ARTHA VIJÑĀNA

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Artha Vijnana was started in March 1959. It is a quarterly journal of the Gokhale Institute of Politics and Economics and is a peer reviewed journal. It has been publishing papers on economics, demography and subjects allied to economics.

From September 2022, the Journal announced an expansion in its focus. The journal would hence forth have a broader and an inter-disciplinary approach. Articles in the areas of economic sociology, political economy are also welcome. *Artha Vijnana* is committed to publishing high quality research, aimed at the broad audience of academicians, practitioners and policy makers, across South Asia and beyond.

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Announcement

Artha Vijnana announces the institution of the Gopal Krishna Gokhale Memorial Annual Prize, awarded in recognition of the paper of most outstanding merit appearing in *Artha Vijnana*, irrespective of the author's age. This prize carries an award of ₹10,000, to be shared equally between all authors. In addition, *Artha Vijnana* announces the institution of the Prof. D R Gadgil Memorial Annual Prize, awarded in recognition of the paper of most outstanding merit appearing in *Artha Vijnana*, by a single author of below 40 years of age. This prize carries an award of ₹10,000.

Artha Vijñāna

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Articles

Finding Gender Inequality among Indian States through the Construction of a Gender Inequality Index

R. Senthamizh Veena

In India, gender inequality manifests in the form of socially constructed, predefined gender roles for men and women that are deeply embedded in Indian cultural and historical roots. This paper is an attempt to examine the extent of gender inequality among the states of India across the socio-economic and political spheres of the country. To this end, a Gender Inequality Index (GII) is constructed, measuring inequality in six dimensions: health and nutrition, education, Information and Communication Technology (ICT), economic participation, household empowerment, and political participation. The GII incorporates 18 parameters at the sub-national level. For constructing the GII, this study has followed the methodology adopted by UNDP in developing the Human Development Index. The results reveal that Kerala exhibits the lowest level of gender inequality among Indian states, while Bihar fares the worst. Overall, the study advocates for a multi-sectoral, holistic approach to uplift women in all states, particularly those identified as "below average performers." It emphasizes that empowering women and treating them on par with men is not an additional privilege but rather a fundamental human right and a prerequisite for a peaceful and prosperous world.

Keywords: Gender equality, Gender Inequality Index, Health and Nutrition, Education, Information and Communication Technology (ICT), Household empowerment, Economic participation, Political participation

I Introduction

Inequality between men and women is universal in all societies, and it is especially overt in Indian society. The genesis of gender inequality in Indian society lies in its patriarchal system, where women are relegated to a secondary status across the socio-economic and political landscape. This gender discrimination is still accepted as the norm within the societal and familial periphery, which is reflected in the attitude of considering a girl child as a burden and giving preference to have a boy child. This is exhibited in the skewed 'sex ratio at birth' in India with 929 females per 1000 males (National Family Health Survey-5, 2021), projecting a lesser number of female children to male children. Amartya Sen refers to this

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phenomenon as 'missing women mystery'[1], which has been attributed to selective abortions, female infanticide, and inadequate healthcare and nutrition for female children (Sen A. 1990, pp. 219-222). Evidence of this can be found in the NFHS-5 data, which reveals that while 59.1 per cent of adolescent girls aged 15-19 years suffer from anaemia, 31.1 per cent of adolescent boys of the same age being anaemic, highlights the gendered gap in nutritional support. Moreover, the notion of educating a girl child as a poor investment persists, stemming from the belief that she will eventually leave her parental home upon marriage. This lack of educational opportunities perpetuates a dearth of skills among women, hindering their employability in today's competitive job market (Sharma R. 2015, pp.41-45). The pervasiveness of gender inequality not only restricts women's access to resources and opportunities but also jeopardizes the life prospects of future generations (Sumanjeet S. 2017, pp. 139-157).

Amartya Sen (1999, p. 193), has noted that women's ability to find employment outside the home, earn an independent income, be literate, and to be educated participants in decisions that affect them both inside and outside the home, are critical for development.

Even after Seventy-Five years of independence, the persistent gender inequality, or gender discrimination, remains a major drawback and cause of concern for India, despite its high rates of economic growth in recent years. This persistent gender inequality in India is reflected in its low ranking in the Gender Inequality Index (GII) developed by the UNDP. India has been placed 122nd position among 191 countries, scoring below average in all dimensions of the GII, namely health, empowerment, and labour market (UNDP 2021). The GII was specifically designed by the UNDP to assess the loss in potential human development arising from gender disparities across these crucial aspects of life. Similarly, the Global Gender Gap Index of the World Economic Forum has placed India at 127th rank out of 146 countries which focused on dimensions of economic participation and opportunity, educational attainment, health and survival, political empowerment (WEF 2023, p.11).

Likewise, the NITI Aayog in India has constructed a GII at the subnational level in accordance with Goal 5 of the United Nations Sustainable Development Goals (SDGs) (United Nations 2015), which aims to achieve gender equality by ending all forms of discrimination, violence, and harmful practices against women while valuing their unpaid care and domestic work with emphasis on effective participation in addition to equal opportunities for leadership at all levels of decision-making in political, economic, and public life for women. To measure the states' performances, NITI Aayog has considered nine parameters (NITI Aayog 2021) and the results are worrying for all the states.

While these indices provide a gist of the gender inequality in India, there are still some unexplored areas that could be incorporated into the index's measurement to provide a comprehensive understanding of the extent of gender inequality in the country. Moreover, though a large amount of literature pertaining to gender inequality or gender discrimination exist in the country (Batra R. and

Reio, T.G. 2016, pp.88-101) (Sharma R. 2015, pp.41-45) (Sumanjeet S. 2017, pp.139-157) (Jayachandran S. 2015, pp. 66-83) (Gaye, A., Klugman, J., Kovacevic, M., Twigg, S., and Zambrano., E, 2010) none of these studies have constructed an index for gender inequality that comprehensively captures the different dimensions of the socioeconomic and political lives of women in the present-day context.

Therefore, this study endeavours to develop a GII that measures inequality across six dimensions: health and nutrition, education, ICT, economic participation, household empowerment, and political participation. It encompasses 18 parameters at the sub-national level. This holistic approach to constructing a GII would add value to the indices built by UNDP and NITI Aayog-SDG. Moreover, the results will facilitate the identification of areas requiring greater attention at the sub-national level and foster healthy competition among states as they strive to achieve gender equality in all societal spheres.

This paper is structured as follows: Following the introduction, the next section outlines the selection of variables for each dimension and the methodology employed in constructing the GII. The subsequent section presents the ranking of states based on the constructed GII values for each dimension, followed by further analysis and interpretation. The study ends with concluding remarks and the way forward for progress towards gender equality.

II Data and Methodology

The methodology is divided into two sections. The first section describes the dimensions and variables selected to construct the Gender Inequality Index (GII). The second section depicts the steps followed to construct the GII and describes the methods used to categorize and analyze the extent of gender inequality in Indian states based on the GII constructed.

Selection of Dimensions and Variables

The distinctive feature of this research paper lies in its holistic approach to analyzing gender inequality across the socio-economic fabric of society. To achieve this, the researcher has selected six dimensions and appropriate variables within each dimension. Data has been sourced from the National Family Health Survey-5 (2021), NSS 75th round (2018), Periodic Labour Force Survey report (2022), and All India Survey on Higher Education (2021). Since the analysis is based on data from different government reports, the study's timeframe aligns with the latest available report for each dataset. The description and justification for the selection of dimensions and variables are given as follows:

A. Health and Nutrition Dimension

The adversity of gender discrimination against girls manifests from the very moment of birth, a phenomenon vividly reflected in the region's skewed 'sex ratio at birth'. Studies by Jayachandran S. (2015, pp.63-88), Das, Gupta and Mari, Bhat (1997, pp.307-315), Bhattacharya, P.C. (2013, pp.117-133), Echávarri, R.A. and Ezcurra R. (2010, pp.249-268) and others have extensively documented the preference for male offspring, leading to a lower proportion of female births compared to males. This preference manifests through antenatal sex determination, sex-selective abortions, foeticide, and infanticide, resulting in a skewed sex ratio (Sahni, M., Verma, N., Narula, D., Varghese, R. M., Sreenivas, V., and Puliyel, J. M. 2008) (Chakraborty L.S. and Sinha D. 2006). These findings echo the proposition made by Amartya Sen in 'missing women theory'.

