ensuring budget transparency to prevent inefficiencies. Enhancing CSR funding for sports activities is one of the important recommendations of this research, such as regularly assessing corporate CSR impact on grassroots sports, shifting to performance-based CSR funding models and encourage long-term corporate commitments for sustainability.

Measuring advancement in the scope of participation rates, performance, policy implementation, and economic contribution through a Sports Development Index, the study provides an evaluation of the progress made. It is important for policymakers, corporations, and sports organizations to know these facets so that they can devise improved strategies and augment a more inclusive sport ecosystem.

■

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APPENDIX

1) PYTHON CODES FOR REGRESSION

```
import pandas as pd
import numpy as np
from sklearn linear_model import Linear Regression

# Assuming your data is in a Data Frame called 'data'
# 1. Prepare the data
X = data[['BUDGET (CR)', 'PUB CSR (CR)',
'PRIV CSR (CR)', 'SPECIAL INITIATIVES (CR)']]  # Independent variables
y = data['INDEX']  # Dependent variable

# 2. Create and train the model
model = Linear Regression ()
model.fit(X, y)

# 3. Calculate metrics and print summary
y_pred = model.predict(X)  # Predictions on the entire data
residuals = y - y_pred
n = len(y)  # Number of observations
p = X.shape[1]  # Number of predictors
dof = n - p - 1  # Degrees of freedom
sse = np.sum(residuals**2)  # Sum of squared errors
sst = np.sum((y - np.mean(y))**2)  # Total sum of squares
r_squared = 1 - (sse / sst)  # R-squared
adj_r_squared = 1 - (1 - r_squared) * (n - 1) / dof  # Adjusted R-squared
mse = sse / dof  # Mean squared error
```

```
# Print summary
print('Coefficients:', model.coef_)
print('Intercept:', model.intercept_)
print('R-squared:', r_squared)
print('Adjusted R-squared:', adj_r_squared)
print('Mean Squared Error:', mse)
# ... (Add other desired statistics)
```

2) PYTHON CODES FOR VAR

```
import pandas as pd
import statsmodels.api as sm

# Assuming your data is in a DataFrame called 'data'
# 1. Prepare the data
data_var = data[['BUDGET (CR)', 'PUB CSR (CR)',
    'PRIV CSR (CR)', 'SPECIAL INITIATIVES (CR)','INDEX']]  # Select relevant
columns

# 2. Create and fit the VAR model
model = sm.tsa.VAR (data_var)
results = model.fit (maxlags=1, ic='aic')  # Determine optimal lag order using AIC

# 3. Print the model summary
Print (results.summary())
```

3) SDI CALCULATION INPUTS

Table A1 - Participation and Gender Inclusivity data

YEAR	NO. OF STC	BOYS	GIRLS	TOTAL
2023-24	186	5264	3375	8639
2022-23	187	5704	3728	9432
2021-22	188	4969	3029	7998
2020-21	188	5681	3544	9225
2019-20	276	8219	3678	11897
2018-19	273	9967	4269	14236
2017-18	287	10481	4426	14907
2016-17	289	9653	4031	13684
2015-16	252	8243	3530	11773
2014-15	250	7594	3438	11032
2013-14	229	7629	3188	10817
2012-13	228	7919	3360	11279
2011-12	308	9893	4227	14120
2010-11	300	9676	4061	13737
2009-10	292	9424	3385	12809
2008-09	293	9319	3657	12976
		TOTAL		188561

(Source: Annual Reports of SAI- Sports Authority of India 2009-2024)

Table A2 - Para Athletic Championship data

YEAR	GOLD	SILVER	BRONZE	TOTAL	RANK	SDI
2008	0	0	0	0	0	0
2011	0	1	0	1	55	2.5
2012	0	1	0	1	67	6
2013	1	0	0	1	33	7
2015	0	2	0	2	50	5
2016	2	1	1	4	43	7
2017	1	2	2	5	34	6.5
2019	2	2	5	9	24	8
2020	5	8	6	19	24	8.5
2023	3	4	3	10	19	8
2024	6	5	6	17	6	9.5
2024	7	9	13	29	18	9

(Source: www.paralympic.org)

Table A3 - Sample Data for State wise Infrastructure Development

1	Andaman and Nicobar Islands		1		1				1	
2	Andhra Pradesh	2	1	2	2			5	2	
3	Arunachal Pradesh	4		3	1	2	13	1		5
4	Assam		1		1	5	1	5		2
5	Bihar	2		5	10				3	
6	Chhattisgarh	0	1	3	3			1	1	2
7	Delhi	1	1	1	1	8			2	
8	Goa	3		1	4				4	2
9	Gujarat	2		2			1	3	2	
10	Haryana		4	2	2	2		5	3	1
11	Himachal Pradesh	1	3	3	3	2	1		2	3
12	Jammu & Kashmir	2		1	1	3		1		1
13	Jharkhand	1	1		1		1		3	
14	Karnataka	8	9	6	7	2	5	4	2	4
15	Kerala	1		2	2	2	1	4	3	5
16	Ladak	2			3		1			
17	Lakshadweep	1			2					1
18	Madhya Pradesh	7	12		6	2	3	4	4	
19	Maharashtra	1	3		2	5	4	3	2	6
20	Manipur	2		3	2	1	4	3		2
21	Meghalaya		3		6				1	2
22	Mizoram	4	3	2	2	3		2	1	
23	Nagaland	2	3		5	1		2		1
24	Odisha	8	1		5	1	1	4	2	
25	Puducherry		1		1		1			
26	Punjab	2	3	5	3	5	1	2	2	1
27	Rajasthan		2		2	9	15	9	3	1
28	Sikkim	1	1	3	3		1		2	
29	Tamil Nadu	3	2	1	3		2	3	1	3
30	Telangana	4		4	3		1	1		
31	Tripura	2	3	2	3			1	1	
32	Uttar Pradesh	12	6	16	16	2	23	1	3	4
33	Uttarakhand	3		1	2	2		3		2
34	West Bengal	3				1	1	1	3	2
TOTAL		84	65	68	108	58	81	68	54	50

(Source: static.pib.gov.in)

Table A4 - Performance of India in World Championships

Year	Rank	Gold	Silver	Bronze	Total	Participants	Sdi
2008	1	33	26	17	76	71	10
2009	51	1	0	2	3	204	7.5
2010	2	38	27	36	101	63	10
2011	9	3	3	3	9	64	8.5
2012	57	0	2	4	6	204	7.5
2013	-	-	-	-	-	-	8
2014	8	11	10	36	57	45	8.5
2015	5	9	4	6	19	65	9.5
2016	67	0	1	1	2	207	7
2017	7	4	1	6	11	64	9
2018	5	15	30	19	64	71	9.5
2019	-	-	-	-	-	-	9.5
2020	4	1	2	4	7	206	10
2021	-	-	-	-	-	-	9
2022	4	22	16	23	61	68	9.5
2023	17	0	2	3	5	71	7.8
2024	71	0	1	5	6	204	6.5

(Source: www.nriol.com)

Table A5 - World Ranking of India in Key Sports

Sports	Cricket	Football	Badminton	Hockey	Kabbadi	Avg Sdi
2025	10	4	7	9	7	7.4
2024	10	4	7	9	7	7.4
2023	10	5	8	10	7	8
2022	10	5	10	10	9	8.8
2021	10	5	9	9	8	8.2
2020	10	5	8	9	8	8
2019	10	4.5	7.5	9	8	7.8
2018	10	5	7	9	7	7.6
2017	10	4.5	6.5	9	6	7.2
2016	10	3.5	6	9	6	6.9
2015	10	2.5	6	9	7	6.9
2014	10	2	6	9	9	7.2
2013	10	2.5	6	8	9	7.1
2012	10	2.5	7	8	8	7.1
2011	10	2.5	6	8	9	7.1
2010	10	3	7	8	9	7.4
2009	10	3.5	6	8	8	7.1
2008	10	3	5	7	6	6.2

(Source: www.icc-cricket.com , www.fifa.com , www.badmintonindia.org)

Table A6 - Sports Policy Implementation Ranking

Year	Rank	Points	Sdi
2014	43	20,467	8
2015	36	54,225	8
2016	31	80,789	8.5
2017	35	1,48,663	8
2018	32	3,34,643	8.5
2019	23	3,27,503	9
2020	-	-	2
2021	28	3,10,425	8.5
2022	23	3,67,243	9
2023	19	4,67,301	9
2024	16	4,88,616	9.5

(Source: https://sportsrankings.world/media-release)

Table A7 - Ethics & Antidoping Compliances

Year	Test	Positives	Fund Expended	Sdi
2008-09	2100	12	5,75,00,000	4
2009-10	4525	17	15,50,00,000	1
2010-11	7175	25	14,00,00,000	4
2011-12	2508	76	3,50,00,000	9
2012-13	2945	119	7,00,00,000	9
2013-14	4445	9	8,30,00,000	1
2014-15	4700	70	11,60,00,000	8
2015-16	3400	48	12,00,00,000	7
2016-17	1969	55	2,80,00,000	9
2017-18	4000	39	14,15,00,000	5
2018-19	4348	18	17,50,00,000	1
2019-20	2712	71	13,00,00,000	8
2020-21	104	72	22,47,00,000	5
2021-22	3865	125	34,00,00,000	6
2022-23	3243	84	24,35,00,000	6
2023-24	4342	142	24,30,00,000	8

(Source: Annual Reports of MoYAS)

Table A8 - Employment Generation

Year	Employability	Percentage	Sdi
2000	61,200	0.443478261	4.5
2001	37650	0.272826087	3
2002	59050	0.427898551	4
2003	57600	0.417391304	4
2004	64200	0.465217391	4.5
2005	69340	0.502463768	5
2006	76840	0.556811594	5.5
2007	78650	0.569927536	5.5
2008	74260	0.538115942	5.5
2009	82740	0.599565217	6
2010	75320	0.545797101	5.5
2011	89740	0.650289855	6.5
2012	93600	0.67826087	6.5
2013	100000	0.724637681	7
2014	83670	0.606304348	6
2015	99730	0.722681159	7
2016	102030	0.739347826	7
2017	94180	0.682463768	7
2018	112060	0.812028986	8
2019	122250	0.885869565	9
2020	67490	0.489057971	5
2021	80490	0.58326087	6
2022	91840	0.665507246	6.5
2023	123460	0.894637681	9
2024	1,38,000	1	10

(Source: www.simplysports.in)

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Decomposing Gendered Health Inequities: A Blinder-Oaxaca Analysis of Time-Use and Sustainable Development in Kerala

Merlin Premala J

Abstract

The persistent gender gap in health outcomes remains a critical challenge in building equitable and sustainable healthcare systems. Using data from Kerala's 2024 Time Use Survey (TUS), this study examines how gendered patterns of time allocation shape disparities in physical and mental health. Applying the Blinder-Oaxaca decomposition, the study separates the gender gap in self-care into explained factors (education, employment, caregiving load) and unexplained components reflecting structural bias. Findings reveal women's disproportionate caregiving burden undermines their productivity, limits workforce participation, and perpetuates time poverty. This hidden "unpaid cost of health" constrains Kerala's progress toward SDGs 3, 5, and 8. Policy recommendations include integrating time-use metrics into public health planning, expanding caregiver support, and promoting equitable access to digital health tools.

Keywords: *Gendered health inequities, Blinder-Oaxaca decomposition, Time Use Survey (TUS), Unpaid care work, Kerala, Sustainable Development Goals*

1. Introduction

Kerala is often celebrated for its progressive health indicators, including high literacy rates, low infant mortality, and near-universal access to healthcare. Yet beneath these achievements lies a paradox: entrenched gender norms continue to shape inequities in health outcomes. Women disproportionately shoulder unpaid care work, reducing their time for rest, leisure, and preventive health practices. Despite higher engagement in health-related decision-making within households, women report lower participation in physical exercise and preventive health behaviours. Their health needs are often subordinated to caregiving duties, reinforcing a cycle of neglect and delayed treatment. In contrast, men's time

allocation favours income-generating activities and personal leisure, which indirectly supports better health outcomes.

This paper applies the Blinder-Oaxaca decomposition to Kerala's 2024 Time Use Survey (TUS) to quantify the explained and unexplained components of gendered health inequities. By linking time-use inequities to Sustainable Development Goals (SDGs), the study highlights the hidden "unpaid cost of health" and its implications for inclusive growth. The analysis is situated within the Sustainable Development Goals (SDGs): SDG 3 (Good Health and Well-being): equitable access to health resources. SDG 5 (Gender Equality): reducing unpaid care burdens. SDG 8 (Decent Work and Economic Growth): enabling women's workforce participation.

2. Literature Review

2.1 Gender and Health Inequities

Research consistently shows that women's disproportionate caregiving burden is linked to chronic fatigue, stress, and reduced participation in exercise (Hirway, 2015; WHO, 2022). Gender norms often dictate that women prioritise family care over self-care, leading to poorer health outcomes despite access to healthcare services.

2.2 Time-Use Surveys in India

Time-use surveys provide critical insights into how individuals allocate their daily hours across paid and unpaid activities. India's TUS has been used to measure time poverty and unpaid work, but few studies have directly linked it to health outcomes (Hirway, 2020). Kerala's 2024 TUS offers a unique opportunity to examine these linkages in a state with progressive health indicators yet persistent gender inequities.

2.3 Blinder-Oaxaca Decomposition

Originally applied to wage gaps (Oaxaca, 1973), the Blinder-Oaxaca decomposition separates observed disparities into explained and unexplained components. Explained differences arise from observable characteristics such as education or employment, while unexplained differences reflect structural bias and discrimination. Recent applications extend the method to health inequities, highlighting its potential to uncover hidden determinants of disparities (Fortin, Lemieux, & Firpo, 2011).

2.4 Kerala's Paradox

Kerala's achievements in health and education coexist with persistent gender inequities in labour and time allocation. Women's disproportionate caregiving

responsibilities limit their workforce participation and self-care, undermining both health outcomes and economic resilience (Devika, 2019).

3. Methodology

3.1 Data Source

The study uses Kerala's 2024 Time Use Survey (TUS), which records daily activities across demographic groups. Key variables include hours spent on unpaid domestic work, caregiving, leisure, rest, exercise, and preventive health practices. Sample: 5,000 households, stratified by district, gender, and employment status.

3.2 Analytical Framework

Dependent Variable : Self-care time (rest, leisure, exercise, preventive health).

Independent Variables : Education, employment status, caregiving load, age, marital status.

Method : Blinder-Oaxaca decomposition separates the gender gap into explained and unexplained components. Blinder-Oaxaca Decomposition

The Blinder-Oaxaca decomposition is widely used in labour economics to analyse wage gaps (Blinder, 1973; Oaxaca, 1973). It separates observed differences into:

Explained component: differences in endowments (education, employment, caregiving load). Unexplained component: structural bias, discrimination, or unobserved factors.

3.3 Statistical Tools

The decomposition was implemented using STATA, with robustness checks through regression models controlling for socio-economic status.

4. Gender disparity

Kerala's 2024 Time Use Survey (TUS) highlights stark gender disparities: women spend far more time on unpaid domestic and caregiving work, while men dominate paid employment. This imbalance directly fuels time poverty, economic insecurity, and health inequities. Time poverty the lack of discretionary time due to unpaid caregiving and domestic work disproportionately affects women. Studies show that women's reduced self-care time leads to poorer physical and mental health outcomes (Bardasi & Wodon, 2010) (Table - 4.1)

Table 4.1 Gender Disparity

Activity Category	Female (Minutes/ Day)	Male (Minutes/ Day)	Gender Gap (Female-Male)	Disparity Index (F/M Ratio)	Health Inequity Relevance
1.Unpaid Domestic Services	289	88	+201minutes	3.28:1	Primary cause of time poverty and reduced capacity for self-care and sleep. (Endowment)
2. Unpaid Caregiving	137	75	+62 minutes	1.83:1	Directly contributes to mental stress and physical fatigue, especially among the elderly. (Endowment)
Total UnpaidWork	426	163	+263 minutes	2.61:1	Core source of the Endowment Effect
3.Employment & Related Activities	341	473	-132 minutes	0.72:1	Reflects lower female economic security and access to resources, a major determinant of health
4.Learning & Education	413	415	2 minutes	0.99:1	High parity, reflects Kerala's strong educational focus, but time may be constrained by domestic duties
5.Leisure, Socializing & Culture	164	177	-13 minutes	0.93:1	Proxy for Restorative Time. Lower time for women increases stress and lowers social connection
6.Self-care & Maintenance (Inc. Sleep)	708	708	0 minutes	1.00:1	Appears equal, but quality of sleep/rest may differ due to mental load (Coefficient Effect)

Women spend over three times more time on domestic services than men. This imbalance is the primary driver of time poverty, leaving women with less time for rest, self-care, and paid employment. Econometrically, this falls under the endowment effect in the Blinder-Oaxaca decomposition, showing how observable differences in time allocation explain health disparities. Chronic sleep deprivation, reduced leisure, and limited healthcare-seeking behaviour are direct consequences of this domestic workload. Women spend nearly twice as much time on caregiving compared to men. This caregiving load contributes to mental stress and physical fatigue, particularly in households with elderly or dependent members. In decomposition terms, caregiving is a major explanatory variable for gendered health inequities, as it directly reduces women's productive capacity and increases health risks. Elevated stress levels, musculoskeletal strain, and reduced mental well-being are linked to caregiving burdens.

Employment Gap is also reflected in the survey results. Men spend 132 minutes more per day in paid work. Women's reduced participation translates into lower income, weaker bargaining power, and limited healthcare access. Kerala shows near parity in learning time, reflecting strong literacy policies. Yet women's educational gains are undermined by domestic and caregiving duties. Women spend 4.4 hours more per day on unpaid domestic and caregiving tasks. This is the core endowment effect in Blinder-Oaxaca decomposition, explaining most of the gender gap in self-care and health outcomes. Health Inequity Link is explained clearly by the fact that poverty from unpaid work reduces sleep, leisure, and healthcare-seeking behaviour, directly worsening physical and mental health.

4.2 Blinder-Oaxaca Decomposition of Gender Gap in Self-Care (Kerala TUS 2024)

Component	Hours Difference	% of Gap
Education	0.8	20%
Employment	1.2	30%
Caregiving load	1.5	37.5%
Other controls	0.2	5%
Explained (Total)	3.7	92.5%
Unexplained (Bias)	0.3	7.5%
Overall Gap	4.0 hrs/day	100%

The decomposition reveals that 92.5% of the gender gap in self-care is explained by observable factors, primarily caregiving load. This suggests that women's disproportionate caregiving responsibilities directly reduce their self-care time.

The unexplained component (7.5%) reflects structural bias - cultural norms, healthcare discrimination, and unobserved variables. This aligns with literature on gendered health inequities, where discrimination persists even after controlling for socioeconomic factors.

Endowment Effects

In education women's lower educational attainment explains 20% of the gap. For employment workforce participation differences explain 30%. Caregiving load is the largest factor, explaining 37.5%.

Coefficient Effects

The unexplained component suggests that even when women have similar education and employment as men, they still experience reduced self-care time. This points to structural inequities in healthcare access and cultural expectations. Women's caregiving responsibilities create a hidden "unpaid cost of health." Reduced self-care time translates into poorer health outcomes, lower productivity, and constrained workforce participation. Caregiving load is the largest contributor, accounting for 37.5% of the gap. Unexplained bias (7.5%) reflects structural inequities in healthcare access and cultural norms. Women's time poverty translates into reduced productivity, limited workforce participation, and poorer health outcomes.

5. Policy Implications

SDG 3 (Health): Addressing unpaid work is essential to improving women's health outcomes. SDG 5 (Gender Equality): Redistribution of unpaid work is central to achieving gender equity. SDG 8 (Decent Work): Reducing unpaid work burdens enables women's fuller participation in the labour market. Strengthening pathways from education to employment for women through skill development, entrepreneurship support, and digital literacy ensures that parity in learning translates into parity in economic security and health. Expanding women's workforce participation through flexible work arrangements, childcare support, and gender-sensitive labour policies can directly improve both economic and health outcomes.

6. Conclusion

Gendered time-use inequities remain a hidden determinant of health disparities in Kerala. The Blinder-Oaxaca decomposition reveals that structural bias outweighs observable differences in explaining self-care gaps. Addressing these

inequities requires systemic redistribution of unpaid labour, caregiver support, and integration of time-use metrics into health policy. By recognizing invisible labour, Kerala can strengthen health outcomes, economic resilience, and progress toward a sustainable and inclusive future. Kerala needs urgent focus on redistributing unpaid care work and ensuring equal returns to education and labour participation. The 2024 Time Use Survey in Kerala provides compelling evidence that time allocation is a critical determinant of gendered health outcomes. Bridging the gender gap in health necessitates systemic changes that recognize and rectify the invisible labour and time constraints faced by women. By aligning healthcare strategies with lived realities, Kerala can move closer to achieving Sustainable Development Goals 3 (Good Health and Well-being), 5 (Gender Equality), and 8 (Decent Work and Economic Growth), fostering a truly inclusive and sustainable health future.

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GST Updates

Meenu Mohan and Shency Mathew

Key GST Reforms and policy updates during October to December 2025

Part A

GST collections and revenue

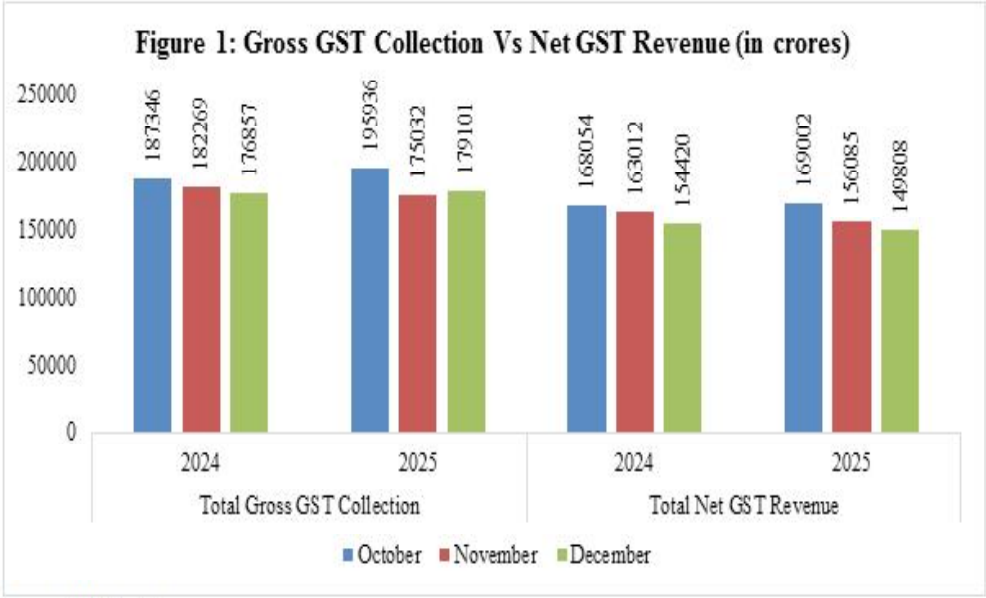
GST in India

Figure 1 presents a comparison of Gross GST collections and Net revenue for October, November, and December in 2024 and 2025. The gross GST collection declined from October to December for both years 2024 and 2025. But when we compare the corresponding months of both years, it is seen that the collection increased in October compared to the previous year. But it declined in November and then picked up in December.

In the case of Net GST revenue, the trend has changed. The net revenue for the months in 2025 declined from the revenue collected in the same months in 2024, except for September, in which a small increase in revenue occurred.

II. GST Revenue in Kerala

Kerala's Goods and Services Tax (GST) revenue showed a positive growth trajectory during the period from July to September 2025 compared to the same months in 2024. In July 2025, the State recorded a collection of Rs.2,721 crore, reflecting a 9% growth over Rs.2,493 crore in July 2024. The upward trend continued in August 2025, with collections rising to Rs.2,723 crore from Rs.2,511 crore in the previous year, marking an 8% increase. The most notable improvement was observed in September 2025, when revenue surged by 13%, from Rs.2,675 crore in 2024 to Rs.3,013 crore in 2025. The consistent increase across these three months indicates a steady expansion in Kerala's GST base, reflecting improved compliance and effective tax administration efforts in the State.



The growth rate of GST collection and revenue shown in Table 1 indicates that GST collection and revenue show no improvement in the last three months of 2025, as compared to the corresponding months in 2024. The growth rate of GST collection is positive only in the month of November 2025. The net revenue growth is negative for the months of November and December (Table -1).

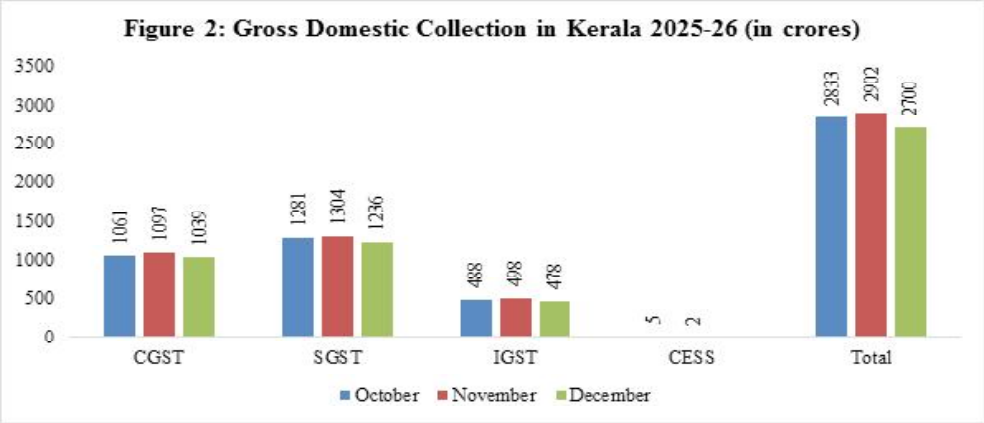
Table 1: Growth of GST (in %)

Months	Total Gross GST Collection		Total Net GST Revenue	
	2024	2025	2024	2025
October	8.1	3.7	10.0	5.4
November	-2.7	-10.7	-3.0	-7.6
December	-3.0	2.3	-5.3	-4.0

Source: calculated based on the data available from the GST portal

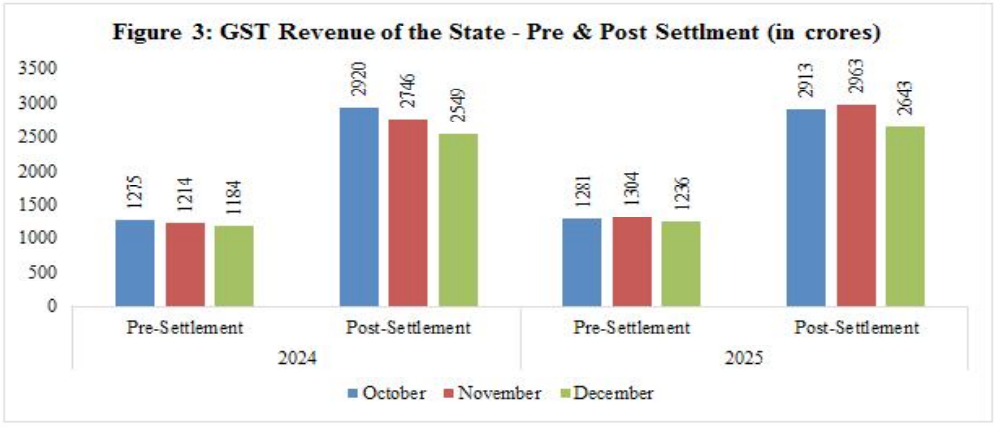
GST in Kerala

The gross GST collection from Kerala, shown in Figure 2, indicates that after a rise of just 69 crores from October to November, Kerala experiences a decline of 200 crores in GST collection in December 2025. The collection of CGST, SGST and IGST declined from their previous performance in November 2025.



Source: Same as Figure 1

Interestingly, the performance of the post-settlement GST revenue of Kerala, shown in Figure 3, shows an improvement from 2024 November and December, against the expectation of a serious decline in the same months in 2025, after the rate rationalisation implemented as part of the GST 2.O reforms.