Furthermore, studies by Miller, B.D. (1997, pp.1685-1695), Sethuraman, K. and Duvvury N. (2007, pp.49-53) and Bose S. (2011, pp. 513-533) among others, have demonstrated that girl children are less likely to receive adequate nutrition compared to boys, leading to undernourishment that impedes their health and physical growth. This discrimination extends to healthcare expenditures, as studies like Saikia, N., Moradhvaj, and Bora, J.K. (2016), Mondal, B. and Dubey, J.D. (2020) have found that in most households, less expenditure is made for women's healthcare compared to men's healthcare across all age groups. Additionally, due to neglect and a lack of importance, women often lack access to adequate reproductive healthcare facilities, resulting in complications and even loss of lives during pregnancy and childbirth. Considering these pervasive issues, the following variables have been chosen to measure gender inequality in health and nutrition:

i)   Sex ratio at birth for children born in the last five years (X_1)
ii) Percentage of mothers who received postnatal care from a doctor/nurse/LHV/ANM/ midwife/other health personnel within 2 days of delivery (X_2)
iii) Percentage of all women aged 15-49 years who are anaemic (X_3)
iv) Female-to-male ratio of average out-of-pocket medical expenditure for hospitalization case (excluding childbirth) (X_4)

B. Education Dimension

Availability and accessibility of quality education are integral parts of human development. For centuries, women have been denied even basic education due to patriarchal maladies, as asserted in the studies of Rammohan, A. and Vu, P. (2018, pp.142-167) and Kingdon G.G. (2002, pp. 25-53). Even today, women face discrimination at different levels of education, reflected in persistently lower literacy rates for women compared to men in all places. This gender gap in education has been documented in many studies, like Chaudhuri, K. and Roy, S. (2009, pp.215-238), Saha, A. (2013, pp. 220-238), Singh, S.P., P. Singh and J.B.

Komaraiah (2023, pp.1-18). To measure gender inequality in the education sector, the following variables have been considered:

i)   Female-to-male ratio of literates (X_5)
ii) Female-to-male ratio of persons with 10 or more years of schooling (X_6)
iii) Percentage of girls' Gross Enrollment Ratio (GER) in higher education (aged 18-23 years) (X_7)

C. *Information and Communication Technology (ICT) Dimension*

Information and Communication Technology (ICT) encompasses a wide range of tools, including mobile phones, computers, internet, social media, and other platforms, that facilitate the rapid access and transfer of digital information from any location. Studies by Islam, M.S. (2015, pp.80-90), Rathi, S. and Niyogi, S. (2015, pp. 519-521), and Abubakar, N., *et. al.* (2017) have highlighted the critical role of ICT tools in raising awareness and disseminating knowledge among women who have historically been denied access to these resources. ICT tools, particularly mobile phones and internet connections, empower women to connect with the world, potentially paving the way for their empowerment. However, despite the availability of ICT devices in many households, female family members often have limited opportunities to utilize these devices for themselves, as evidenced by studies conducted by Adeni, S. (2016, pp. 1-15) and Jain, S. (2006). Consequently, the ICT dimension has been included, incorporating the following variables to assess gender inequality:

i)   Percentage of women who have ever used the internet (X_8)
ii) Female-to-male ratio of persons who have ever used the internet (X_9)
iii) Percentage of women having a mobile phone that they themselves use (X_{10})

D. *Household Empowerment Dimension*

Gender inequality originates in the household, where women are discriminated against in the name of customs and traditions. Women are more often neglected and oppressed in their spousal household, where they deal with issues ranging from humiliation to physical abuse. Thus, a key component of gender disparity is household empowerment or lack thereof, and the following variables have been chosen to reflect this dimension.

i)   Percentage of currently married women who usually participate in three household decisions (X_{11})
ii) Percentage of ever-married women aged 18-49 years who have ever experienced spousal violence (X_{12})

E. Economic Participation Dimension

Under the prevailing patriarchal system, women have been historically denied economic independence and were made to rely on male family members for their financial needs. This patriarchal system granted exclusive inheritance rights to male members, leaving women with no control or ownership of family income and assets, thus limiting their economic participation (Dagdeviren, H. and Oosterbaan, L. 2022) (Deere and Doss 2006, pp. 1-50) (Deere, C.D., Odura, A.D., Swaminathan, H., and Doss, C. 2013, pp.249-265). Additionally, the prolonged denial of education hindered women's acquisition of skills and knowledge required by the labour market, leading to significantly lower female labor force participation compared to men as registered by the studies of Kaur, P. and Sharma, S., (2023, pp.52-64), Sengupta, P. and Puri, R. (2022, pp.50-81), Ara, S. (2021, pp.415-445) Sorsa, P., Mares, J., Didier, M., Guimaraes, C., Rabate, M., Tang, G., and Tuske, A. (2015), Chaudhary, R. and Verick, S. (2014), Bhalla, S. and Kaur, R. (2011). Even when women enter the job market, they face discrimination in the form of lower wages and limited access to high-power positions (Khanna 2012, p.30, Chakraborty 2020, pp. 765-780). These factors have collectively contributed to a significant gender gap in economic participation at both household and societal levels. Therefore, the study deemed it essential to include the economic participation dimension and has selected the following variables to represent gender inequality in economic participation

i)   Percentage of women owning a house and/or land (alone or jointly with others) (X_{13})
ii)   Percentage of women having a bank or savings account that they themselves use (X_{14})
iii) Women average wage earnings (₹) per day from casual labour work other than public works (X_{15})
iv)   Ratio of women-to-men aged 15-59 years labour force participation rate (X_{16})

F. Political Participation Dimension

In the male-dominated society, women were not allowed to be involved in any public affairs including politics. As a result, women's political participation remains negligible in many societies, particularly in India. The Indian political landscape has long been dominated by men, with women's entry into politics often met with stigma and prejudices (Clots-Figueras, I. 2011, pp.664-690) (Kapoor, M. and Ravi, S. 2013, p. 10) (Rai, P. 2011, pp. 47-55). Despite these challenges, women's representation in authoritative spheres like politics is crucial to amplifying the voices of marginalized women and shaping policies that promote their upliftment (Khanna, M. 2009, pp. 55-64). Recognizing the significance of this dimension, this study has included the political empowerment dimension and

incorporated the following variables to represent gender inequality in political participation:

i) Percentage of elected women over total seats in the state legislative assembly (X_{17})
ii) Percentage of women in council of ministers in the state legislative assembly (X_{18})

This study distinguishes itself from previous research on gender inequality by adopting a comprehensive approach that encompasses both well-established aspects like health, education, and economic participation, and less explored but equally significant dimensions such as ICT access, household empowerment, and political participation. The inclusion of these diverse aspects enables the construction of a more holistic and inclusive Gender Inequality Index (GII).

Data Analysis Methodology

To carry out the gender inequality analysis at the sub-national level in India, the Gender Inequality Index (GII) was constructed for the states of the country. To this end, the 28 states of the country along with the National Capital Territory of Delhi (NCT of Delhi) was considered. Due to the differing political administrative structures of states and union territories in India, and the unavailability of data for many of the selected variables for the union territories, it was impractical to construct a unified GII for both states and union territories. Therefore, this study focuses solely on the 28 states and NCT Delhi for the construction of GII and analysis (although NCT Delhi is a union territory, its political and administrative structure resembles that of states, and data availability for the selected variables justifies its inclusion).

Following the selection of variables, to obtain a preliminary overview of each state's position on each variable, the states were ranked for all 18 variables. Then, based on the rankings, the states were placed into three categories: better performer, average performer, and below average performer. For ease of understanding, the states were given the shades of white (better performer), light grey (average performer), and dark grey (below average performer) in the tabulation of values. Subsequently, a comparison was made between the states to visualize the status of women and gender inequality prevailing in each state.

Constructing Gender Inequality Index

To construct the GII, the methodology adopted by UNDP for developing the Human Development Index has been followed (UNDP 2007). Accordingly, the steps involved in the construction of GII in this study are as follows:

Step 1: For variables where women's status was considered in relation to men's status, the female-to-male ratio was calculated by dividing the value of female with the value of male for the respective variables.

Step 2: After tabulating data for all the selected variables, a minimum and maximum value for each variable have been calculated

Step 3: For positive indicators (variables where higher values indicate better performance), the minimum value was taken as 10 per cent less than the observed minimum value, and for negative indicators (variables where lower values indicate better performance), the maximum value was taken as 10 per cent more than the observed maximum value for each variable.

Step 4: The index value for positive indicator was calculated by using the following formula:

$$(InX_{is}) = \frac{(X_{is} - MinX_{is})}{(MaxX_{is} - MinX_{is})}$$

And the index value for negative indicator was calculated using the following formula

$$(InX_{is}) = \frac{(MaxX_{is} - X_{is})}{(MaxX_{is} - MinX_{is})}$$

Where,
InX_{is} – Index value of the 'i'th variable for the 's'th state (which runs from 1 to 29 representing the 28 states and NCT Delhi)
X_{is} – Actual value of the 'i'th variable for 's'th state
$MinX_{is}$ – Minimum value of 'i'th variable for all the states
$MaxX_{is}$ – Maximum value of 'i'th variable for all the states

This calculation will yield index values for each variable ranging between 0 and 1, where values closer to 1 represent better performance and values closer to 0 indicate lesser performance.

Step 5: The next step was to calculate gender inequality in each dimension. The dimensional index was calculated by aggregating the index values of each variable through the geometric mean.
The formula to calculate Geometric Mean (GM) is:

GM = $(X_1 \cdot X_2 \cdot ..., \cdot X_n)^{1/n}$ (Taking logarithm on both sides),

log GM = log $(X_1 \cdot X_2 \cdot ... X_n)^{1/n}$

= $(1/n)$ log $(X_1 \cdot X_2 \cdot ... X_n)$

$$= (1/n) [\log X_1 + \log X_2 + \ldots + \log X_n]$$

$$= \frac{\sum_{i=1}^{n} \log x_i}{n}$$

$$GM = \text{Antilog} \frac{\sum_{i=1}^{n} \log x_i}{n}$$

Step 6: This calculation will give the index value for each dimension. Then, building on the approach of NITI Aayog, the composite GII was calculated by aggregating the geometric mean of all the dimensions. This was done by calculating the geometric mean of the dimensional means as done in the NITI Aayog report for SDGs (NITI Aayog 2021).

Step 7: Finally, the states were ranked based on the composite GII, and analysis and inferences were drawn from it.

III Data Analysis and Interpretation

This section presents the analysis of inter-state disparity and the extent to which gender inequality persists among the states of India in six dimensions through the selected socio-economic variables that capture the prevailing gender discrimination in society.

A. Gender Inequality in Health and Nutrition

As said earlier, health is one of the prominent aspects in which gender inequality prevails. The level of gender inequality in health and nutrition among the Indian states is furnished in Table 1.

Table 1: Gender Inequality in Health and Nutrition Dimension among the States of India

States	Sex ratio at birth for children born in the last five years (females per 1,000 males)	Percentage of mothers who received postnatal care from a doctor/ nurse/ LHV/ ANM/ midwife/ other health personnel within 2 days of delivery (%)	Percentage of all women aged 15-49 years who are anaemic (%)	Female-to-male ratio of average out-of-pocket medical expenditure for hospitalization case (excluding childbirth) (₹)	Health and Nutrition Index
	(X_1)	(X_2)	(X_3)	(X_4)	(In_1)
Andhra Pradesh	934 (17)	90.7 (5)	58.8 (20)	69.06 (17)	0.5451 (11)
Arunachal Pradesh	979 (4)	56.4 (27)	40.3 (6)	95.18 (5)	0.6017 (7)
Assam	964 (10)	65.3 (25)	65.9 (27)	86.49 (8)	0.4781 (17)
Bihar	908 (20)	57.3 (26)	63.5 (23)	71.13 (15)	0.3822 (25)
Chhattisgarh	960 (11)	84 (15)	60.8 (22)	71.48 (14)	0.5402 (12)

States	Sex ratio at birth for children born in the last five years (females per 1,000 males)	Percentage of mothers who received postnatal care from a doctor/ nurse/ LHV/ ANM/ midwife/ other health personnel within 2 days of delivery (%)	Percentage of all women aged 15-49 years who are anaemic (%)	Female-to-male ratio of average out-of-pocket medical expenditure for hospitalization case (excluding childbirth) (₹)	Health and Nutrition Index
	(X_1)	(X_2)	(X_3)	(X_4)	(In_1)
Delhi	923 (18)	85.4 (12)	49.9 (10)	80.06 (12)	0.6189 (4)
Goa	838 (29)	95.4 (1)	39 (5)	118.34 (2)	0.6961 (3)
Gujarat	955 (13)	89.7 (6)	65 (25)	51.16 (24)	0.4063 (23)
Haryana	893 (25)	91.3 (4)	60.4 (21)	62.93 (21)	0.4742 (18)
Himachal Pradesh	875 (28)	86.3 (10)	53 (12)	46.02 (26)	0.3609 (27)
Jharkhand	899 (22)	69.1 (22)	65.3 (26)	62.54 (22)	0.3835 (24)
Karnataka	978 (5)	87.4 (9)	47.8 (9)	65.08 (19)	0.6107 (5)
Kerala	951 (14)	93.3 (2)	36.3 (4)	74.98 (13)	0.7137 (2)
Madhya Pradesh	956 (12)	83.5 (16)	54.7 (17)	42.95 (29)	0.3471 (28)
Maharashtra	913 (19)	85.4 (13)	54.2 (15)	65.01 (20)	0.5228 (14)
Manipur	967 (9)	73.4 (18)	29.4 (2)	52.05 (23)	0.5247 (13)
Meghalaya	989 (2)	43.9 (28)	53.8 (14)	111.38 (4)	0.4149 (22)
Mizoram	969 (7)	68 (23)	34.8 (3)	43.25 (28)	0.3744 (26)
Nagaland	945 (15)	43.9 (29)	28.9 (1)	113.77 (3)	0.4726 (19)
Odisha	894 (23)	88.4 (7)	64.3 (24)	70.27 (16)	0.4709 (20)
Punjab	904 (21)	86.2 (11)	58.7 (19)	83.26 (9)	0.5608 (10)
Rajasthan	891 (26)	85.3 (14)	54.4 (16)	67.04 (18)	0.5117 (15)
Sikkim	969 (8)	69.3 (21)	42.1 (7)	121.03 (1)	0.7443 (1)
Tamil Nadu	878 (27)	93.2 (3)	53.4 (13)	82.54 (10)	0.5850 (9)
Telangana	894 (24)	87.6 (8)	57.6 (18)	94.39 (6)	0.5950 (8)
Tripura	1,028 (1)	71.9 (20)	67.2 (28)	80.07 (11)	0.5079 (16)
Uttarakhand	984 (3)	72 (19)	50.4 (11)	89.57 (7)	0.6105 (6)
Uttar Pradesh	941 (16)	78 (17)	42.6 (8)	46.86 (25)	0.4518 (21)
West Bengal	973 (6)	68 (24)	71.4 (29)	43.83 (27)	0.2462 (29)
India	929	78	57.0	70.10	-

Note: X_4 - "Health in India", NSS 75th Round, Ministry of Statistics & Programme Implementation, Government of India.

Source: X_1, X_2, X_3, - National Family Health Survey (NFHS-5), Ministry of Health and Family Welfare, Government of India.

Table 1 highlights gender inequality in the health and nutrition dimension among the states of India. In terms of 'sex ratio at birth', Tripura emerges as the frontrunner with 1,028 females per 1,000 males. Notably, Tripura stands out as the sole state where the female birth rate surpasses the male birth rate. Meghalaya follows closely, registering 989 female births per 1,000 male births. It is appalling to observe that states like Tamil Nadu (27th rank), Himachal Pradesh (28th rank), and Goa (29th rank) occupy the bottom three positions in the 'sex ratio at birth'

indicator. Furthermore, it is worrying that eight states exhibit a 'sex ratio at birth' below 900, indicating that over 100 female infants were missing for every 1,000 male infants born. The next indicator, 'Percentage of mothers who received postnatal care from a health professional within 2 days of delivery,' sheds light on the reproductive healthcare accessibility for women in their respective states. Goa leads the pack with 95.4 per cent, followed closely by Kerala and Tamil Nadu with 93.3 per cent and 93.2 per cent, respectively. This anomaly in the positions of Goa and Tamil Nadu in these two indicators is perplexing, and both state governments have disputed the validity of the 'sex ratio at birth' data, asserting that it does not accurately reflect the actual situation within their states. (Kannan, Ramya 2021, November 25) (Malkarnekar, G. 2022, May 6).

Further a major form of discrimination faced by women is the disparity in their nutritional intake, which is reflected in the prevalence of anaemia among them. It is alarming to note that, except for a few states, over half of the female population aged 15 to 49 years in nearly all states suffers from anaemia. West Bengal emerges as the worst-case scenario, with 71.4 per cent of women grappling with anaemia. Regarding healthcare, women often find themselves at a disadvantage when it comes to the expenses incurred for medical treatment, excluding childbirth. The 'female-to-male ratio of average out-of-pocket medical expenditure for hospitalization cases' illustrates the average amount spent on medical treatment for women (excluding childbirth) in comparison to every ₹100 spent for males for the same purpose. In this variable, states like Sikkim (₹121.03), Goa (₹118.34), Nagaland (₹113.77), and Meghalaya (₹111.38) register values exceeding 100, indicating that in these states the average amount spent on medical expenditure for women is higher than for men. In all other states, coincidentally those with larger populations, the value falls below 100, reflecting a lower expenditure on medical treatment for females compared to males. Moreover, in states like Uttar Pradesh (₹46.86), Himachal Pradesh (₹46.02), West Bengal (₹43.83), Mizoram (₹43.25), and Madhya Pradesh (₹42.95), the values are less than 50, implying that less than half the amount is spent on female medical expenditure compared to medical expenditure for male.

The health and nutrition index was computed by converting these raw values to indices and then aggregating them using the Geometric Mean (GM),. It reflected gender discrimination in the overall health and nutrition dimension, with Sikkim (0.7443), Kerala (0.7137), and Goa (0.6961) occupying the top three positions with lesser gender inequality, whereas Himachal Pradesh (0.3609), Madhya Pradesh (0.3471), and West Bengal (0.2462) were in the bottom three positions, revealing a high level of gender inequality and negligence towards female health and nutrition.