Source: Same as Figure 1

Part B

GST Orders, Circulars, Notifications and Advisories

1. GST Rate Structure

The first pillar of change is the rationalization of GST rates, under which the earlier multi-slab structure of 0%, 5%, 12%, 18%, 28% and special rates has been streamlined into a simplified regime with principal slabs of 0%, 5%, 18% and 40% (applicable to select luxury and sin goods), while the existing 3% rate on gold and precious metals continues. The 12% and 28% slabs have effectively been subsumed, with most items earlier taxed at 12% moved to 5%, and goods from the 28% slab either reduced to 18% or elevated to 40% in the case of demerit and luxury goods. In addition, several medical devices, essentials, diagnostic kits and life-saving drugs have been exempted or subjected to lower rates to enhance healthcare affordability, and GST exemption has been extended to individual health and life insurance premiums, with insurance companies correspondingly losing eligibility to claim input tax credit on such supplies.

2. Procedural Changes

Apart from rate changes, the procedural and compliance reforms effective from 1 October 2025 assume critical importance, as they alter the processes for claiming credits, filing returns, and engaging with the GST framework.

3. Invoice Management System (IMS) & ITC Acceptance

With the Invoice Management System (IMS) becoming mandatory, the earlier system of auto-populating input tax credit (ITC) from GSTR-2B into GSTR-3B by the GSTN has been withdrawn. Under IMS, taxpayers are now required to actively review each invoice and manually accept, reject, or mark it as pending before claiming ITC, and only invoices that are explicitly "accepted" will be eligible for credit in GSTR-3B. Consequently, reconciliation between the taxpayer's books of accounts and the IMS has become compulsory for every tax period. Specific time limits have also been prescribed for taking action on invoices: monthly filers must do so within one month, while quarterly filers must act within the relevant quarter. This reform shifts the onus of compliance to the recipient, curtails indiscriminate or blind credit claims, and strengthens accountability within the GST framework.

Source: GSTN Advisory Dated 30/10/2025.

4. GSTR-3B- Many fields will be Auto-populated

From October 2025 onwards, several fields in GSTR-3B-particularly those relating to tax liability that are auto-populated from GSTR-1 or the Invoice Furnishing Facility (IFF)-will be hard-locked, disallowing any manual edits. Any correction to these

values will have to be carried out only through amendments in GSTR-1 or GSTR-1A and not in GSTR-3B. This measure is intended to curb ad hoc adjustments in GSTR-3B and to enforce stricter and more consistent linkages across the GST return forms.

5. Credit Notes & ITC Reversal

The proviso to Section 34(2) of the CGST Act has been amended to stipulate that any reduction in the supplier's tax liability through the issuance of a credit note shall be permissible only after the recipient has reversed the corresponding input tax credit. Consequently, a credit note shall not result in a reduction of the supplier's tax liability unless the recipient has first reversed the attributable ITC. This amendment seeks to preserve the integrity of the input tax credit chain and to prevent the misuse of credit notes for artificial reduction of tax liabilities.

6. Pre-deposit for Penalty Appeals

The amendments to Section 107(6) and Section 112(8) of the CGST Act provide that, in cases where an order imposes only a penalty without any tax demand, the appellant shall be required to pre-deposit 10 per cent of the penalty amount for filing an appeal before the Appellate Authority or the Appellate Tribunal. This measure is intended to discourage frivolous appeals and streamline litigation relating to penalties.

7. Unique Identification Marking (UIM)

The amendment to Section 2 introduces the mechanism of Unique Identification Marking (UIM) with the objective of establishing an effective track-and-trace framework for specified goods, including sin goods and scrap iron. Under this framework, such notified goods are required to bear a tamper-proof, non-removable digital identification mark. In addition, Section 148A authorises the Government to require reversal of Input Tax Credit (ITC) in cases where inputs are diverted or used otherwise than for the intended purpose.

8. Introducing a Simplified GST Registration

A notification provides for the insertion of Rule 9A, under which GST registration may be granted electronically within three working days, subject to automated data scrutiny and risk-based parameters. It further introduces Rule 14A, offering an optional electronic registration mechanism for taxpayers whose monthly output tax liability is below ?2.5 lakh. The rule prescribes the eligibility conditions, Aadhaar authentication requirements, and the procedure for opting into and exiting the electronic registration system. In this regard, new statutory forms-GST REG-32, relating to the application for withdrawal, and GST REG-33, pertaining to the order of withdrawal-have been notified. The notification also details the verification framework, document submission norms, and the manner of filing applications through the GST common portal.

Approved at the 56th GST Council Meeting on September 3, 2025, and announced by Finance Minister Nirmala Sitharaman, the initiative introduces a simplified GST registration mechanism to ease compliance for small and low-risk businesses. The revised framework enables auto-approval of nearly 96% of new registration applications within three working days, a marked improvement over the earlier scrutiny process that generally required three to seven days and often extended further. Rather than a blanket reform, the measure provides targeted relief to small businesses that are vital to India's economy. The simplified procedure is applicable to new GST registrations submitted through the GST Portal (gst.gov.in) with effect from November 1, 2025.

Small and low-risk businesses are eligible to get the benefit. If the projected output tax liability (CGST + SGST/UTGST + IGST) on supplies made to registered persons is below ?2.5 lakh per month, the applicant is eligible. This self-assessment is voluntary and may be opted for at the time of application. A dedicated scheme has been provided for suppliers making supplies through e-commerce platforms like Amazon and Flipkart across multiple States. Under this scheme, the issue of maintaining a "principal place of business" is simplified, as there is no requirement to set up physical establishments in each State.

Applicants classified as high risk-such as those with a history of non-compliance or supplies above the threshold-must undergo the standard process. Existing registrants may seek migration to the scheme after approval is granted.

As per the 56th GST Council Press Release dated 3 September 2025, the revised provision is expected to benefit nearly 96% of applicants. The measure significantly simplifies compliance procedures, thereby enhancing ease of doing business while continuing to safeguard revenue integrity. Notably, this reform is particularly advantageous for startup artisans and small sellers of handicrafts operating through online platforms, as it removes procedural bottlenecks that previously delayed market entry.

Source: Notification No. 18/2025-Central Tax Dated: 31st October, 2025

9. Proper Officers for Adjudication under Section 74A, 75(2) and 122 of CGST

In order to address a jurisdictional gap, the circular assigns specific officers as "proper officers" for the purpose of adjudication under Sections 74A, 75(2), and 122 of the CGST Act and Rule 142(1A). Earlier, no officers had been expressly empowered to exercise authority under these provisions. These sections deal respectively with the assessment of tax short-paid from FY 2024-25 onwards, re-assessment of tax where allegations of fraud fail at the appellate stage, and the imposition of penalties for various statutory violations. The circular also lays down officer-wise monetary thresholds governing the issuance of show cause notices and passing of orders under Sections 74A and 122.

Source: Circular No. 254/11/2025 - GST Dated: 27th October, 2025

10. Advisory to file pending returns before expiry of three years

The Government of India has issued an advisory urging taxpayers to file all pending GST returns before the expiry of the three-year statutory time limit prescribed under the Finance Act, 2023. With effect from 1 October 2023, the amended provisions prohibit the filing of returns after three years from their respective due dates under Section 37 (GSTR-1), Section 39 (GSTR-3B and other returns), Section 44 (GSTR-9/ 9C), and Section 52 (GSTR-8) of the CGST Act. This restriction will be enforced on the GST portal beginning with the November 2025 tax period. Consequently, returns pertaining to the October 2022 tax period (including GSTR-1, GSTR-3B, GSTR-5, etc.), as well as annual returns for the financial year 2020-21, will become time-barred from 1 December 2025 onwards. Taxpayers are therefore strongly advised to reconcile their records and file all pending returns at the earliest to avoid being statutorily barred from compliance.

Under the prevailing statutory framework, taxpayers are prohibited from furnishing GST returns after a lapse of three years from the prescribed due date for such returns under Section 37 (details of outward supplies), Section 39 (self-assessed tax payments), Section 44 (annual return), and Section 52 (tax collected at source). These provisions encompass returns including GSTR-1, GSTR-1A, GSTR-3B, GSTR-4, GSTR-5, GSTR-5A, GSTR-6, GSTR-7, GSTR-8, and GSTR-9/9C. This time-bar will be operationalised on the GST portal with effect from the November 2025 tax period. Consequently, any return whose due date falls three years or more prior to November 2025 and remains unfurnished by that time will no longer be permitted to be filed.

Source: GSTN Advisory Dated 29/10/2025

11. Advisory for Simplified GST Registration Scheme

Key Features Implemented on the GST Portal: While applying for registration in FORM GST REG-01, applicants should select "Yes" under the "Option for Registration under Rule 14A." Aadhaar authentication is mandatory for the Primary Authorized Signatory and at least one Promoter/Partner. Registration shall be granted electronically within three working days from the date of generation of the Application Reference Number (ARN), subject to successful Aadhaar authentication. Taxpayers opting for registration under Rule 14A are advised to take note of the following conditions, in case they intend to withdraw from the Scheme at a later stage: All returns due from the effective date of registration up to the date of filing the withdrawal application must be filed. The taxpayer must have filed:

(a) Returns for a period of minimum three months, if applying for withdrawal before 1st April 2026, or

(b) Returns for a period of minimum one tax period, if applying for withdrawal on or after 1st April 2026.

No amendment or cancellation application for registration availed under rule 14A should be pending. No proceedings under Section 29 (cancellation of registration) for registration availed under rule 14A should be initiated or pending.

Source: GSTN Advisory Dated 01/11/2025

12. New GSTAT Benches

The Government of India, through the Ministry of Finance, Department of Revenue, issued Office Order No. 03/2025 dated 26 December 2025, approving the allotment of benches to the appointed Members of the Goods and Services Tax Appellate Tribunal (GSTAT). The order details the postings of Technical Members (Centre), Technical Members (State), and Judicial Members across various locations throughout the country, encompassing both metropolitan centres and regional benches.

The allotment specifies the place of posting of each Member with a view to ensuring adequate geographical coverage and operational preparedness of the Tribunal. Issued with the approval of the competent authority, the order was circulated to all Members concerned, senior revenue officials, the President of GSTAT, and the Registrar of the Principal Bench at New Delhi. This administrative measure formalises the constitution and deployment of GSTAT benches, thereby facilitating the effective functioning of the Tribunal and strengthening appellate adjudication under the GST framework across India.

Source: Office Order No. - 03/2025, Ministry of Finance, Department of Revenue, Government of India 26th December, 2025

13. Changes in GST Appeal Portal

The Goods and Services Tax Appellate Tribunal (GSTAT), vide Order No. 315/2025 dated 16 December 2025, revoked its earlier order dated 24 September 2025 which had prescribed a staggered mechanism for filing appeals under Section 112 of the Central Goods and Services Tax Act, 2017. The earlier arrangement required appeals arising from orders passed under Sections 107 and 108 to be filed in phases, owing to limitations in portal capacity.

Upon a review of the technical preparedness and operational capacity of the GSTAT appeal portal, the Tribunal concluded that continuation of the staggered filing system was no longer necessary. Accordingly, with a view to facilitating smooth and unhindered access for appellants while ensuring system efficiency, the Tribunal decided to discontinue the said mechanism.

In exercise of the powers conferred under Rule 123 of the GST Appellate Tribunal (Procedure) Rules, 2025, the President of GSTAT ordered that the revocation shall take effect from 18 December 2025. Appeals already filed under the earlier staggered filing arrangement prior to that date were expressly protected and shall remain valid.

The order was issued without prejudice to the statutory powers of the Tribunal under Section 112 of the Act.

Source: GSTAT Order 315/2025 Dated 26/12/2025

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New Studies on Kerala

Young Scholars' Forum, GIFT
Led by Manju Annie Antony Pinto and Ijlal Yasir

Investment, Finance, and Financial Institutions

Other Articles

Kerala - A model state for financial inclusion in India. (2025). EPRA International Journal of Environmental Economics, Commerce and Educational Management, 12(10), 119.

Financial inclusion is really a system of bringing the people into the main stream of financial behaviour for facing their day-to-day requirements. In Kerala there are many plans and programs adopted by the government to build a strong Financial Inclusion across the states. This is a conceptual study, fundamentally aims to analyse such plans & programs and to arrive at a conclusion about its efficiency as regards its implementation. This research work is also attempts to examine the position of Kerala in terms of overall financial inclusion efforts of India.

Society and Culture

Scopus Indexed

Jacob, M. R. S., & Muruganathan, M. (2025). Socio-economic vulnerability and mental well-being of migrant households: A case-study of Pathanamthitta District of Kerala. TPM - Testing, Psychometrics, Methodology in Applied Psychology, 32(S9), 1268-1273.

Migration has emerged to be a socio-economic phenomenon in Pathanamthitta district, where a significant share of households depend on internal and international mobility for income, education, and improved living standards. Migration largely contributes to upward economic mobility, but at the same time it also generates financial and emotional strain causing psychological challenges for families left behind. This study examines the socio-demographic characteristics of migrant households, their socio-economic vulnerability, and mental well-being levels through the WHO-5 scale. Primary data were collected from 120 migrant households across selected taluks using a structured questionnaire for the study. The study highlights that higher socio-economic vulnerability reduces psychological well-being, underscoring the need for integrated policies addressing financial stability, mental health support, and social protection. There is a need to strengthen community-level counselling services, enhanced financial

literacy, and social welfare coverage to safeguard the well-being of migrant households in Pathanamthitta.

A thematic analysis of the Kudumba Shree self-help group programmes (2020-2025). (2025). TPM - Testing, Psychometrics, Methodology in Applied Psychology, 32(S9).

The social impact of Self-Help Groups (SHGs) on women's empowerment and social inclusion is an ever-vibrant global topic. In India, a lot of studies have analysed the role of these self-help groups in fostering women's economic, social, and political inclusion, moulding leadership skills, and strengthening physical and psychological wellness. In Kerala, the State Poverty Eradication Mission, Kudumbashree, started Neighbourhood SHGs (NHGs) with the aim of poverty eradication and women's empowerment and their social inclusion. It consists of a three-tier structure with Neighbourhood Groups (NHGS) working like SHGS as primary level units, Area Development Societies (ADS) at the ward level, and Community Development Societies (CDS) at the local government level. While the community network is formed around the central themes of poverty eradication and women's empowerment, its main features include democratic leadership and support structures formed from the 'Kudumbashree family'. There will be 10 - 20 members in each self-help group representing their homes. Kudumbashree has successfully linked with major government initiatives like the National Rural Livelihood Mission (NRLM) and MGNREGS and designed and implemented many empowerment programs, including Microfinance, Economic Entrepreneurship Development, the Haritha Karma Sena, and the Ashraya destitute rehabilitation project to realise the dream of women's inclusion and encourage women's representation in societies and welfare programmes. With approximately 46 lakh members in its core groups, Kudumbashree constitutes one of the largest women's movements in Asia. The mission continuously updates its empowerment agenda by planning various initiatives, entrepreneurship, empowerment programmes and also expanding its network through the formation of Auxiliary Groups for young women and students, Balasabha for teenagers, aiming to bridge generational gaps and leverage their capacity for social development, career development. The purpose of this study is to consolidate those studies conducted in Kerala on Kudumbashree from 2020 to 2025, synthesising their social relevance, key themes, trends, challenges, and opportunities, and proposing valid policy recommendations. It analyses the updating of the SHG programmes and its extension to social and political participation

Book Chapter

Parvathy, D., & Mary, R. (2025). Role of social and solidarity economy (SSE) in Kerala, India: Special reference to the cooperative movement. In Post-pandemic world order (1st ed., pp. 1-11). Routledge.

All commercial endeavours that aim to be both financially sustainable and motivated by a strong social goal are collectively referred to as "social economy." This covers a broad spectrum of organisations and includes mutual societies, cooperatives, foundations, non-profit associations, and social businesses. Social economy companies seek to turn a profit for stakeholders apart from owners or investors. They are owned, governed, and controlled by their members. In Kerala, cooperatives have a significant impact on and change most facets of social and economic life in both rural and urban areas. In the primary sectors of the Kerala economy, such as agriculture and rural credit, distribution of agricultural inputs, storage, fertiliser, marketing, labour, microfinance, and housing, cooperatives are essential. The cooperatives exhibit greater resilience during times of crisis because of their unique governance features that guarantee member centrality. This chapter tries to explore the role of the social economy of Kerala in general and how it can help to build a sustainable cooperative resilience model for the post-pandemic period.

Other articles

Ramla, K. (2025). Predictors of student dropout: A discriminant analysis of Muslim and non-Muslim students in higher education in the Malabar regions of Kerala. Advanced International Journal for Research (AIJFR), 6(5).

Educational attainment plays a crucial role in shaping human capital and social development, but student dropouts remain a persistent issue, particularly in marginalized communities. This study applies discriminant analysis to examine the differences between Muslim and non-Muslim student dropouts in the higher education sector of the Malabar region of Kerala. Using primary data, the analysis evaluates the influence of variables such as standard of living, marriage, parental attitude, economic condition, health issues, job prospects, exam results, and students' aspirations to continue education. The results indicate that marriage, parental attitude, standard of living, and health issues are the strongest predictors of dropout disparities between Muslims and non-Muslims. While Muslim students generally performed well academically and demonstrated a willingness to pursue higher education, parental objection and early marriage significantly hindered their continuation. Poor economic condition affected 24.8% of nonMuslims but only 5.2% of Muslims affected it. The findings underscore the importance of community and parental awareness programs to reduce dropout rates and foster equal educational opportunities.

Agriculture and Rural Economy

Scopus Indexed

Saruk, B. S., & Rayalu, G. M. (2025). Optimizing rice yield prediction: A policy-oriented approach to agricultural sustainability. Results in Engineering, 28, 107844.

Accurate forecasting of rice yield is critical to ensuring global food security, supporting market stability, and enabling data-driven agricultural policy. This study evaluates a comprehensive suite of machine learning (ML) and statistical regression models to predict rice yield using meteorological and agronomic data from Kerala, India. Models assessed include Random Forest Regression (RFR), Gradient Boosting Regression (GBR), Support Vector Regression (SVR), Multiple Linear Regression (MLR), Least Absolute Shrinkage and Selection Operator (LASSO) Regression, Ridge Regression (RR), Elastic Net Regression (ELNR), and a hybrid ensemble combining LASSO, XGBoost, and RFR. GBR achieved the highest predictive accuracy (= 0.839), followed closely by SVR (= 0.837) and the hybrid model (= 0.827), with the hybrid model attaining the lowest Root Mean Square Error (RMSE). Beyond predictive performance, the study integrates causal inference to assess the impact of a policy intervention initiated in 2010. Regression results indicate that the policy is associated with a statistically significant yield increase of approximately 279 Kg/Ha , while excessive rainfall is negatively associated with yield (-0.243 Kg/Ha/mm;). The integration of predictive analytics and policy-aware modeling presents a robust framework for forecasting yield and evaluating the real-world effectiveness of agricultural interventions. These insights offer substantial value for policymakers and stakeholders aiming to optimize food production systems.

Lekshmi, G. S., Aryadevi Remanidevi Devidas, R., Pushpalatha, R., Gangadharan, B., & Hariprasad, K. M. (2025). Enhancing coconut yield potential: A climate-smart land suitability analysis using machine learning. Smart Agricultural Technology, 12, 101087.

Coconuts (Cocos nucifera L.) play a critical role in Kerala's agricultural landscape, serving as a cornerstone of agricultural income and significantly contributing to the state's economy. Despite their economic importance, variations in land and climate conditions across the region lead to inconsistencies in coconut yield and productivity, limiting the full potential of coconut farming. This study aims to enhance coconut cultivation in Kerala by i) comparing various machine learning (ML) and deep learning (DL) models to identify the optimal model for soil suitability prediction; ii) developing a climate model to assess climate suitability; and iii) integrating both soil suitability and climate suitability models to classify the study regions into suitability categories highly suitable, moderately suitable, less suitable, and not suitable, for coconut farming. Using a dataset from the Soil Survey Department, the XGBoost algorithm was applied to classify soil suitability in the study area (Thiruvananthapuram, Kerala, India). Climate

suitability was assessed using the MaxEnt model. Finally, GIS tools were used to combine these results into a comprehensive suitability map. For soil suitability prediction, we tested various machine learning and deep learning models, ultimately selecting XGBoost as the optimal model due to its near-perfect accuracy of 100%. The MaxEnt model enhanced the assessment of climate suitability with an accuracy of 67.7%, providing insights into optimal farming conditions. This study presents an integrated land and climate suitability model for coconut farming, demonstrating the effectiveness of ML and DL models for soil suitability analysis. This approach offers a robust framework for improving coconut cultivation and can be applied to other regions and crops.

Scopus Indexed- Book Chapter

Ayyoob, K.C., Bhattacharya, D., Sarkar, K.A. et al. Comparison of statistical models and machine learning algorithms in forecasting rubber yield in Kerala. J Rubber Res 28, 675-681 (2025).

Rubber is the most important economic crop of Kerala, which plays a significant role in the agrarian economy of the state. The present study aimed to develop a forecasting model for the yield of rubber in Kerala, using the productivity data and meteorological data from the past 62 years, from the year 1960-1961 to 2022-2023. The study used both conventional approaches and advanced machine learning techniques for the model development. Different time series models have been developed based on ARIMA, ARIMAX, NNAR, and NNARX methods. Annual rainfall and annual maximum temperature were used as exogenous variables for this study. The models were compared for accuracy and goodness of fit using RMSE and MAPE values. The conventional models, ARIMA and ARIMAX, performed well in model model-building phase, but the prediction accuracy declined in the validation phase. The models NNAR (2,4) and NNAR (2,3) with exogenous variables have performed equally well in terms of accuracy and model fit across both development and testing phases. NNAR (2,4) has been identified as the best model considering its simplicity.

Punnoli, D., Jayarajan, K., Sankar, T., Punnoli, S., & Palaniswamy, J. (2025). Efficient water management to enhance rice crop productivity and farm income under climate variability and change. In P. K. Rai & S. Rai (Eds.), Blue-Green Land Management and Smart Ecosystem Services (Advances in Geographical and Environmental Sciences). Springer, Singapore.

Geomorphology, one of the comprehensive branches of geography, has evolved from a more descriptive subject to a more applied subject. Rice production in the country is increasingly at risk with enhancing climate variability and change. Rice production

demands more irrigation water demand. Cultivation of rice takes around 25 percentage of worlds fresh water resources. There is always a demand supply gap in the production of this staple crop, rice production in Kerala as it produces only less than one-fifth of its requirement. In the present study area, Bharathapuzha basin (BPB), rice is a major crop. Detailed semi structured interview was conducted to understand the water management in rice cropping systems in the basin. The challenges and opportunities in water management are dealt in this research paper. The basin receives a rainfall in the range of 700 mm in the east, north eastern ends and to 2800 mm on the west and north west. Kharif (Viruppu crop) on these lands is largely a rainfed crop grown during the South West Monsoon. Generally starting as a dry broadcast crop, it ends up in wet conditions. Whereas Rabi crop (Mundakan) crop is generally a transplanted crop under assured irrigation grows throughout under continuous wet conditions during the northeast monsoon rainfall. The net irrigation water requirement for paddy varies with season, less during Viruppu and more during Mundakan, ranged from 500 to 1500 mm in the basin, through minor, medium and major irrigation projects. The rising climate extremes, variability and change, more focus must be shown to manage the available surface and ground water for irrigation as paddy requires. Simulation modeling states an increasing crop water demand for rice production in the present and future climate change scenario due to day and night time warming. Cluster analysis identifies blocks with similar characteristics located in different regions of the districts. Farmers have seemed to be benefitting in irrigation management by adopting ICT-based weather early warning and nature-based solutions recently. Even then, in the current harvesting season, Mundakan rice, January 2024, unprecedented rainfall due to cyclonic depressions in Arabian Sea, has spoiled the harvest ready crops in the basin. Farmers stated that there is always an year delay in getting weather-based crop insurance under the Vila Insurance Plan under both state and central government. Crop insurance system must be more vigorous to reduce risks and cater to the timely needs of the marginal, small and medium rice farmers. Efficient crop water management using the possibilities of both traditional natural farming and latest ICTs is a must to sustain and enhance farmers' income.

Book Chapter

Nambiar, S. R., Satheendran, S. S., & Dhanya, R. (2026). Land use/land cover changes of Kannur District, Kerala from 1969 to 2024: A geospatial investigation. In K. Muthukkumaran, K. M. Mini, S. K. Shukla, & K. S. Kasiviswanathan (Eds.), Proceedings of the International Conference on Advances in Materials, Modeling, and Analysis for Sustainable and Resilient Infrastructure, Volume 1 (AMMA SRI 2025) (Lecture Notes in Civil Engineering, Vol. 719) Other Articles.

Variations in Land Use and Land Cover (LULC) impact significant policy decisions and contribute to global developments. Rapid population increase, urbanization, and limited arable land are important drivers influencing global LULC change in the world now. The change in land use does not necessarily indicate the deterioration of the land. Land-use patterns fluctuate due to many causes, compromising biodiversity, energy budgets, water, and greenhouse gas emissions, and leading to significant climate shifts in the biosphere. The indicators of these changes are fast and can be identified as the total amount of greenhouse gases in the atmosphere, such as nitrous oxide (NO), methane, and carbon dioxide transformation, degradation of natural vegetation regions, and biodiversity loss. Geospatial techniques can be employed to recognize alterations in LULC mapping. In this study, the LULC pattern as well as its shifts in Kannur district, Kerala, were assessed using optical remote sensing, as well as their spatiotemporal changes from 1969 to 2024. The investigation indicated that the study area is experiencing significant urbanization due to the large-scale change of natural ecosystems, notably mixed crops and barren land. It was discovered that the attempt to categorize LULC using satellite photos was successful. The results of the study prove that the severe deleterious effects were mainly seen on the vegetation cover as a result of modifications in land use following a growth in development, which alters the pattern of land cover.

Other Articles

Nair, A., Chandran, S. S., & Varangalil, N. (2025). Building resilience: Addressing heatwaves in Kerala through climate change adaptation and policy response. Working paper, Amrita Vishwa Vidyapeetham, Amritapuri, India. Posted November 5, 2025 (manuscript dated November 2, 2025).

Kerala, well known for its tropical climate, is now burning out with heat waves due to climate change. The occurrence of heatwaves is intensifying each year, and the impacts are affecting the population through many sectors like health, occupation, diseases, education, outdoor activities, ecosystem, biodiversity, etc. Mortality associated with heat waves is increasing, and extreme heat events are now becoming life-threatening. The temperature recorded in different districts of Kerala has already reached 40? in February 2025, even before the summer season started. The highest temperature recorded in Palakkad is 41.9? in April 2016, then 41.8? in April 2024, and the year 2024 is the warmest year of Kerala. A total of 5 deaths were confirmed due to heatstroke in Kerala in 2016, 2024, and 2025. Still, heatwave events are not taken seriously into consideration as other extreme weather events like floods, heavy rainfall, landslides, etc. The percentage of articles covering the heatwaves is so low across the country. So, this paper reviews the heatwave trends due to climate change in Kerala by critically analyzing the published works and government reports. Here, we evaluate the adaptation strategies and policy

frameworks adopted for the extreme heat wave events and the urgency in implementing Kerala-specific action plans for unprecedented climate variations.

Shanila, S., & Helen, S. (2025). Development of a scale to assess Kerala farmers' attitude towards digital technologies in agriculture. Indian Journal of Extension Education, 61(4), 165-169.

The expanding role of digital technologies in agriculture highlights the importance of understanding farmers' attitudes toward their adoption, particularly in the context of Kerala's digital infrastructure and e-governance. The research, carried out in 2025, sought to create a standardized Likert attitude scale to evaluate the attitude of Kerala farmers on the employment of digital technologies in agriculture. A preliminary collection of 68 attitude statements was formed through literature research and expert input. These statements were assessed by 30 specialists in agricultural extension, and following their feedback, 56 items were chosen for further analysis. The chosen items were distributed to 60 farmers from non-sample regions-30 from Karuvatta Panchayat and 30 from Kayamkulam Municipality, situated in the Onattukara Sandy Plain agro-ecological unit. Participants rated the statements using a five-point Likert scale. Employing the t-test established by Edwards (1957, 1969), statements with strong discriminative ability were retained, resulting in a final scale of 20 items comprising 10 positive and 10 negative statements, achieving a Cronbach's Alpha of 0.91, which demonstrates excellent reliability and content validity confirmed through expert assessment.

Neha, A. R., Bindu, B., Simi, S., Manju, P. R., & Pratheesh, P. G. (2025). Chemical characterisation of exotic jackfruit (Artocarpus heterophyllus Lam.) varieties. Journal of Advances in Biology & Biotechnology, 28(11), 1650-1656.