B. Gender Inequality in Education

Education is another major area where women face discrimination. The level of gender inequality in education among the Indian states is shown in Table 2

Table 2: Gender Inequality in Education Dimension among the States of India

States	Female-to-male ratio of literates[2]	Female-to-male ratio of persons with 10 or more years of schooling	Percentage of girls GER in higher education (aged 18 - 23 years) (%)	Education Index
	X_5	X_6	X_7	In_2
Andhra Pradesh	0.863 (20)	0.827 (17)	36 (11)	0.5413 (14)
Arunachal Pradesh	0.832 (22)	0.817 (20)	32.8 (14)	0.4811 (17)
Assam	0.916 (12)	0.834 (16)	18.4 (26)	0.3528 (22)
Bihar	0.736 (28)	0.673 (28)	15.1 (29)	0.1165 (29)
Chhattisgarh	0.877 (17)	0.889 (11)	21.3 (22)	0.4176 (19)
Delhi	0.928 (8)	0.980 (4)	48.5 (4)	0.8070 (2)
Goa	0.966 (5)	0.933 (8)	37.3 (9)	0.7106 (7)
Gujarat	0.842 (21)	0.741 (25)	20.6 (23)	0.3078 (26)
Haryana	0.871 (18)	0.796 (22)	33.7 (12)	0.5059 (15)
Himachal Pradesh	0.966 (4)	0.924 (9)	44.7 (5)	0.7717 (4)
Jharkhand	0.759 (27)	0.712 (27)	17.5 (28)	0.1953 (28)
Karnataka	0.867 (19)	0.888 (12)	37.2 (10)	0.5968 (11)
Kerala	1.001 (2)	1.050 (1)	52.3 (1)	0.9539 (1)
Madhya Pradesh	0.804 (25)	0.734 (26)	26.8 (18)	0.3480 (23)
Maharashtra	0.910 (15)	0.826 (18)	33.5 (13)	0.5564 (13)
Manipur	0.920 (10)	0.819 (19)	38.6 (8)	0.6029 (10)
Meghalaya	1.053 (1)	1.012 (3)	29 (16)	0.7148 (6)
Mizoram	0.972 (3)	1.018 (2)	27.5 (17)	0.6434 (9)
Nagaland	0.920 (11)	0.836 (15)	19.3 (25)	0.3765 (20)
Odisha	0.822 (23)	0.855 (13)	20.1 (24)	0.3451 (24)
Punjab	0.915 (13)	0.954 (6)	29.1 (15)	0.5921 (12)
Rajasthan	0.728 (29)	0.644 (29)	26 (19)	0.2001 (27)
Sikkim	0.956 (6)	0.891 (10)	44 (6)	0.7320 (5)
Tamil Nadu	0.926 (9)	0.958 (5)	48.6 (3)	0.7905 (3)
Telangana	0.785 (26)	0.743 (24)	40.9 (7)	0.4317 (18)
Tripura	0.914 (14)	0.789 (23)	18.4 (27)	0.3300 (25)
Uttarakhand	0.894 (16)	0.843 (14)	48.9 (2)	0.6735 (8)
Uttar Pradesh	0.806 (24)	0.809 (21)	24.3 (20)	0.3710 (21)
West Bengal	0.933 (7)	0.948 (7)	22.3 (21)	0.4968 (16)
India	0.847	0.817	27.9	-

Source: X_5, X_6 - National Family Health Survey (NFHS-5), Ministry of Health and Family Welfare, Government of India, X_7- All India Survey on Higher Education (AISHE) 2020-21, Department of Higher Education, Ministry of Education, Government of India.

Table 2 shows that the 'Female-to-male ratio of literates' in the states of Meghalaya (1.053) and Kerala (1.001) are around the value of one, which means that for every one male literate, there is one female literate in these states. In other words, there are equal numbers of male and female literate people in these states. Following these states are Mizoram and Himachal Pradesh, with values of 0.972 and 0.966, respectively. From these values, it can be inferred that for every 100 male literates, there are around 97 and 96 female literates in Mizoram and Himachal Pradesh, respectively. On the other hand, the states like Jharkhand (0.759), Bihar (0.736), and Rajasthan (0.728) that are in the bottom three positions have a ratio value less than or equal to 0.75, indicating that for every 100 males who are literate, there are only less than or equal to 75 female literates in these states.

In the variable 'Female-to-male ratio of persons with 10 or more years of schooling,' again the states of Kerala (1.050), Mizoram (1.018), and Meghalaya (1.012) have values equal to one, which mean that male and female have equal access to school education in these states. Similar to the previous variable, the states of Jharkhand (0.712), Bihar (0.673), and Rajasthan (0.644) were in the bottom three ranks, and along with these states, another five states had a ratio value less than 0.79, highlighting the neglect of even school education for female children in these states.

The 'Gross Enrolment Ratio (GER) for girls in higher education' variable shows the percentage of female children who enter higher education. Among the states, again Kerala is in the first position with 52.3 per cent of females entering higher education, followed by Uttarakhand and Tamil Nadu with 48.9 per cent and 48.6 per cent GER, respectively. Conversely, in states like Nagaland (19.3 per cent), Assam (18.4 per cent), Tripura (18.4 per cent), Jharkhand (17.5 per cent), and Bihar (15.1 per cent), the GER is less than 20, which means that less than 20 per cent of the female population pursues higher education in these states. It is noteworthy that the GER in higher education variable not only reflects the availability and accessibility of education to the female population but also reflects the aspirations of the female population in these states, which is a sign of women's empowerment.

The education index shows the aggregate index value of the variables selected for the education dimension. Predictably, Kerala holds the top position with a 0.953 index value, indicating near-zero inequality between males and females in education in the state. Delhi and Tamil Nadu follow in second and third place, with index values of 0.807 and 0.790, respectively. These index values show that although these states are in better ranks, there is still room for improvement to achieve the position of complete equality between male and female genders in education. The states in the bottom three positions are Rajasthan, Jharkhand, and Bihar, with index values of 0.200, 0.195, and 0.116, respectively. These values highlight the glaring disparity in educational opportunities between men and women in these states, which calls for immediate attention.

C. Gender Inequality in Information and Communication Technology (ICT)

The accessibility and usage of ICT like mobile phones and the internet have become indispensable for access to knowledge and a better standard of living in this globalized world. The availability and usage of these devices by women will open many doors for them, leading to their empowerment. Table 3 shows the inequality in ICT tools between women and men in the states of India.

Table 3: Gender Inequality in ICT Dimension among the States of India

States	Percentage of women who have ever used the internet (%)	Female-to-male ratio of persons who have ever used the internet (%)	Percentage of women having a mobile phone that they themselves use (%)	ICT index
	X_8	X_9	X_{10}	In_3
Andhra Pradesh	21 (28)	0.430 (29)	48.9 (25)	0.0919 (29)
Arunachal Pradesh	52.9 (7)	0.739 (8)	76.4 (7)	0.6368 (7)
Assam	28.2 (21)	0.667 (13)	57.2 (16)	0.3147 (17)
Bihar	20.6 (29)	0.472 (27)	51.4 (19)	0.1147 (28)
Chhattisgarh	26.7 (23)	0.474 (26)	40.7 (28)	0.1301 (26)
Delhi	63.8 (4)	0.740 (7)	73.8 (9)	0.6897 (5)
Goa	73.7 (2)	0.889 (2)	91.2 (1)	0.9289 (2)
Gujarat	30.8 (19)	0.523 (21)	48.8 (26)	0.2293 (20)
Haryana	48.4 (10)	0.669 (11)	50.4 (20)	0.4076 (14)
Himachal Pradesh	49.7 (9)	0.732 (9)	79.5 (6)	0.6272 (8)
Jharkhand	31.4 (18)	0.541 (20)	49 (24)	0.2443 (19)
Karnataka	35 (16)	0.561 (18)	61.8 (12)	0.3413 (16)
Kerala	61.1 (5)	0.803 (5)	86.6 (3)	0.7778 (4)
Madhya Pradesh	26.9 (22)	0.483 (25)	38.5 (29)	0.1164 (27)
Maharashtra	38 (14)	0.618 (14)	54.8 (17)	0.3591 (15)
Manipur	44.8 (13)	0.606 (15)	72.2 (10)	0.4803 (12)
Meghalaya	34.7 (17)	0.824 (4)	67.5 (11)	0.4916 (11)
Mizoram	67.6 (3)	0.848 (3)	82.3 (5)	0.8202 (3)
Nagaland	49.9 (8)	0.772 (6)	82.5 (4)	0.6664 (6)
Odisha	24.9 (26)	0.491 (24)	50.1 (22)	0.1736 (24)
Punjab	54.8 (6)	0.701 (10)	61.2 (13)	0.5367 (10)
Rajasthan	36.9 (15)	0.566 (17)	50.2 (21)	0.2968 (18)
Sikkim	76.7 (1)	0.981 (1)	88.6 (2)	0.9843 (1)
Tamil Nadu	46.9 (11)	0.668 (12)	74.6 (8)	0.5462 (9)
Telangana	26.5 (24)	0.462 (28)	60 (15)	0.1975 (23)
Tripura	22.9 (27)	0.501 (23)	53.1 (18)	0.1674 (25)
Uttar Pradesh	30.6 (20)	0.518 (22)	46.5 (27)	0.2122 (21)
Uttarakhand	45.1 (12)	0.605 (16)	60.9 (14)	0.4266 (13)

States	Percentage of women who have ever used the internet (%)	Female-to-male ratio of persons who have ever used the internet (%)	Percentage of women having a mobile phone that they themselves use (%)	ICT index
	X_8	X_9	X_{10}	In_3
West Bengal	25.5 (25)	0.546 (19)	50.1 (23)	0.2069 (22)
India	33.3	0.583	54	-

Source: National Family Health Survey (NFHS-5), Ministry of Health and Family Welfare, Government of India.