A study entitled "Characterization of selected exotic jackfruit (Artocarpus heterophyllus Lam.) varieties" was conducted at the Department of Fruit Science, College of Agriculture, Vellayani, Thiruvananthapuram, from November 2024 to July 2025. Fifteen exotic jackfruit varieties were identified from South Kerala, covering the districts of Thiruvananthapuram, Kollam, Alappuzha, and Kottayam. No systematic study has been conducted so far regarding the evaluation of exotic jackfruit varieties under Kerala conditions. Therefore, this study focused on the chemical characters, including TSS, Acidity, reducing sugars, non reducing sugars, total sugars and total carotenoid content present in these varieties. The J 33 variety had a high TSS of 40.7°Brix, while Thailand Red and J 13 varieties had the highest acidity level of 0.64%. The Thailand Red variety exhibited the highest reducing sugar level (8.33%), and total sugar content was found to be high in J 33 variety (17.92%). The Red Jack variety had the highest carotenoid content

of 4430.13 ?g/100g. The results obtained were subjected to statistical analysis using Principal Component Analysis (PCA). The results indicate that the exotic jackfruit varieties possess distinct advantages and further exploration and utilisation of these varieties is essential for promoting commercial cultivation.

Thomas, S., & Lekshmy, P. R. (2025). Probabilistic coastal risk mapping under sea-level rise: A Monte Carlo framework for dynamic exposure hotspots. Science of the Total Environment, 1002, 180552

Coastal systems face escalating threats from sea-level rise (SLR), yet major knowledge gaps persist: most assessments remain deterministic, lack interpretable machine learning approaches, and fail to quantify uncertainties in climate projections or shoreline responses. This study presents an integrated, uncertainty-aware framework for assessing coastal exposure and prioritizing risk under future SLR scenarios. Focusing on Kerala, India, the analysis combines spatial modelling (InVEST Coastal Vulnerability Model), explainable machine learning (Random Forest with SHapley Additive explanations), probabilistic SLR projections, and Monte Carlo (MC) simulations. Shoreline exposure was ranked based on six biophysical and habitat-based factors. The key findings are: 1) Feature importance identified wind exposure (47 %), topographic relief (17 %), and wave energy (17 %) as the dominant drivers. 2) MC simulations (2000) incorporating ±1 rank perturbations and SLR sampling from the 17th-83rd percentile IPCC AR6 projections resulted in statistically significant reclassification of 29.5 % of shoreline points (paired t-test, $p < 0.001$). 3) Scenario-based projections for 2030, 2050, and 2100 across Shared Socioeconomic Pathways revealed nonlinear increases in exposure. 4) Uncertainty-aware maps revealed emergent hotspot patterns in transitional districts such as Thiruvananthapuram and Malappuram. 5) Composite Risk Index, integrating physical exposure with Social Vulnerability Index, identified Malappuram as a high-priority district due to compounded socio-economic vulnerability despite moderate physical exposure. This study presents a novel integration of InVEST, SHAP-based interpretability, and MC uncertainty propagation for coastal risk modelling in Kerala. The framework provides a scalable, evidence-based tool for local-to-regional adaptation planning, aligned with the Sendai Framework's call for anticipatory, risk-informed action.

Arun, R. (2025). Dynamics of paddy cultivation in Kerala (2005-2020): An analysis of declining area, rising productivity, and future of food security. EPRA International Journal of Agriculture and Rural Economic Research (ARER), 13(10).

This study provides a comprehensive analysis of the paddy cultivation sector in the state of Kerala, India, from 2005 to 2020, a period characterized by significant structural

transformations. The research addresses the central paradox of a sharp and continuous decline in the area under paddy cultivation occurring concurrently with a steady increase in land productivity. The primary objectives of this paper are to empirically analyse the trends in land utilization, including both cultivated and fallow lands; to examine the divergent trajectories of total production and per-hectare productivity; and to evaluate the profound implications of these trends for the state's food security. The methodology is based on a descriptive and comparative analysis of time-series data compiled from official government sources, including the Kerala Directorate of Economics and Statistics and National Sample Survey reports. The findings reveal a substantial contraction of approximately 25.6% in the cultivated paddy area over the 15-year period. In stark contrast, productivity demonstrated a robust increase of 35.3%, rising from approximately 2,285 kg/ha to over 3,090 kg/ha. Despite these efficiency gains, the state's domestic production has stagnated, consistently meeting only about 10% of its total rice consumption, thereby creating a significant food security deficit. Scenario-based analysis indicates that even under optimistic assumptions of full land utilization and achieving national productivity benchmarks, Kerala cannot attain self-sufficiency. The study concludes that productivity enhancements alone are insufficient to address the state's food security challenges. It underscores the critical need for an integrated policy framework that not only promotes technological adoption and climate resilience but also addresses the underlying socio-economic drivers of land conversion, thereby ensuring the economic viability and ecological sustainability of paddy farming in Kerala.

Thomas, M. K., & Attokkaran, S. V. (2025). A study on the impact of the Kerala Paddy and Wetland Conservation Act, 2008: An analysis of area, production, and productivity trends. Unpublished research article, Department of Economics, Vimala College (Autonomous), Thrissur, Kerala, India. Available online: 25 October 2025.

The steady decline in paddy cultivation area has been a significant concern for food security in Kerala. In response, the Government of Kerala enacted the Kerala Paddy Land and Wetland Conservation Act in 2008, aimed at protecting existing paddy fields from conversion to other uses. This study evaluates the impact of this Act by comparing trends in the area under cultivation, production output, and productivity (yield per hectare) of rice in Kerala for the periods before (2000-01 to 2009-10) and after (2010-11 to 2020-21) the implementation of the Act. Data from the Kerala Agricultural Statistics and other government publications are analyzed. The findings indicate that while the Act appears to have contributed to a stabilization of the area in the latter part of the study period and a significant, consistent improvement in productivity. This suggests that the Act, alongside other supportive measures, has been successful in intensifying cultivation on protected lands, though challenges in expanding the cultivation area persist.

Guntha, R., Anand, S., Kumar, N. M., Singh, B., Indukala, P. K., Sreedevi, R. S., & Rashed, T. (2025). A systemic approach to the analysis of organic farming practices: A case study of rural Kerala, India. SSRN working paper.

This study analyzes the challenges of organic farming adoption in Nellarachal, Kerala, India, through a systems-thinking approach encompassing pre-fieldwork, fieldwork, and post-fieldwork phases. Survey data from 40 local farmers were statistically analyzed, revealing that factors such as land ownership (r=0.587), animal husbandry (r=0.569), and market access directly influence successful transition to organic farming, while alternative livelihoods (r=?0.387) and group cultivation (r=?0.477) negatively affect outcomes. The findings show that 60% of farmers prefer alternative wage labor over farming, and most combine organic and chemical practices for commercial crops due to financial and logistical constraints. Policy implications include the need for tailored support: interventions should address farmer revenues, facilitate consumer-market linkages, and promote accessible training in local contexts. Compared to Sikkim's uniform transition policy, the study's systems-based interventions recommend targeted subsidies, labor support, and consumer awareness measures to enable sustainable, scalable adoption. The research demonstrates that leveraging systems thinking yields actionable recommendations for policymakers to design more effective, context-sensitive organic farming initiatives.

Sunil, V. G., Benny, A., Krishna, A. R., Aswathi, K. K., & Jaliya, M. K. (2025). Enhancing agricultural productivity and income through ICT-mediated extension: A case study of the Farm Extension Manager App in Kerala, India. Asian Journal of Current Research, 10(4), 223-231.

The Farm Extension Manager (FEM@Mobile) mobile app, developed by Kerala Agricultural University, offers farmers crop-specific fertiliser schedules, pest and disease diagnostics, and protocol-based advisories. This study evaluates its effectiveness using a mixed-methods approach, combining app feature analysis, user analytics, and a field survey of 120 farmers, with impact estimation conducted through Propensity Score Matching (PSM) to ensure methodological rigor.

Public Policy

Scopus Indexed

Bhat, W. A., & Majid, S. (2025). Beyond "another possible world": A critical reassessment of the Kerala model's enduring contradictions. Third World Quarterly, 46, 267-288.

Often lauded as a progressive alternative to neoliberal development, the Kerala Model,

particularly as celebrated by T.M. Thomas Isaac's Kerala: Another Possible World (2022), presents an intriguing case of high human development despite modest economic growth. This article critically reassesses Kerala's trajectory, situating Isaac's optimistic narrative within broader scholarly critiques to unpack the model's inherent contradictions. Employing thematic and historically-informed qualitative analysis, the study examines democratic decentralization, crisis management, and the Kerala Infrastructure Investment Fund Board (KIIFB). While recognizing achievements like high literacy and life expectancy, the analysis rigorously interrogates how these successes coexist with significant structural challenges, including persistent youth unemployment, escalating fiscal deficits, remittance dependency, and KIIFB's transparency concerns. Enduring inclusivity gaps for marginalized communities further temper its egalitarian claims. Drawing comparative insights, the findings advocate for transparent fiscal governance, economic diversification, and inclusive participatory frameworks to address these tensions. This reassessment offers crucial lessons for subnational entities navigating neoliberal constraints, suggesting Kerala's 'another possible world' is a dynamic, contested project requiring continuous critical engagement rather than uncritical emulation.

Other Articles

K. J Joseph and Kiran Kumar Kakarlapudi (2025). The Income Distance Paradox Devolution Conundrum for the Finance Commission (GIFT Discussion Paper Series 06/ 2025). Gulati Institute of Finance and Taxation.

We highlight two key issues of concern for the 16th Finance Commission. Declining progressivity in devolution is evident in the downward trend in the share of lower-income states in the divisible pool, as well as a paradox of declining fiscal capacity among states with rising per capita income. Neither low-income nor high-income states benefited from the income distance criterion, which had the highest weight in the devolution, assuming a positive relationship between fiscal capacity and per capita income. The study recommends adjustments to the weights of the income distance criterion and population to ensure that performers are not penalised while progressivity is maintained.

Nidheesh, M. K. (2025). Population ageing and tax devolution in India: A critical analysis with a focus on social security pension and health care programmes in Kerala. Ubezpieczenia Spo?eczne. Teoria i Praktyka, November 2025.

Rapid population ageing in India increases states' welfare and health care costs, while the 15th Finance Commission's horizontal devolution has strained several state budgets.

Objective:?To assess how ageing affects social pension and health care programmes and whether the current tax-sharing formula matches states' needs, using Kerala as a case study. Materials and methods:?Secondary-data synthesis, including Finance Commission reports, demographic projections, union and state budgets, parliamentary records, economic reviews, and news reports. The study traced demographic trends, union allocations to IGNOAPS and NPHCE, Kerala's spending on social pensions, palliative care and the special programme for old age, and simulated inter se shares of the states for the 16th Commission with updated inputs. Results:?Union funding for key old-age programmes remains limited, whereas Kerala has significantly expanded its own allocations. The state now covers roughly half of its older population under the social pension programme; however, borrowing caps delayed pension disbursements. Simulations show that, if the 15th-FC formula persists, several states- including those with a higher share of the older population - lose share in the divisible pool; adding the 'share of older population' as a criterion would enhance equity and fiscal capacity for ageing policy. Recommendation: revise the devolution formula accordingly for the 16th FC.

Krishnakumar, U. R. (2025). Kerala - A model state for financial inclusion in India. EPRA International Journal of Environmental Economics, Commerce and Educational Management, 12(10), 119.

Financial inclusion is really a system of bringing the people into the main stream of financial behaviour for facing their day-to-day requirements. In Kerala there are many plans and programs adopted by the government to build a strong Financial Inclusion across the states. This is a conceptual study, fundamentally aims to analyse such plans & programs and to arrive at a conclusion about its efficiency as regards its implementation. This research work is also attempts to examine the position of Kerala in terms of overall financial inclusion efforts of India.

Chathukulam, J., & Joseph, M. (2025). Nurturing young: Fifty years of Integrated Child Development Services (ICDS) in India. Indian Public Policy Review, 6(4)

India has been grappling with a nutrition crisis for decades, and the governments over the years have introduced various public policy responses and schemes to address it. The Integrated Child Development Services (ICDS), introduced in 1975, is one among them. The ICDS is India's foremost nutritional and child development scheme, employing a multipronged approach to children's holistic development and well-being by integrating health, education and nutritional interventions through a vast network of Anganwadi centres across the country. This paper critically examines the strengths, challenges, weaknesses, and opportunities of ICDS over the last fifty years. It also offers insights into strategies aimed at fortifying its future direction, through the lens of 2020

National Education Policy (NEP) 2020 and early childhood care and education (ECCE). To enhance its rankings in global indices and to eradicate all forms of malnutrition, India must prioritize the strengthening of the ICDS-Anganwadi framework. Furthermore, the long-term success of India's national development agenda (Viksit Bharat 2047), as well as its commitment to achieving the Sustainable Development Goals by 2030, is inextricably linked to the health, nutrition, and well-being of its present and future generations. In this context, a robust and reimagined ICDS-Anganwadi paradigm emerges as a cornerstone for inclusive and sustainable development.

Labour

Scopus Indexed

Jacob, R. S., & Muruganathan, M. (2025). Socio-economic vulnerability and mental well-being of migrant households: A case study of Pathanamthitta district of Kerala. TPM, 32(S9), 1268.

Migration has emerged to be a socio-economic phenomenon in Pathanamthitta district, where a significant share of households depends on internal and international mobility for income, education, and improved living standards. Migration largely contributes to upward economic mobility, but at the same time it also generates financial and emotional strain causing psychological challenges for families left behind. This study examines the socio-demographic characteristics of migrant households, their socio-economic vulnerability, and mental well-being levels through the WHO-5 scale. Primary data were collected from 120 migrant households across selected taluks using astructured questionnaire for the study. The study highlights that higher socio-economic vulnerability reduces psychological well-being, underscoring the need for integrated policies addressing financial stability, mental health support, and social protection. There is a need to strengthen community-level counselling services, enhanced financial literacy, and social welfare coverage to safeguard the well- being of migrant households in Pathanamthitta.

Cleetus, R., & Anitha, V. (2025). Does male out-migration influence labour force participation of left-behind wives?-Evidence from Kerala. Journal of International Migration and Integration / Revue de l'intégration et de la migration internationale.