Table 3 shows that among the states of the country, Sikkim, Goa, and Mizoram hold the top three positions in both the 'Percentage of women who have ever used internet' and the 'Female- to-male ratio of persons who have ever used the internet' variables. It was surprising to see a small state like Sikkim hold the first position in internet usage among women. The data tells us that in the state, around 76.7 per cent of women have ever used the internet, and the female-to-male ratio value is 0.981, which means that for every 100 men who have ever used the internet, 98 women in the state have used it, which is an appreciable performance. Among the other states, only in seven states more than 50 per cent of the women population have ever used the internet. In the remaining twenty-two states, less than 50 per cent of the women have ever used the internet. Further, in the bottom three states of Tripura (22.9 per cent), Andhra Pradesh (21 per cent), and Bihar (20.6 per cent), only around 20 per cent of the women have ever used the internet.

In the 'Percentage of women having mobile phones that they use for themselves', again Goa and Sikkim are in the top two positions, followed by Kerala in the third position. On the other hand, states in the bottom three positions were Uttar Pradesh, Chhattisgarh, and Madhya Pradesh, where only 46.5 per cent, 40.7 per cent, and 38.5 per cent of women had a mobile phone that they use for themselves. The ICT index shows the overall inequality in the usage of ICT tools between males and females in the states of the country. Among the states, Sikkim (0.984), Goa (0.928) and Mizoram (0.820) are in the top three positions while Madhya Pradesh (0.116), Bihar (0.114) and Andhra Pradesh (0.091) are in the bottom three position, exhibiting stark inequalities between male and female genders in the usage of ICT tools.

D. Gender Inequality in Household Empowerment

Women face a wide spectrum of discrimination, ranging from subtle disregard to physical abuse in the household. This pervasive issue has far-reaching consequences, hindering women's empowerment and overall well-being. Table 4 projects the status of women's empowerment or lack thereof in households among the states of India.

Table 4: Gender Inequality in Household Empowerment Dimension among the States of India

States	Percentage of currently married women who usually participate in their household decisions[3] (%)	Percentage of ever-married women aged 18-49 years who have ever experienced spousal violence[4] (%)	Household Empowerment index
	X_{11}	X_{12}	In_4
Andhra Pradesh	84.1 (28)	30 (20)	0.4162 (26)
Arunachal Pradesh	87 (25)	24.8 (16)	0.5361 (18)
Assam	92.1 (11)	32 (23)	0.5320 (19)
Bihar	86.5 (26)	40.1 (28)	0.3185 (28)
Chhattisgarh	92.7 (8)	20.2 (12)	0.7055 (11)
Delhi	92 (12)	22.6 (14)	0.6622 (13)
Goa	93.1 (6)	8.3 (2)	0.8485 (5)
Gujarat	92.2 (10)	14 (8)	0.7674 (7)
Haryana	87.5 (23)	18.2 (11)	0.6172 (14)
Himachal Pradesh	93.9 (5)	8.3 (2)	0.8665 (3)
Jharkhand	91 (14)	31.5 (22)	0.5227 (21)
Karnataka	82.7 (29)	44.4 (29)	0.1868 (29)
Kerala	94.1 (4)	9.9 (4)	0.8535 (4)
Madhya Pradesh	86 (27)	28.1 (19)	0.4777 (22)
Maharashtra	89.8 (18)	25.2 (17)	0.5879 (15)
Manipur	94.8 (3)	39.6 (27)	0.4231 (24)
Meghalaya	92.3 (9)	16 (10)	0.7471 (8)
Mizoram	98.8 (2)	10.9 (5)	0.9378 (2)
Nagaland	99.2 (1)	6.4 (1)	1 (1)
Odisha	90.2 (17)	30.6 (21)	0.5230 (20)
Punjab	91.4 (13)	11.6 (6)	0.7753 (6)
Rajasthan	87.7 (21)	24.3 (15)	0.5565 (16)
Sikkim	89.7 (19)	12.1 (7)	0.7305 (9)
Tamil Nadu	92.8 (7)	38.1 (26)	0.4332 (23)
Telangana	87.2 (24)	36.9 (25)	0.3808 (27)
Tripura	90.9 (16)	20.7 (13)	0.6639 (12)
Uttar Pradesh	87.6 (22)	34.8 (24)	0.4193 (25)
Uttarakhand	91 (15)	15.1 (9)	0.7292 (10)
West Bengal	88.9 (20)	27 (18)	0.5482 (17)
India	88.7	29.3	-

Source: National Family Health Survey (NFHS-5), Ministry of Health and Family Welfare, Government of India.

The variable 'Percentage of currently married women who usually participate in household decisions' provides insights into women's involvement in domestic decision-making. States like Nagaland (99.2 per cent), Mizoram (98.8 per cent), and Manipur (94.8 per cent) occupy the top three positions closely followed by Kerala (94.1 per cent) in fourth position, indicating a high level of women's

participation in household decision-making. This encouraging trend is evident in 17 states where over 90 per cent of women reported regular participation in household decisions. Even in the states with the lowest participation rates, more than 80 per cent of women indicated their participation, suggesting a gradual shift towards women's empowerment within the household sphere.

The variable 'Percentage of ever-married women aged 18–49 years who have ever experienced spousal violence' sheds light on the prevalence of domestic violence against women. Nagaland holds the lowest percentage, with only 6.4 per cent of women reporting spousal violence. Goa and Himachal Pradesh share the next position, with both states recording 8.3 per cent of women experiencing spousal violence. While these numbers may seem relatively low, they represent a significant social issue that must be addressed to ensure women's safety and well-being. The persistence of spousal violence, even in minimal instances, highlights the need for comprehensive measures to eliminate such practices and foster a society that upholds gender equality. Conversely, states like Bihar and Karnataka exhibit alarmingly high rates of spousal violence, with over 40 per cent of women reporting having experienced it. These findings underscore the urgent need for targeted interventions in these regions to address the root causes of domestic violence and protect women's rights.

Overall, Nagaland stands in the first position in the household empowerment index, where the highest percentage of women participated in household decisions and the lowest percentage of women experienced spousal violence. This model should be emulated in other states to cultivate a mindset and practices that promote gender equality in households.

E. Gender Inequality in Economic Participation

Historically, women's subordinate position in public and private spheres has deprived them of the right to hold assets in their names or participate in financial decision-making. They have been denied employment opportunities and continue to face discrimination in the labour market. Thereby the Table 5 portrays the gender inequality in economic participation among the Indian states.

Table 5: Gender Inequality in Economic Participation Dimension among the States of India

States	Percentage of women owning a house and/or land (alone or jointly with others) (%)	Percentage of women having a bank or savings account that they themselves use (%)	Women average wage earnings (₹) per day from casual labour work other than public works	Ratio of women-to-men aged 15-59 years labour force participation rate (%)	Economic Participation Index
	X_{13}	X_{14}	X_{15}	X_{16}	In_5
Andhra Pradesh	47.8 (12)	81.8 (7)	293.57 (18)	0.564 (8)	0.5308 (10)
Arunachal Pradesh	70.2 (1)	78.2 (16)	387.52 (7)	0.449 (16)	0.6305 (3)
Assam	42.7 (15)	78.5 (14)	245.05 (24)	0.365 (20)	0.3618 (21)

States	Percentage of women owning a house and/or land (alone or jointly with others) (%)	Percentage of women having a bank or savings account that they themselves use (%)	Women average wage earnings (₹) per day from casual labour work other than public works	Ratio of women-to-men aged 15-59 years labour force participation rate (%)	Economic Participation Index
	X_{13}	X_{14}	X_{15}	X_{16}	In_5
Bihar	55.3 (8)	76.7 (18)	299.61 (16)	0.146 (29)	0.2288 (26)
Chhattisgarh	45.6 (13)	80.3 (10)	207.17 (28)	0.653 (4)	0.3567 (22)
Delhi	22.7 (27)	72.5 (26)	NA*	0.179 (28)	0.1579 (29)
Goa	23.2 (23)	88.3 (3)	298.39 (17)	0.302 (26)	0.3157 (24)
Gujarat	42.6 (16)	70.01 (28)	249.81 (22)	0.443 (17)	0.3482 (23)
Haryana	39.3 (18)	73.6 (24)	382.83 (10)	0.278 (27)	0.3948 (17)
Himachal Pradesh	23.1 (25)	83.1 (6)	412.63 (6)	0.824 (1)	0.5082 (11)
Jharkhand	64.2 (5)	79.6 (12)	288.59 (19)	0.573 (7)	0.5709 (6)
Karnataka	67.6 (2)	88.7 (2)	279.78 (20)	0.420 (19)	0.5559 (7)
Kerala	7.3 (19)	78.5 (15)	424.47 (4)	0.520 (11)	0.4735 (12)
Madhya Pradesh	39.9 (17)	74.7 (22)	246.35 (23)	0.518 (12)	0.3819 (20)
Maharashtra	22.9 (26)	72.8 (25)	229 (26)	0.514 (13)	0.2523 (25)
Manipur	58.4 (7)	74 (23)	421.12 (5)	0.351 (23)	0.5321 (9)
Meghalaya	65 (4)	70.4 (27)	386.32 (8)	0.674 (3)	0.6246 (4)
Mizoram	20.8 (28)	80.7 (9)	460.83 (3)	0.511 (14)	0.4093 (15)
Nagaland	26.9 (20)	63.7 (29)	496.82 (2)	0.652 (5)	0.3996 (16)
Odisha	43.5 (14)	86.5 (4)	242.77 (25)	0.431 (18)	0.4158 (14)
Punjab	63.5 (6)	81.6 (8)	353.8 (11)	0.325 (25)	0.5350 (8)
Rajasthan	26.6 (21)	79.6 (13)	383.94 (9)	0.552 (9)	0.4597 (13)
Sikkim	53.1 (9)	76.4 (20)	535.35 (1)	0.707 (2)	0.7477 (1)
Tamil Nadu	47.9 (11)	92.2 (1)	309.2 (15)	0.528 (10)	0.5878 (5)
Telangana	66.6 (3)	84.4 (5)	350.01 (12)	0.602 (6)	0.6933 (2)
Tripura	17.2 (29)	76.9 (17)	348.69 (13)	0.352 (22)	0.2262 (28)
Uttar Pradesh	51.9 (10)	75.4 (21)	263.44 (21)	0.346 (24)	0.3919 (18)
Uttarakhand	24.6 (22)	80.2 (11)	334.64 (14)	0.455 (15)	0.3837 (19)
West Bengal	23.2 (24)	76.5 (19)	224.19 (27)	0.355 (21)	0.2281 (27)
India	43.3	78.6	271.66	0.435	-