The workforce from South Asian countries used out-migration as a route to escape from unemployment and poverty prevailing in those countries. The search for a better standard of living also motivates workers to migrate from low-income countries to high-income developed countries. Generally, such migrations are highly gendered

and temporary. The left-behind families in source countries are one of the important outcomes of such migration. The absence of male family heads and remittances transferred by them from the destination countries influences the labour supply behaviour of non-migrant family members, particularly left-behind wives. Kerala, the southern state of India, has a long tradition of international workforce migration, mainly to the Gulf countries. In this scenario, the article examines the influence of solo male out-migration on the labour supply behaviour of left-behind wives in Kerala. The study's findings are based on an extensive field survey conducted among 780 sample respondents of left-behind wives and married women from the two migration-intensive districts-Kollam and Malappuram of Kerala. The logistic regression model is used to analyse the impact of the Gulf migration status of husbands, individuals, households, and regional-level characteristics on the labour supply behaviour of left-behind wives. The main findings of the study show that although the left-behind wives are relatively younger and more educated than the married women in non-migrant households, their labour force participation rate is lower than that of married women in non-migrant households. The Gulf migration status of husbands, education status, children belonging to the age groups of (0-5) and (6-14), time spent on unpaid work, and non-labour income are the important variables that influence the labour supply behaviour of left-behind wives in Kerala.

Romis Thomas, N., Thampi, K., & Mary Mathew, L. (2025). Migrant inclusive responses to public health emergencies: a case vignette of Kerala State, India. Development in Practice, 1-8.

Internal migrants form an inevitable yet often invisible segment of India's population. Despite their critical contributions, they face marginalisation shaped by intersecting identities, such as caste, class, ethnicity, and region. These structural barriers oftesn exclude them from social policies and protections, heightening their vulnerability, especially during humanitarian crises and public health emergencies, when large-scale reverse migration and social exclusion become starkly visible. This practice paper, grounded in Critical Appreciative Inquiry, utilised reflections gathered through the authors' direct engagements, expert interviews, supervisory reports, and insights from secondary sources, including published studies and media accounts. Drawing from the direct engagements and collaborations with Community-Based Organisations (CBOs), supervision of social work trainees, and ongoing work with researchers, the authors explore Kerala's distinctive approach to migrant inclusion. The state's model of social protection for interstate migrants, referred to as "guest workers", is critically examined. Employing a critical social work lens, this note offers grounded, practice-based insights into the challenges and possibilities of building inclusive frameworks in a society structured by deep social hierarchies and systemic hindrances.

Book chapter

Jacob, R. (2025). Examining the dynamics of women's entry into the labour force and the gendered evaluation of unpaid work: An econometric study of female employment in Kollam District, Kerala. Decent work and economic growthwth.

This study delves into the intricate dynamics surrounding the involvement of women in the labour force, with specific focus on Kollam District in Kerala. By employing econometric methods, the multifaceted factors influencing female employment and the gendered evaluation of unpaid work in this region are analysed. Kerala, renowned for its high literacy rates and progressive social indicators, presents a unique context to explore the active participation of women in the labour market and the societal perceptions regarding unpaid domestic responsibilities. Through a combination of quantitative data analysis and qualitative insights, this research endeavours to explore the determinants shaping women's integration into the labour force and the prevailing gender biases affecting the valuation of unpaid work. Key variables under scrutiny include educational attainment, household income, cultural norms and childcare provisions related to women's empowerment and workforce integration. By unravelling the complexities inherent in women's labour force participation and the underestimation of unpaid work, this study contributes to a deeper understanding of gender dynamics in the realm of employment. Moreover, the findings have implications for policy interventions aimed at promoting gender equality, fostering women's economic empowerment, and recognizing the vital contribution of unpaid labour to the overall economy.

Other Articles

Kumar, S. K., Haripriya, K., & Dileepkumar, K. K. (2025). Discoursing the life of women labourers in Kerala. Lyceum India Journal of Social Sciences, 2(6), 29.

Women have increasingly become pivotal agents in shaping the global economy. Historically, their participation was largely restricted to domestic and caregiving responsibilities within the household sphere. However, the modernization and restructuring of social dynamics have facilitated their emancipation and integration into the wider economic domain. The growth of micro-enterprise sectors has created substantial employment avenues for women, enabling their active engagement in productive and entrepreneurial activities. Consequently, women have begun to compete alongside men in advancing processes of social and economic development. This transition marks a paradigmatic shift from their conventional domestic roles to participation in broader social and business domains.

Srikanth, C., & Dey, S. (2025). Gender roles in women's labour force participation. IIM Kozhikode Society & Management Review.

This study introduces a theoretical framework of women's labour force participation (LFP) decision as a manifestation of two opposing forces: the labour market's 'push' in favour of, and social institutions' 'pull' away from participation. The socioculturally diverse southwestern Indian state of Kerala is chosen as the ideal setting to test this framework. Using data from two rounds of the Kerala Migration Survey (KMS) 2013 and 2018 the study finds that higher levels of education reduce the likelihood that women participate in the labour force. This article also addresses the impact of a shock to migration the Nitaqat system on women's LFP and finds evidence that long-standing social norms that prevent women's LFP can change under economic crises such as the Nitaqat system that caused a large-scale return migration of Muslim emigrants from the Gulf countries. We find that prior to the migration shock, in the Muslim-dominated Malabar region, the strong social norms of the Sunni Muslims permeated across religions, which discouraged women's LFP. Due to the return migration of predominantly Muslim men prompted by the Nitaqat system, we find evidence of a more favorable attitude towards women's labor force participation (LFP) in the Malabar region. By studying women's LFP in Kerala, which has a significant proportion of Hindus, Christians and Muslims, the article finds support for LFP decisions as influenced by categorical identity affiliations.

Manjusha, P., & Haseena, V. A. (2025). Reverse structural change in female workforce to agriculture: Insights from Periodic Labour Force Survey (PLFS) data. South Asian Journal of Social Studies and Economics, 22(10), 220-229

Female labour force participation in India has been historically lower than that of males, with evidence of a long term decline. However, Periodic Labour Force Survey (PLFS) data between 2017-18 and 2022-23 indicate a modest revival. Rural and urban FLFPR increased by 12.3 percent and 4.3 percent, respectively, at all India level. This study examines labour market dynamics through a twofold approach. First, a comparative analysis of sectoral employment between Kerala and India is undertaken using secondary data from the Periodic Labour Force Survey for the period 2017-18 to 2022-23. The analysis highlights structural shifts across primary, secondary, and tertiary sectors, situating Kerala's employment trajectory within the national context. Second, a socio-economic assessment of women agricultural workers in Kerala is conducted, focusing on variables such as social group, education, and income levels. The study concluded that there is a reverse structural change in the female workforce to agriculture after 2019-20. It is probably distress-driven. In other words, it can be argued that there is an increasing female labor force participation during the period of COVID in the

agriculture sector. But they are not returning to other sectors in the post-COVID period. They were continuing in the low-paid agriculture sector.

Gender and Social Inclusion

Scopus Indexed

Joseph, J., Sankar, H., Sharma, S. K., & Nambiar, D. (2025). Sex differences in disease burden, utilization, and expenditure on primary health care services in Kerala, India. Scientific Reports, 15, Article 17116.

Sex and gender are important determinants of health, conditioning health exposures and needs, health seeking behavior, health outcomes, and subsequent consequences. We aim to explore the nature and magnitude of sex differences in disease burden, service awareness, utilization, expenditure and satisfaction while accessing primary health care services in the light of recent primary care reforms implemented in the southern Indian state of Kerala. We conducted a cross-sectional study to explore the nature and magnitude of sex differences in disease burden, service awareness, utilization, expenditure and satisfaction in the public sector of Kerala, India. A household survey using multistage random sampling design was conducted to collect information from 3234 households in the selected eight PHC catchment areas of four districts in the state. Descriptive data analysis was carried out with a focus on disease burdens, place of care seeking, cost of care and patient satisfaction, using STATA 12. More males reported fever as their primary ailment compared to females (67.7% vs. 58.6%). A greater proportion of males as compared to females knew about the recently implemented reforms (43% vs 36%; p?=?0.01). Allopathic (modern medicine) care was the most sought-after system of medicine across the sample. A higher proportion of females visited government primary health centres for outpatient care (34.7% vs. 27.5%; p?=?0.00).Our analysis found statistically significant differences in the self reported cost of care in the private sector: 20 times greater than in public sector for males, whereas the difference was roughly five fold among females (Private: ?650, $8.5 (95% CI ?524, ?776) vs. Public: ?120, $1.58 (95%CI ?17, ?223, p?<?0.001)). Males showed greater awareness of state health reforms than females, and high patient satisfaction existed for both private and public outpatient care across sex groups. We found significant sex differences in health system utilization and expenditure in Kerala, although our present analysis lacks data on trans, intersex and other sexual and gender minority groups. Further research on intersectionalities, such as care-seeking experiences across genders and socioeconomic groups, could enhance our understanding of the role of sex in care seeking.

Kaladharan, S., Manayath, D., Rejikumar, G., & Faria, A. (2025). Conceptualizing sustainable medicine consumption: A Delphi study. Cleaner and Responsible Consumption, 19, 100360

Sustainable Medicine Consumption (SMC) encompasses responsible consumer practices related to the acquisition, use, and disposal of medicines while considering social, economic, and environmental sustainability dimensions. This study employs the Delphi method to achieve expert consensus on key consumer practices that contribute to SMC. A panel of experts, including pharmacists, academicians, researchers in public health and sustainability, and physicians, participated in multiple rounds of evaluation to refine and prioritize relevant statements. During the first Delphi round (n?=?21), consensus was reached on 30 out of 47 items (63.8?%). Additionally, based on expert feedback, two new items were added. In the second round (n?=?19), all 32 items (100?%) reached consensus and were included as components of SMC. Based on the results of the second round, a proposed conceptualization of SMC, incorporating an interprofessional perspective, was presented in the third Delphi round for validation by the experts (n?=?9). The final conceptualization offers a comprehensive framework for SMC by integrating all dimensions of sustainability (environmental, social, and economic) while encompassing all phases of medicine consumption, including acquisition, use, and disposal. Findings highlight the importance of integrating consumer responsibility into sustainable healthcare practices and provide a foundation for future research on consumer-driven sustainability in medicine use.

Sruthy, S., Navaneeth, A., Naga Kumar, K. C. V., Jesni, K. C., Binish, M. B., Mohan, M., Surendran, U., Harikumar, P. S., & Samuel, M. P. (2025). Microplastic contamination in urban groundwater: Risk assessment, citizen perception and policy imperatives - A case study of Kozhikode City, Kerala State, India. Science of the Total Environment, 1000, 180395.

Microplastics (MPs) contamination in urban groundwater is an emerging environmental and public health threat, particularly in regions relying on open wells for drinking water. This study examines the occurrence, characteristics, ecological risks and sources of MP contamination across 120 open wells in Kozhikode Municipal Corporation, Kerala, India. MPs were detected in 73.33 % of samples, with concentrations ranging from 24 to 1889 particles/L (average: 103.73 ± 2.28 particles/L). Polypropylene (75.66 %) was the dominant polymer, followed by high-density polyethylene (HDPE) (9.56 %) and low-density polyethylene (LDPE) (7.7 %). Particle size analysis showed a predominance of 30-100 ?m particles, with significant fractions under 30 ?m, raising concerns about biological uptake and health risks. Ecological risk assessment using the polymer hazard index (PHI) and pollution load index (PLI) identified polyvinyl chloride

(PVC) as the most hazardous polymer (PHI: 10,001), with several urban hotspots exhibiting high pollution loads. Positive matrix factorization (PMF) results, supported by field observations, identified three major source categories: beverage and packaging waste (e.g., bottles, wrappers) linked to HDPE and polystyrene (PS); household and agricultural sources (e.g., domestic waste, well covers, nets) associated with polyethylene terephthalate (PET) and PVC; and medical and industrial inputs (e.g., personal care products, textile fibers) corresponding to polyvinylpyrrolidone (PVP) and polyethylene-co-polypropylene (PE-co-PP), highlighting diverse contamination pathways. A household survey of 450 respondents revealed a significant knowledge gap, with 75.8 % unaware of microplastics in drinking water. However, 85.8 % expressed a strong willingness to adopt sustainable alternatives, including coir or jute-based well covers and non-polymeric water extraction tools. These findings underscore the urgent need for integrated policy interventions, community education, and sustainable infrastructure improvements to safeguard groundwater quality in urban settings.

Other Articles

Padath, Pratheesh. "Beyond the Waves: Ethnic Socio-Cultural Life and Transforming Women's Roles in the Alappuzha Sea Fishermen Community". Indialogs, 2025, vol.VOL 12, no. 1, pp. 49-73, doi:10.5565/rev/indialogs.305.

Fishing communities, one of the oldest worldwide, have lived along coasts for centuries, intertwined with the seas for daily and long-term needs (Venkataraman & Raghunathan, 2015). Kerala's sea fisher folk, particularly in Alappuzha, have distinct ethnic heritage and traditional knowledge of the sea and fisheries. Their livelihoods are ensured by using this knowledge to guide their fishing activities, understand weather patterns, manage resources, and handle post-harvest. The article discusses the value of fishing as a way of life and the distinctive cultural customs of the fishing community, such as the ethnic as well as the social customs. It draws attention to the difficulties the community faces, including dwindling fish stocks, deteriorating environmental conditions, and the effects of globalization on their means of subsistence. Through an ethnographic study, this research aims to understand the cultural practices, social relationships, and economic activities of the fishermen community. The experiences and roles of women are the main emphasis of this paper's sociocultural analysis of the sea fishing community in Alappuzha. The study also examines the ways in which cultural norms, economic pursuits, and conventions affect women's lives using a qualitative research technique. The findings emphasize the value of women's contributions to the community's way of life, but they also draw attention to the difficulties women encounter in carrying out their responsibilities in a patriarchal society

Growth and Development

Other Articles

Sasikumar, V. K. (2025). Political economy critique of climate change and sustainable development: An ethnography from rural (tribal) Kerala - An Asian case. In Encyclopedia of monetary policy, financial markets and banking (Vol. 2, pp. 623-634). Elsevier.