Source: X_{13}, X_{14} - National Family Health Survey (NFHS-5), Ministry of Health and Family Welfare, Government of India, X_{15}, X_{16} – Annual Report (2021-22), Periodic Labour Force Survey (PLFS), Ministry of Statistics and Programme Implementation, Government of India.

As evident from Table 5, Arunachal Pradesh stands in the first position for 'Percentage of women owning a house and/or land (alone or jointly with others),' with an appreciable 70.2 per cent ownership rate. Karnataka and Telangana follow closely, with 67.6 per cent and 66.6 per cent, respectively. Conversely, in nearly ten states, less than 30 per cent of women own a house and/or land (alone or jointly with others). Tripura exhibits the most significant gender disparity, with only 17.2 per cent of women owning property. Regarding 'Percentage of women having a

bank or savings account that they use for themselves,' Tamil Nadu emerges as the top performer, with an impressive 92.2 per cent of women having a bank account. Notably, in all states except Nagaland (63.7 per cent), more than 70 per cent of women have a bank or savings account that they used themselves.

In terms of 'Average wage earnings per day for women,' smaller states like Sikkim (₹535.35), Nagaland (₹496.82), Mizoram (₹460.83), and Manipur (₹421.12) occupy the top five positions, with Kerala securing fourth place with an average wage of ₹424.47 per day for women. The states in the bottom three positions, Maharashtra, West Bengal, and Chhattisgarh, exhibit significantly lower average wage rates per day for women, with only ₹229, ₹224.19, and ₹207.17, respectively.

In the patriarchal Indian society, female labour force participation has consistently been lower. As evidenced by Table 5, the 'Ratio of women-to-men in the labour force participation rate' was less than or equal to 0.5 in all states except for a few, with the worst cases being Delhi and Bihar, with values of 0.179 and 0.146, respectively. These figures imply that for every 100 male labourers, there are only 17 and 14 female labourers in these states, respectively.

Overall, in the economic participation index Sikkim stands out in the first position, followed by Telangana and Arunachal Pradesh, indicating lesser gender inequality. In contrast, West Bengal, Tripura, and Delhi occupy the last three places, reflecting a lower level of economic participation among women in these states.

F. Gender Inequality in Political Participation

Women's active participation in politics and their adequate representation in government bodies are crucial for formulating policies and programs that effectively address gender inequality and promote women's empowerment. Table 6 provides an overview of women's political participation across Indian states.

Table 6: Gender Inequality in Political Participation Dimension among the States of India

States	Percentage of elected women over total seats in the state legislative assembly (%) X_{17}	Percentage of women in council of ministers in the state legislative assembly (%) X_{18}	Political Participation Index In_6
Andhra Pradesh	8 (17)	15.38 (3)	0.5870 (6)
Arunachal Pradesh	5 (24)	0	0.0577 (27)
Assam	4.76 (25)	12.5 (6)	0.4082 (16)
Bihar	10.7 (10)	9.67 (12)	0.5383 (13)
Chhattisgarh	14.44 (2)	7.69 (17)	0.5577 (11)
Delhi	11.42 (8)	14.28 (5)	0.6758 (4)
Goa	7.5 (20)	0	0.0707 (26)
Gujarat	8 (18)	6.25 (19)	0.3742 (18)

States	Percentage of elected women over total seats in the state legislative assembly (%)	Percentage of women in council of ministers in the state legislative assembly (%)	Political Participation Index
	X_{17}	X_{18}	In_6
Haryana	10 (11)	7.14 (18)	0.4472 (14)
Himachal Pradesh	1 (28)	0	0.0258 (28)
Jharkhand	12.35 (4)	9.09 (14)	0.5607 (8)
Karnataka	4 (26)	2.94 (22)	0.1814 (22)
Kerala	7.86 (19)	14.3 (4)	0.5607 (9)
Madhya Pradesh	9.13 (13)	11.76 (7)	0.5484 (12)
Maharashtra	8.33 (15)	0	0.0745 (24)
Manipur	8.33 (16)	0	0.0745 (25)
Meghalaya	5.08 (22)	8.33 (15)	0.3442 (19)
Mizoram	0 (29)	0	0.01 (29)
Nagaland	3 (27)	8.33 (15)	0.2645 (21)
Odisha	8.9 (14)	23.8 (1)	0.7702 (2)
Punjab	11.11 (9)	6.25 (19)	0.4410 (15)
Rajasthan	12 (5)	10 (11)	0.5797 (7)
Sikkim	9.38 (12)	0	0.0790 (23)
Tamil Nadu	5.13 (21)	5.71 (21)	0.2864 (20)
Telangana	5.04 (23)	11.76 (7)	0.4074 (17)
Tripura	15 (1)	11.11 (9)	0.6832 (3)
Uttar Pradesh	11.66 (6)	9.61 (13)	0.5602 (10)
Uttarakhand	11.43 (7)	11.11 (9)	0.5964 (5)
West Bengal	13.7 (3)	18.6 (2)	0.8448 (1)
India	8.9	9.21	-

Source: Government websites of respective states.

An analysis of Table 6 reveals that all the states have performed poorly in terms of women's participation in politics. In the 'Percentage of elected women over total seats' in their respective state assemblies, the best among the worst states were Tripura with 15 per cent, Chhattisgarh with 14.44 per cent, and West Bengal with 13.7 per cent. Notably, in almost all states, women accounted for less than 10 per cent of members in the legislative assemblies. The situation is even worse in the 'Proportion of women in the council of ministers' in each state assembly. Odisha leads with 23.8 per cent of its councils composed of women ministers, followed by West Bengal with 18.6 per cent. In many states, women's representation in the council of ministers falls below 10 per cent, with seven states, including Maharashtra, having no women ministers in their respective state councils of ministers. In the combined value representing the political empowerment index, West Bengal holds the top position, followed by Odisha and Tripura. The states in the bottom three positions are Arunachal Pradesh, Himachal Pradesh, and Mizoram.

These findings underscore the urgent need for targeted interventions to enhance women's political participation and representation in India. By addressing the underlying barriers and fostering a more inclusive political landscape, we can pave the way for a society that truly values and respects women's voices and contributions.

G. Composite Gender Inequality Index (GII)

To capture the pervasiveness of gender inequality across the socio-economic spectrum of the Indian states, the index values derived from each of the six dimensions were combined to construct the composite Gender Inequality Index (GII), as presented in the Table 7.