The relation between climate change and sustainable development is obvious, it is now an acceptable fact in the academic literature that underscores its greater relevance. I would like to go beyond this linear notion and how complexly these two have entwined each other. It is more than one way of connecting climate change but examines ways in which these connections have already been established. Kerala in India is depicted as a state to be a model for all the third world countries. In this article, through the lens of political economy and ethnographic methods, I would like to see how far it is, true and false. Furthermore, this article looks at how sustainable development practices are implemented to have an impact on climate change. By examining the Kerala model, I would like to state that our actions are not enough to get it done.

Surendran, S., Nambiar, D., Benny, G., Sankar, H., & Joseph, J. (2025). Methodological reflections on identifying and reaching groups left behind from health programs for fieldwork in Kerala, India. Discover Public Health, 22, Article 631.

A plethora of tools have been used to understand health inequities. While these could be well-executed in a controlled environment, the uncertainties of working in a community lead to challenges that are sometimes beyond researchers' control. This is further aggravated while working with 'vulnerable' population sub-groups. As part of a larger health systems research project focused on health inequalities, we sought to identify these groups to assess their needs. We discussed in this article, our methodological reflections on trying to identify and carry out research with groups left behind, and the way we approached the challenges incurred during the data collection process. Identifying 'vulnerable' groups required constant interrogation and questioning of the very definition of 'vulnerability' in varied contexts and in relation to other groups facing disadvantages. Different strategies were used, including snowball sampling from FGD participants. Even when identified, we found that in some cases, the FGD method was inappropriate for fieldwork and that the ethical requirement of ensuring some care access for study participants became increasingly difficult to assure. Equity-oriented research must involve constant reflexivity around such ethical dilemmas, which we feel are too often ignored -just as some 'vulnerable' populations are- in typical (writing about) research studies.

Book Chapter

Kaleekal, T. (2025). Collaborative evolutionary governance of estuaries in Kerala, India. In Ecohydrology of Kerala: River catchments and coastal backwaters-Ecohydrology from catchment to coast (pp. 295-308).

Governance of the estuarine social-ecological system is a challenge for policymakers and academicians. While local communities perceive estuaries as commons, the private sector values and uses them as a low-cost infrastructure for making economic profits. These conflicting perspectives have complicated resource uses between local communities and modern enterprises and led to the degradation of estuarine biodiversity. A critical examination of modern development experiences and estuarine resource management, however, reveals that the currently practised state-centric modes of estuarine governance are biased towards privatization and neglect local community needs and livelihood rights. A system of governance that guarantees sustainable development and ecosystem health and just shares estuarine resources to sustain community livelihoods is, therefore, essential. This paper identifies major challenges of the present estuarine governance strategies in Kerala and presents an alternate collaborative governance framework to ensure socially acceptable sharing of estuarine resources and ecological services between traditional and modern resource users.

What is new(s) from GIFT

A. Seminars/Webinars

GIFT conducted a Seminar in the capacity of knowledge partner on "Vision 2031' - State Level Seminar organized by the Finance Department, Government of Kerala on 13th October 2025 at Ernakulam.

GIFT conducted a Seminar on Consumption and Multiplier Effect-Evidence at the all - India State levels on November 14, 2025.

The paper was presented by Shri R Mohan IRS(Rtd), Former Income Tax Commissioner and Honorary Fellow GIFT; Prof. R Ramakumar, Tata Institute of Social Sciences, Mumbai; and Dr Kiran Kumar Kakarlapudi, Assistant Professor, GIFT. The session was chaired by Prof. K J Joseph, Director GIFT and the discussant of the paper was Prof. M Parameswaran, Centre for Development Studies (CDS),Trivandrum.

Abstract : The study attempts to find out differential impact of GST rate changes can have across States in India. The analysis leads to the conclusion that the States with higher per capita income have generally lower Marginal Propensity to Consume (MPC) and hence a lower Consumption Multiplier, albeit with a few outliers. It is seen that the tax cuts of 1997 and making consumption tax rates uniform across States through introduction of Value Added Tax in 2005 resulted in statistically significant breaks in Private Final Consumption Expenditure. The same effect is not seen in 2017, when GST was introduced. The average MPC at the States level is 0.578.

GIFT conducted a Seminar on Who Really Pays for Trump's Tariffs? on December 05, 2025.

The paper was presented by Prof. Nanak Kakwani, University of New South Wales & Distinguished Professor, GIFT. The session was chaired by Prof. K N Harilal, Chairman, 7th State Finance Commission, Government of Kerala. Prof. K J Joseph, Director GIFT welcomed the gathering.

Abstract : This paper examines tariff incidence through multi-stage supply chain analysis. It addresses three specific questions: (i) how do tariffs propagate through multi-stage supply chains? (ii) what is the quantitative distribution of burden between consumers and foreign producers? and (iii) how do supply chain markups amplify the inflationary impact of tariffs? By examining these questions through both theoretical modelling and empirical analysis, we aim to move beyond political assertions to provide evidence-based insights on tariff incidence.

GIFT conducted a Seminar on Dreaming a New Kerala on December 12, 2025.

A talk was delivered by Prof Padmakumar Nair Vice Chancellor, Thapar University Patiala. Prof K J Joseph acted as the moderator of the talk and welcomed the gathering. Dr Kiran Kunar Kakarlapudi Assistant Professor, GIFT proposed the vote of thanks.

GIFT conducted a Seminar on Fiscal Federalism and Development Dynamics-Punjab and Kerala Perspective on December 15, 2025.

A talk was given by Prof Lakhwinder Singh, Professor, Thapar School of Liberal Arts and Sciences (TIET), Patiala and Visiting Professor of Institute of Human Development. Prof K J Joseph acted as the moderator of the talk and welcomed the gathering. Dr Aswathy Rachel Varughese, Assistant Professor, GIFT delivered the vote of thanks.

GIFT organized 9th I S Gulati Commemoration Lecture on Equalisation Transfers in India and Profiles of Inequality on December 17, 2025.

The seminar on Equalization Transfers in India and profiles of inequality was presided over by Shri K N Balagopal, Hon'ble Finance minister Government of Karala and Chairman GIFT. Prof D K Srivastava Chief Policy Advisor at Ernst & Young (EY), India, Former Director, Madras School of Economics (MSE) and Member, 12th Finance Commission was the speaker of the paper. Prof T M Thomas Issac, Former Minister for Finance Kerala & Distinguished Fellow, GIFT moderated the session. Prof K J Joseph welcomed the gathering. Dr Renjith P S, Assistant Professor, GIFT proposed the vote of thanks.

More than 65 participants joined the lecture physically and more than 10 members joined the session online. The lecture started at 3.30 pm and concluded by 5.30 pm.

Abstract : Fiscal transfers to states in India have been guided by the equalisation principle among other considerations. The outcomes of such transfers have been equalizing in relation to a number of dimensions including education and health outcomes, per capita state primary revenue expenditures and per capita consumption expenditures. There is also a decrease in the incidence of poverty. We juxtapose these outcomes with a profile of growing inequality in per capita GSDP and per capita fiscal capacity as proxied by nominal GSDP. These two profiles show directionally opposite trends. We explore what causes these opposite movements and highlight the role of market forces in inducing spatial concentration patterns of capital stock and investment flows. We consider policy options to moderate or reverse this pattern of growing divergence in per capita incomes across states.

Seminar Co ordinators - *Dr Kiran Kumar Kakarlapudi and Dr Geetha Rani V*

B. Teaching and Training programmes

1. Post Graduate Diploma in GST (PGDGST)

Second Schedule of Classes started on 25th October 2025 for the current batch of PGD-GST students. Regarding the renewal of the MoU with CAST Chapter (the platinum channel partner, Nergy Vidya) for initiating the practical training for the students, the Nergy Vidya team visited GIFT on 10th October 2025 and 3rd November 2025 and made a presentation on the modules incorporated in their platform .MoU between CAST and GIFT was signed on 6th November 2025.The Training of Trainers programme for PGD GST Practicals were held in the month of November 2025.The practical sessions were started on 21st December 2025.The Second Schedule classes ended on 28th December 2025

Coordinators - *Dr. Meenu Mohan & Dr Geetha Rani V*

For more details: https://www.gift.res.in/index.php/course/detail/14/PGD-GST

2. PhD programme

Ph. D Program

The activities of the Ph.D programme during October 2025 to December 2025 are listed below. The course work for the sixth batch of Ph. D is ongoing. The Ph. D pre-submission seminar of Ms. Lekshmi Prasad was held on 3rd October, 2025 at GIFT. The open defence and viva voce of Ms. Aisha Ibrahim Mohammed, first batch Ph. D scholar was held on 14th October 2025 in the Hall of Fame, School of Management Studies, CUSAT. On 13th and 27th November 2025 the Ph. D **Committee meetings were held to discuss the Ph. D related matters.** A Research Committee (RC) meeting was held on 2nd December 2025 at GIFT. Mr. Jerome, PhD scholar of the second batch has presented his work progress seminar on 5th December 2025. The work progress seminar presentations of Ms. Vipasha Ray Hajong and Ms. Indhu T R were conducted on 10th December 2025. An interactive session with well known public finance economist Prof. D. K. Srivastava was held on 17th December 2025 in the Boardroom, GIFT. As part of Public Revenue module of the coursework, the lecture series on Taxation in Developing countries were organised on 14th and 15th October 2025 by R. Mohan and 16th and 17th October 2025 by **Prof. Pinaki Chakraborty at GIFT. The module workshop on public revenue by the sixth batch Ph.D scholars were held on 30th October 2025. The external lecture on Public Expenditure module of the coursework was held on 3rd and 4th December 2025 by R Mohan at GIFT. The module workshop on public expenditure by the sixth batch Ph.D scholars were held on 22nd December 2025.**

Seminar Presentations of Research Scholars

Ashkar K, GIFT Ph.D scholar presented a research paper at the 13th Annual Conference Indian Health Economics and Policy Association Organized by School of Humanities and Social Sciences Indian Institute of Technology, Mandi, during 12th to13th December 2025.

Divya Kannan K R, GIFT Ph.D scholar presented a paper in the 3rd ISID Conference on India's Industrial Transformation: Towards a manufacturing Strategy to Navigate Global Shift, ISID Campus, New Delhi during 28th to 31st October, 2025.

Vandanan S, GIFT Ph.D scholar presented a paper titled 'Harnessing Holistic Wisdom: A Community-Based Business Model for Sustainable Rural Empowerment in India', in the 10th PAN-IIM World Management Conference organised by the Indian Institute of Management(IIM) Ranchi on 27th to 29th November, 2025.

Workshops attended/ presented

Munawwara Zubair, GIFT Ph.D scholar participated in One-Day Online Workshop on "Assessing Eco-Efficiency with DEA, SFA and LCA: Concept of Calculation" organized by MIDS on 11th October, 2025.

A M Indu A S Maheswaran, GIFT Ph.D scholar presented a paper titled "Compliance of Indian Accounting Standard (Ind AS) Across Indian Firms: A Fair Value Perspective" in 27th Workshop on Accounting and Finance in Emerging Economies organized by University of Westminster, UK held on 15th December, 2025.

Amalu Seby, GIFT Ph.D scholar attended a one-day online workshop on "Assessing Eco-Efficiency with DEA, SFA and LCA: Concept to Calculation" organized by Madras Institute of Development Studies (MIDS) as part of its Development Analytics on 11 October 2025.

Gopika G, GIFT Ph.D scholar participated 10 day Training Programme in Doing Research in public finance DRIP 1.0 Training programme in public finance for Doctoral Scholars from 10th to 19th November 2025 at NIPFP , New Delhi, India.

Gopika G GIFT Ph.D scholar attended a one-day online workshop on "Assessing Eco-Efficiency with DEA, SFA and LCA: Concept to Calculation" organized by Madras Institute of Development Studies (MIDS) as part of its Development Analytics on 11 October 2025.

Ashkar K, GIFT Ph.D scholar attended 'Doing Research IN public finance DRIP 1.0 Training programme in public finance for Doctoral Scholars on 10th to 19th November 2025 at NIPFP, New Delhi, India.

Divya Kannan K R, GIFT Ph.D scholar attended 10 day Training Programme in Doing Research in public finance DRIP 1.0 Training programme in public finance for Doctoral Scholars 10th to 19th November 2025, NIPFP , New Delhi, India.

Publications

Joseph, J., & Anuraj, P. K. (2025). Searching the roots of taxation: From Vedic to Contemporary. IOSR Journal of Humanities and Social Science, 30(11, Series 4), 77-84. https://doi.org/10.9790/0837-3011047784 Publication Date: 25.11.2025.

Invited lectures/ Talks

A M Indu A S Maheswaran, GIFT Ph.D scholar delivered a talk on "IFRS Mantra - Just Disclose It" and "Hedge Accounting -IFRS 9" on October 14th 2025 at Jain University, Kochi.

Others

Arun Paul received third prize on a write up titled "Stray Dog's Conundrum in Kerala: Possibilities and Challenges submitted for the seminar on Vision Kerala 2031, Organized by Department of Finance, Government of Kerala on 13th October, 2025.

Course Coordinators : *Dr Sumalatha B S and Dr Renjith P S*

3. Research Capacity Building Program (RCBP)

The Research Capacity Building Program (RCBP) on **Data Analytics Using Python,** jointly organised by the Gulati Institute of Finance and Taxation (GIFT) and the Kerala State Higher Education Council (KSHEC), is currently underway and progressing well. The three-month certificate programme, comprising 72 hours of structured training delivered fully in online mode, has witnessed strong participation, with **over 100 participants enrolled so far** from diverse academic and professional backgrounds. The programme will continue **until mid-February**, and early feedback from participants has been **highly encouraging,** particularly highlighting the course's hands-on pedagogy, interactive learning environment, and practical exposure to Python programming, data handling and visualisation, statistical analysis, and applied research workflows.

Course Coordinators : *Dr Aswathy Rachel Varughes and Dr Akhil M* P

C. Publications

1. Kerala Tax Reporter (KTR)

July, August and September 2025 issues of KTR published Online and offline.

https://www.gift.res.in/ktr

2.Innovation and Development

A Routledge journal from GIFT, **Volume 15, No. 3 (2025)** published, Editor in Chief, K J Joseph.

For details, please visit https://www.tandfonline.com/toc/riad20/current

3. Weekly update on Finance, Taxation and the Indian Economy

This is an attempt by the Young Scholar' Forum in GIFT, led by Smt Soudhamini G S, Assistant Librarian to update on important developments on Finance, Taxation and the Indian economy. Twelve issues of Weekly updates published during October to December September 2025 which are available in GIFT Website. Latest issue: 20-26 December 2025.