Table 7: Composite Gender Inequality Index (GII) among the States of India

States	Health and Nutrition Index	Education Index	ICT index	Household Empowerment index	Economic Participation Index	Political Participation Index	Composite index
	In_1	In_2	In_3	In_4	In_5	In_6	GII
Andhra Pradesh	0.545 (11)	0.541 (14)	0.091 (29)	0.416 (26)	0.530 (10)	0.587 (6)	0.3903 (18)
Arunachal Pradesh	0.601 (7)	0.481 (17)	0.636 (7)	0.536 (18)	0.630 (3)	0.057 (27)	0.3914 (17)
Assam	0.478 (17)	0.352 (22)	0.314 (17)	0.532 (19)	0.361 (21)	0.408 (16)	0.4012 (15)
Bihar	0.382 (25)	0.116 (29)	0.114 (28)	0.318 (28)	0.228 (26)	0.538 (13)	0.2419 (29)
Chhattisgarh	0.540 (12)	0.417 (19)	0.130 (26)	0.705 (11)	0.356 (22)	0.557 (11)	0.4004 (16)
Delhi	0.618 (4)	0.807 (2)	0.689 (5)	0.662 (13)	0.157 (29)	0.675 (4)	0.5384 (3)
Goa	0.696 (3)	0.710 (7)	0.928 (2)	0.848 (5)	0.315 (24)	0.070 (26)	0.4536 (11)
Gujarat	0.406 (23)	0.307 (26)	0.229 (20)	0.767 (7)	0.348 (23)	0.374 (18)	0.3769 (21)
Haryana	0.474 (18)	0.505 (15)	0.407 (14)	0.617 (14)	0.394 (17)	0.447 (14)	0.4691 (9)
Himachal Pradesh	0.360 (27)	0.771 (4)	0.627 (8)	0.866 (3)	0.508 (11)	0.025 (28)	0.3545 (25)
Jharkhand	0.383 (24)	0.195 (28)	0.244 (19)	0.522 (21)	0.570 (6)	0.560 (8)	0.3811 (19)
Karnataka	0.610 (5)	0.596 (11)	0.341 (16)	0.186 (29)	0.555 (7)	0.181 (22)	0.3645 (24)
Kerala	0.713 (2)	0.953 (1)	0.777 (4)	0.853 (4)	0.473 (12)	0.560 (9)	0.7023 (1)
Madhya Pradesh	0.347 (28)	0.348 (23)	0.116 (27)	0.477 (22)	0.381 (20)	0.548 (12)	0.3348 (26)
Maharashtra	0.522 (14)	0.556 (13)	0.359 (15)	0.587 (15)	0.252 (25)	0.074 (24)	0.3239 (27)
Manipur	0.524 (13)	0.602 (10)	0.480 (12)	0.423 (24)	0.532 (9)	0.074 (25)	0.3695 (23)
Meghalaya	0.414 (22)	0.714 (6)	0.491 (11)	0.747 (8)	0.624 (4)	0.344 (19)	0.5349 (4)
Mizoram	0.374 (26)	0.643 (9)	0.820 (3)	0.937 (2)	0.409 (15)	0.01 (29)	0.3021 (28)

States	Health and Nutrition Index	Education Index	ICT index	Household Empowerment index	Economic Participation Index	Political Participation Index	Composite index
	In_1	In_2	In_3	In_4	In_5	In_6	GII
Nagaland	0.472 (19)	0.376 (20)	0.666 (6)	1 (1)	0.399 (16)	0.264 (21)	0.4823 (7)
Odisha	0.470 (20)	0.345 (24)	0.173 (24)	0.523 (20)	0.415 (14)	0.770 (2)	0.4097 (13)
Punjab	0.560 (10)	0.592 (12)	0.536 (10)	0.775 (6)	0.535 (8)	0.441 (15)	0.5652 (2)
Rajasthan	0.511 (15)	0.200 (27)	0.296 (18)	0.556 (16)	0.459 (13)	0.579 (7)	0.4064 (14)
Sikkim	0.744 (1)	0.732 (5)	0.984 (1)	0.730 (9)	0.747 (1)	0.079 (23)	0.5339 (5)
Tamil Nadu	0.585 (9)	0.790 (3)	0.546 (9)	0.433 (23)	0.587 (5)	0.286 (20)	0.5139 (6)
Telangana	0.595 (8)	0.431 (18)	0.197 (23)	0.380 (27)	0.693 (2)	0.407 (17)	0.4196 (12)
Tripura	0.507 (16)	0.330 (25)	0.167 (25)	0.663 (12)	0.226 (28)	0.683 (3)	0.3772 (20)
Uttarakhand	0.610 (6)	0.673 (8)	0.212 (21)	0.419 (25)	0.391 (18)	0.560 (10)	0.4552 (10)
Uttar Pradesh	0.451 (21)	0.371 (21)	0.426 (13)	0.729 (10)	0.383 (19)	0.596 (5)	0.4702 (8)
West Bengal	0.246 (29)	0.496 (16)	0.206 (22)	0.548 (17)	0.228 (27)	0.844 (1)	0.3723 (22)

Source: Calculated from the above tables.

It can be discernible from Table 7 that among all the Indian states, Kerala emerged as the top performer with the GII value of 0.7023, indicating lowest gender inequality. This remarkable achievement can be attributed to its first and second place in the 'education' and 'health and nutrition' indices respectively, coupled with its fourth place in the 'ICT' along with 'household empowerment' indices. Only in 'economic participation' index, does Kerala fall under the 'average performer' category. In all other dimensions, the state was in the 'better performer' category, which is commendable.

The subsequent positions in the composite GII were occupied by Punjab, Delhi, Meghalaya, Sikkim, and Tamil Nadu. While Punjab did not secure a top-five ranking in any of the six dimensions, it has achieved second place due to its consistent performance across all dimensions, consistently falling under either the 'better performers' or 'average performers' category. In fact, apart from Kerala, Punjab is the only state that is not categorized as a 'below average performer' in any of the six dimensions.

Regarding Delhi, despite securing the last position in the economic participation index, it has managed to rank among the top five positions in four out of six dimensions, propelling the state to the third place in the composite GII among all states.

On the other hand, the states that occupied the bottom five positions in the composite GII were Himachal Pradesh, Madhya Pradesh, Maharashtra, Mizoram, and Bihar. It was concerning to observe an economically large state like

Maharashtra ranked third-last in terms of gender inequality. Notably, Maharashtra did not achieve 'better performer' status in any of the six dimensions, with its best performance being a 13th rank in the 'education index'. With regard to Mizoram, despite securing 'better performer' status in three of the six dimensions, its poor performance in the 'health and nutrition' and 'political participation' indices resulted in a second-last position for the state.

Among all the Indian states, the one that has secured the last position, indicating the prevalence of the highest level of gender inequality, is Bihar, with a Gender Inequality Index (GII) value of 0.2419. The state fell into the 'below average' category in five out of six dimensions, with dismal rankings across all dimensions, highlighting the stark inequality and dire situation of women in the state. These values underscore the fact that India still has a long way to go in achieving gender equality across the socio-economic and political spheres of society.

IV Conclusion and Way Forward

In India, the exploitation and oppression of women are age-old phenomena deeply rooted in its culture and history, that transcends generations and permeates all spheres of life and societal strata. As evidenced by the preceding analysis, this discrimination is not only blatantly evident in health, education, and household empowerment indicators but also in the recently developed ICT indicators, highlighting the persistence of gender inequality in Indian society. Notably, states such as Bihar, Gujarat, Jharkhand, Madhya Pradesh, Odisha, Tripura, and West Bengal fell into the "below average" category in three or more of the six dimensions analyzed, reflecting the widespread prevalence of gender inequality across the socio-economic landscape. This pervasive disparity necessitates a multi-sectoral, holistic approach to uplift women in these states.

Furthermore, it is disconcerting to observe that some of the larger states, such as Maharashtra, Karnataka, Gujarat, and Andhra Pradesh, which occupy prominent positions in the country's economic landscape, rank among the lowest in the Gender Inequality Index. This suggests that improved economic conditions do not necessarily translate into women's empowerment in society. Therefore, addressing gender discrimination, which pervades every aspect of society, necessitates a fundamental shift in societal attitudes, moving away from the perception of women as inferior and towards parity with men in all spheres of life.

Accordingly, achieving the goal of gender equality necessitates concerted government action through the formulation of policies and programs specifically designed to empower women. While numerous initiatives aimed at women's empowerment have been implemented by both the central and state governments, the preceding analysis, based on the data from government reports, indicates that the benefits of these programs have not materialized adequately, leaving women persistently marginalized and denied equal opportunities. In this context, the researcher posits that an improvement in gender equality can be achieved by

increasing the women's representation in government and administrative positions, which would serve to establish a pipeline for the upliftment of other women in society. This can be accomplished through legal measures such as the enactment of the long-pending 33 per cent women's reservation bill and implementing it in the forthcoming parliament and actual state elections. Additionally, it can be made mandatory to employ a certain percentage (plausibly from 35 to 40 per cent) of women in all public and private organizations across the country. Further, a massive public action program could be undertaken to increase female literacy rates from school to higher education in all states of the nation. These actions could contribute to raising awareness and creating opportunities for women in socio-economic and political spheres, paving the way for achieving the goal of gender equality in the country. Finally, it is crucial to recognize that empowering women and treating them on par with men is not an additional privilege but rather a fundamental human right and a prerequisite for a peaceful and prosperous world.

Endnotes

[1.] 'Missing women mystery' indicates a shortfall in the number of women relative to the expected number of women in a region or country.

[2.] Refers to women/men who completed standard 9 or higher and women/men who can read a whole sentence or part of a sentence.

[3.] Decisions about health care for herself, making major household purchases, and visits to her family or relatives.

[4.] Spousal violence is defined as physical and/or sexual violence.