For details, please visit https://www.gift.res.in/index.php/publish/publish_list/14/Weekly-Updates-on-Finance

4.Monthly Content Alert from GIFT Library

The GIFT library provides a monthly content alert service, extensively designed to support the research endeavors of our PhD scholars. This attempt provides a selection of recently published journal article titles, abstracts, and links, delivering them directly to the GIFT community each month. The content alert service is more than just a monthly update and the initiative aims to be an indispensable tool for scholars, providing them with timely access to the latest research developments in their fields. It is drawn from a wide array of reputed journals.

Twelve issues of the content alert service have been published, covering the period from October to December 2025. The preparation of this content alert is led by Smt Soudhamini G S, Assistant Librarian, GIFT. Latest issue: December 29, Vol. 12. Part 4 , 2025

D. Faculty Publications

1.GIFT Discussion Paper

B S Sumalatha and Anitha Kumary L: (2025), Finance Commission (FC) Grants-in-aid to the States: Need for increasing the base and size of FC grants in India, GIFT Discussion Paper Series No.9/2025

Abstract : The Finance Commission (FC) grant plays a significant role in reducing vertical imbalances for two reasons. First, it is a non-discretionary transfer, unlike conditional transfers such as grants for centrally sponsored schemes. Second, it is recommended by the Consolidated Fund of India (CFI), which has been growing, and that leaves more room for its flexibility as compared to the divisible pool, which could be changed only through constitutional amendments. A mere increase in the share of FC grants does not resolve the current fiscal problems faced by the states without an increase in the base and size of the FC grants. There is a strong case for increasing the grants-in-aid from the Finance Commission from 7.6% to at least 12% of the divisible pool, given the existing low base (less than 20% of total grants). If the FC grants rise to 12% of the divisible pool, Kerala would gain an additional Rs. 50719 crore during the 16th FC period. The gap between the grants-in-aid share of Kerala in the 16th FC period is estimated from the divisible pool and gross revenue, based on a 50% increase from the existing share, and would be Rs. 57485 crore. Based on this estimate, grants-in-aid should also be allocated from the union government's gross revenue, as they are drawn from the Consolidated Fund of India. This will enhance the overall kitty available for the 16th FC and increase the grants-in-aid allocation to the states.

Keywords: *Finance Commission Grants, Consolidated Fund of India, Gross Revenue, Sixteenth Finance Commission*

https://www.gift.res.in/wp-content/uploads/2025/10/Finance-Commission-FC-Grants-in-aid-to-the-States.pdf

P S Renjith and Steffy Antony (2025), Fiscal Restructuring Towards 'Sound Finance' in India, GIFT Discussion Paper Series No.10/2025

Abstract : While the 16th Finance Commission's mandate does not explicitly prioritize fiscal sustainability or fiscal restructuring, these considerations remain integral to its constitutional duty under Article 280(4)(d) to uphold the "interests of sound finance." In the current fiscal context, marked by rising debt and persistent deficits at both the Union and State levels, this study analyses the sustainability and growth implications of India's public debt and proposes a restructuring of deficit

targets. The central argument is that fiscal rules should be reframed around three pillars-fiscal sustainability, growth implications, and macroeconomic stability, rather than being anchored to exogenous or uniform targets. Employing a stochastic Intertemporal Budget Constraint (IBC) framework and a public debt-growth model using data from 1991-92 to 2022-23, the analysis reveals that the existing debt-deficit positions of both the Union and the States are unsustainable. The study estimates that achieving sustainability requires reducing the general government debt to 70.38% of GDP, comprising 46.65% for the Union and 23.74% for the States, assuming adherence to the 3% fiscal deficit ceiling and a 10-year average nominal GDP growth of 10.9%. State-level assessments show sustainable debt thresholds of 27.8% for Kerala, which can be achieved within a decade under existing fiscal rules and growth profiles. The study also proposes complementary fiscal indicators to safeguard fiscal space while ensuring discipline, namely, the Debt Service to Debt Receipts ratio and he Capital Expenditure to Fiscal Deficit ratio. Integrating these parameters would help prevent unsustainable borrowing, promote productive public investment, and allow flexibility where debt finances growth-enhancing expenditures.

The findings underscore the need for differentiated, sustainability-linked fiscal rules across states to achieve balanced fiscal consolidation and inclusive growth.

KeyWords : *Fiscal Sustainability, Fiscal Consolidation, Fiscal Federalism, Finance Commission, Debt Thresholds*

JEL Classification : *E62, H63, H68, H72, C32*

https://www.gift.res.in/wp-content/uploads/2025/11/Fiscal-Restructuring-Towards-Sound-Finance-in-India.pdf

Vidya V Devan (2025), The Evolution of Fiscal Federalism in India: Assessing the Transformative Impact of the 101st Constitutional Amendment and GST, GIFT Discussion Paper Series No.11/2025

Abstract : Federalism is a governance structure that integrates multiple tiers of government, National and State or Provincial, within a unified political framework while preserving the autonomy of its constituent units. Fiscal federalism, a vital dimension of this system, pertains to the allocation and sharing of financial powers between these levels of government, including the authority to levy, collect, and appropriate taxes. In India, fiscal federalism has undergone a significant transformation since 1950, with the decade from 2010 to 2020 witnessing a particularly notable shift following the 101st Constitutional Amendment of 2016, which introduced the Goods and Services Tax (GST). This paper traces the evolution

of India's fiscal federalism, with special reference to how the introduction of GST has redefined the financial relationship between the Union and the States.

Key Words : *Fiscal Federalism, Revenue sharing, State Autonomy, Goods and Services Tax (GST)*

https://www.gift.res.in/wp-content/uploads/2025/11/The-Evolution-of-Fiscal-Federalism-in-India_John-Dickinson.pdf

Nirmal Roy V P and Shency Mathew (2025), Mandate or Momentum? Options before the XVI Union Finance Commission in Fulfilling the Constitutional Promise to Local Governments, GIFT Discussion Paper Series No.12/2025

Abstract : Ever since local governments gained prominence as the third tier in India's federal finance structure with the 73rd and 74th Constitutional Amendment Acts (CAAs) of 1993, a large number of functions, functionaries, and finances have been devolved to local governments in most states. Starting with the 11th Union Finance Commission (hereafter UFC), the specific Terms of Reference (ToR) of the UFCs with respect to Local Governments have been following the article 280 (3) (bb) itself; *'the measures needed to augment the Consolidated Fund of a State to supplement the resources of the Panchayats and Municipalities in the State based on the recommendations made by the Finance Commission of the State.'* While UFC grants to local governments have seen a substantial increase over the period, it is also perplexing that the proportion of tied- and performance-based grants has become a core feature of the UFC recommendations. The increase in tied grants has derailed the true spirit of devolution and the essence of the 73rd and 74th Constitutional Amendment Acts, leading to a decline in the transfers to local governments. This paper critically examines the criteria, conditionalities, and the tied nature of previous UFC recommendations and suggests an overhaul to achieve local government grant devolution by the incumbent XVI UFC. Given the rising prominence of local governments in service delivery, the Union Government must devolve more funds to achieve equity and efficiency through decentralised governance. This study suggests that local governments need proper handholding to increase their efficiency through periodic training embedded with technology, but not through measures that squeeze their fiscal autonomy.

Key Words : *Local Governments, Intergovernmental transfers, Finance Commission, Grants-in-aid*

https://www.gift.res.in/wp-content/uploads/2025/11/Mandate-or-Momentum_Nirmal-Roy-V-P-Shency-Mathew-Revised.pdf

Ashkar K, Md Zakaria Siddiqui, Anoop S Kumar and P S (2025), Population Ageiing and Federal Transfers: A reform Agenda for the Finance Commission in India , GIFT Discussion Paper Series No.13/2025

Abstract : Many Indian states that are at mature stages of demographic transition face significant fiscal challenges posed by faster demographic transition or population ageing. Currently, the Finance Commission's horizontal tax-sharing (devolution) criteria do not account for the disproportionate burden of public expenditure on states that are ageing relatively faster than the national average. Observing the severity of the issue and its omission in current devolution criteria, the study proposes incorporating the share of the population aged 60 and above as an explicit factor in the devolution formula to improve the fairness in the horizontal transfer of central taxes. This adjustment aims to account for the unequal fiscal burden of public expenditure resulting from the varying pace of ageing across states. If all states aged uniformly from the same baseline, then such an issue would not arise. The proposed formula has an insignificant effect on the progressivity of fiscal transfers achieved by the existing formula, suggesting it is a credible alternative to the existing mechanism.

Key Words : *Fiscal Federalism, Tax Devolution, Demographic Transition ,Population Ageing.*

https://www.gift.res.in/wp-content/uploads/2025/12/Population-Ageing-and-Fed.pdf

B S Sumalatha, Anitha Kumary L and V P Nirmal Roy (2025), Issues and Challenges of Fiscal Federalism in India,An Analysis on the Centrally Sponsored Schmes, GIFT Discussion Paper Series No.14/2025

Abstract : Intergovernmental transfers from the union government to the states are crucial for addressing the vertical and horizontal fiscal imbalances that characterize India's federal structure. The fundamental mismatch between the revenue capacity and expenditure needs of sub-national governments necessitates an uninterrupted flow of these transfers. These transfers operate through two main channels: unconditional and conditional transfers. The unconditional transfers are recommended by the Finance Commission (FC), these include tax devolution and general-purpose grants-in-aid. Whereas, the conditional transfers are provided through the Centrally Sponsored Schemes (CSS) and Central Sector Schemes by various union ministries, these are specific-purpose, conditional grants. The present study analyses the structure of these conditional and unconditional transfers over time. The study finds a considerable increase in non-statutory (tied) transfers, particularly evident after the abolition of the Planning Commission. The CSS constitute the largest portion of these non-statutory grants. Although the number of CSS has increased over time, the overall financial allocation has fallen during the last few

years. A significant structural shift occurred in 2023-24: the number of CSS schemes was first raised to 75 and then further to 82, while the previous rationalized categorization of 'Core of Core' and 'Core' schemes was simultaneously discontinued. The state wise analysis shows that states such as Kerala, Haryana, and Punjab receive the lowest per capita CSS amount compared to other states. The problem is compounded by implementation issues, as evidenced by the significant gap between the budgeted and actual CSS flows to Kerala. The fundamental issue remains that CSS are often uniformly designed, suffering from the widely criticized 'one size fits for all' approach. The increased reliance on tied transfers raises the important concern of whether the diverse developmental needs and regional specificities of the states are adequately taken into account while designing and implementing these centralized schemes.

KeyWords : *Vertical and Horizontal Imbalance, Federal fiscal relationship, Finance Commission grants, Non-statutory grants, Centrally Sponsored Schemes (CSS)*

https://www.gift.res.in/wp-content/uploads/2025/11/Issues-and-Challenges.pdf

Nanak Kakwani and Hyun H. Son (2025), Who Really Pays for Trump's Tariffs? GIFT Discussion Paper Series No.15/2025

Abstract : This paper examines tariff incidence through multi-stage supply chain analysis. It addresses three specific questions: (i) how do tariffs propagate through multi-stage supply chains? (ii) what is the quantitative distribution of burden between consumers and foreign producers? and (iii) how do supply chain markups amplify the inflationary impact of tariffs? By examining these questions through both theoretical modelling and empirical analysis, we aim to move beyond political assertions to provide evidence-based insights on tariff incidence.

Key Words : *Global trade, supply chain, tariffs, tax incidence, exporters, importers, retailers, landing cost, consumer demand.*

https://www.gift.res.in/wp-content/uploads/2025/12/FINAL_Who-Really-Pays-for-Tariffs_17-Dec-2025.pdf

Shency Mathew and Anitha Kumary L (2025), Determinants of GST Revenue Performance: Demonstrating the Fiscal Advantage of Manufacturing States in India , GIFT Discussion Paper Series No.16/2025

Abstract : Revenue mobilisation is the process of generating revenue, influenced by a complex interplay of factors. The capacity to mobilise revenue may vary depending on the nature of taxes and the factors that affect their collection. The Goods and Services Tax (GST) was implemented in India in 2017, with the expectation that it would reform the

indirect tax system significantly and enhance revenue mobilisation. However, the States did not achieve the targeted revenue performance level for various reasons, including the COVID pandemic. Earlier, there was the notion that the manufacturing States would be the net losers and the Consumer States the gainers. In this regard, this paper explores the ground reality of GST revenue mobilisation in the States with a special focus on manufacturing States. The major findings indicate that the change from origin-based to destination-based tax did not have a significant negative impact, as expected, because states with a substantial manufacturing base have a broad consumption base and a sizeable service tax base, which mitigated potential losses.

KeyWords : *GST, VAT, Revenue mobilisation, IGST Settlement*

https://www.gift.res.in/wp-content/uploads/2025/12/Determinants-of-GST-Revenue-Performance-Demonstrating-the-Fiscal-Advantage-of-Manufacturing-States-in-India.pdf

2. Faculty publications and presentations

a. Faculty Publications

- Akhil M P (2025). *"Perceived CSR and its ripple effects: Understanding organisational legitimacy and stakeholder engagement"* , **Social Responsibility** Journal published by Emerald in December 2025, https://doi.org/10.1108/SRJ-06-2025-0632
- Akhil M P (2025). *"Unveiling the thematic landscape of generative AI: A bibliometric analysis of emerging research trends,* **" Information Discovery and Delivery** Journal published by Emerald in November 2025, https://doi.org/10.1108/IDD-05-2025-0111

News paper articles

- Anitha Kumary L & Sumalatha B S 'GST rate reduction will hit Kerala's finances' published in Business Line on 02/10/2025.
- Sumalatha B S and Anitha Kumary L (2025). Thozhilurappu Pathadiyile Mattangal, (Changes in MGNREGA) Samsthana Dhanakariyathinu Kanatha Aaghatham , Mathrubhumi Malayalam daily, 29 December 2025.

b. Faculty Presentations

- Dr Geetha Rani presented a paper titled *"Assessing the impact of India's BRSR Framework on Corporate Gender Equality: Cross Sector Evidence from 30 BSE Listed Firms"* at the three-day International Conference on Women Shaping a Sustainable Future: Converging Science and Society. The event was organized by the University of Kerala in association with KSCSTE and funded by PM-UShA, held from 15-17 December 2025.

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