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Appendix

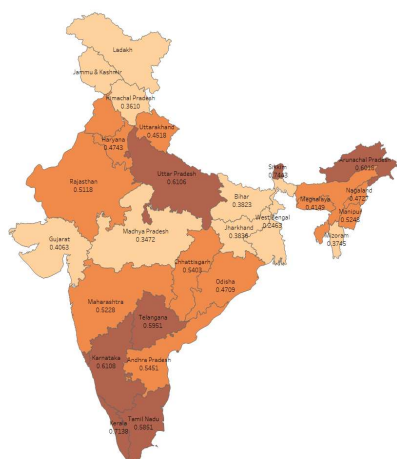### Figure 1: Health and Nutrition Index
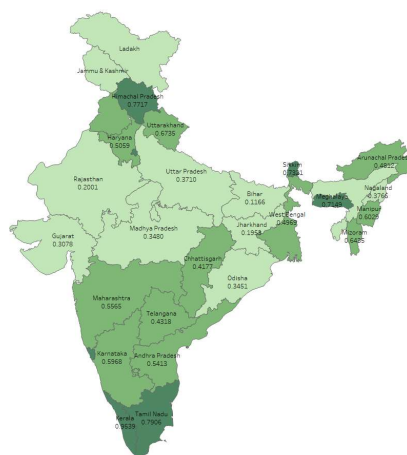

Figure 2: Education Index
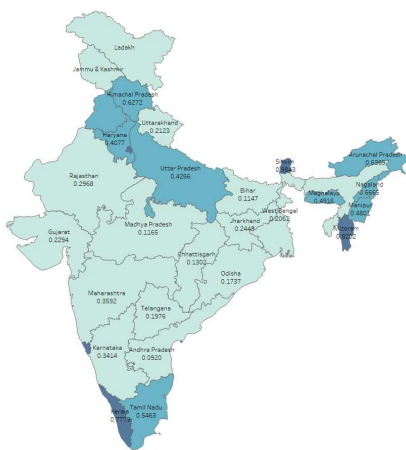

Figure 3: ICT Index

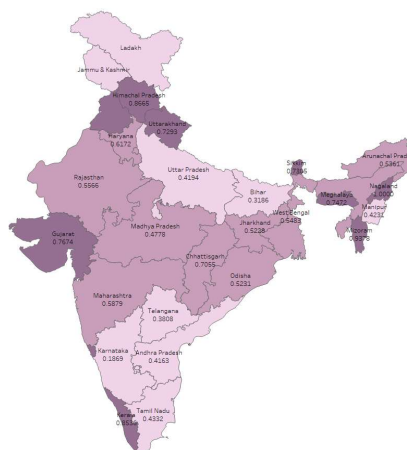### Figure 4: Household Empowerment Index

Figure 5: Economic Participation Index
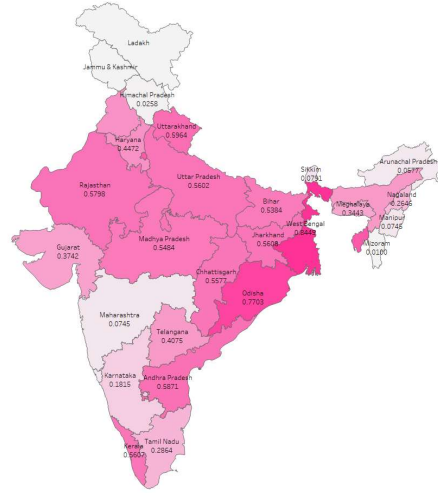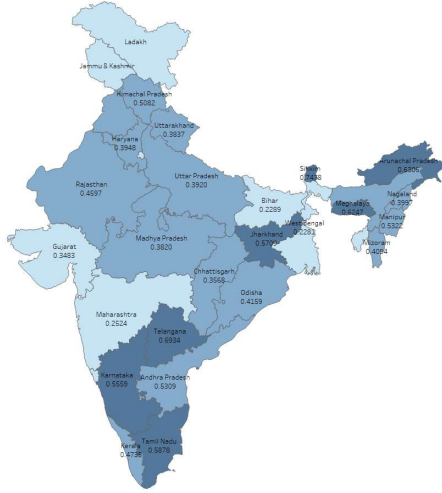
Figure 6: Political Participation Index

Figure 7: Composite Gender Inequality Index (GII)

Source: Based on computed results from above Tables.

Performance of the Industrial Sector in North-East India: Evidence Using Wroclaw Taxonomic Technique

Saurish Bhattacharjee and Mridusmita Patowary

Industrial Development has been a major area of interest among the policy makers throughout the world. This paper explores the status of Industrial Development in North-East (NE) India and examines the disparity in Industrial Development among the North-Eastern States by constructing Industrial Development Index (IDI) using Wroclaw Taxonomic Technique based on the notion of growth pole. The study is conducted at two time points 2007-08 and 2017-18. The study used nine industry indicators and concluded by ranking the states. The result indicates that industrial disparity is persistent among the North-Eastern States. Assam and Sikkim are found to be comparatively more developed than the other states taken under consideration. None of the states are categorized as highly developed and Manipur was found to be industrially less developed. The paper also recommends policies to reduce the disparity and promote industrialization in the North-Eastern region which is unexplored compared to the other parts of the country focusing on its ties with the South-Asian Nations.

Keywords: Growth Pole, Industrial Development, Industrial Disparity, Industrial Development Index, North-East India

I Introduction

Developing a regional growth strategy that is both balanced and sustainable is the primary objective of all nations in the world. Policymakers try to strike a balance in economic growth across the board to reduce inter-regional disparities. Regional disparity can be defined as a discrepancy or asymmetry in the living standards of people in various portions of a region. The impact of this regional discrepancy on an economy's ability to flourish has pushed the government to take action to promote balanced regional growth (Kumar and Rani 2019). According to Kuznets (1955), disparity or inequality rises in the early phases of development and declines as the economy matures. Myrdal (1956), Hirschman (1958), etc., emphasized the role of the state to reduce the level of disparity. The World Development Report (2006) placed particular emphasis on the issue of inequality of opportunity, which lowers the incentive to work and thereby employment,

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the degree of wellbeing, and negatively impacts economic growth. When equality is achieved, poverty decreases, inclusive growth intensifies, and the door to sustainable development gets unlocked.

Any region's industrial growth is influenced by environmental, physical, topographical, and monetary variables. In many nations around the world, the issue of regional imbalance in industrial development is a major issue of concern (Williamson 1986). Strong backward links result from autonomous industrialization, which strengthens the markets for the region's primary products. It is also inextricably linked to the construction of numerous sorts of infrastructural facilities throughout the region. It relieves the agricultural sector of disguised unemployment by absorbing excess labour in the region and boosting agricultural productivity (Dholakia 1989). After independence, the government of India has launched various policies since the inception of planning for attaining a balanced regional development. Before independence, the primary sector contributed the most to Gross Domestic Product (GDP) with the primary occupation employing the largest percentage of the workforce. However, even though the primary sector employed most of the workforce, its percentage of contribution decreased over time. The contribution of the secondary and service sectors has increased since the New Economic Policy (NEP) of 1991. India's industrial sector accounts for nearly a quarter of the country's GDP.

The word "industry" by itself is frequently used to refer to manufacturing. An enterprise that produces goods in an organised way is referred to as "industry." The process of turning raw materials into those that are useful for economic activity is frequently referred to as manufacturing. It is occasionally regarded as a category of businesses that are distinct from those in agriculture, mining, and other industries because they are homogenous in nature. The degree of industrialisation has an impact on the region's trade, business, socioeconomic, and cultural environment. All forms of productive businesses—divisible into primary, secondary, and tertiary industries—are referred to as industries in economics. Fishing, mining, forestry, and other activities belong under the primary sector, whereas manufacturing and services are considered to be part of the secondary industry. However, manufacturing of goods is included in industry generally. The data has been gathered in accordance with the fact that the term "industry" will be used in this article to refer specifically to manufacturing activity.

In India, regional disparities in socioeconomic development and intra-regional disparities among the various regions have been a major reason for concern (Kurian 2000). According to Kurian (2007), those who are socially and economically excluded always remain so. There has been wide disparity in the sphere of socio-economic development across the country even after the 75th year of independence. India is the most inequal country according to World Inequality Report (2022). The goal of achieving balanced regional development has been emphasized from the beginning of planning. Despite this, continuing inequity is seen even after the new economic reforms of 1991. In addition to other factors

contributing to growing inequality, the discrepancy in industrial development could worsen the situation.

The policies relating to industries throughout the British period were primarily implemented for their personal benefit. However, the politicians and businessmen from India placed adequate emphasis on the problems with industrial growth. India's manufacturing sector grew by about 15 per cent from 1950 to 1990, and following the economic reforms of 1991, that number jumped to 30 per cent (Awasthi 2014). The country's quick industrialization was emphasised in the Second five-year plan, which ran from 1956 to 1961. The Third five-year plan, undertook the concept of balanced development across the country to promote industrialisation across the country. Unlike in the case of wealthy nations, not all of the States have benefited from the economic changes implemented in 1991 since the growth effect has not trickled down to many States, particularly the North-Eastern States of India and consequently led to widened inequality across the States of the country (Sharma and Khosla 2013).

North-East India comprises eight States, namely Arunachal Pradesh, Assam, Manipur, Nagaland, Tripura, Meghalaya, Mizoram, and Sikkim, connected to the rest of the nation through a narrow corridor called the Siliguri Corridor. The region accounts for 7.9 per cent of the State's total geographical area and shares an international border with Nepal, Bhutan, China, Myanmar, and Bangladesh. The North-Eastern States' industries historically centred mostly on extraction processes, with a stronger emphasis on tea and oil. Assam's plains were mostly used for tea plantations. Colonial capitalists controlled the entire modern manufacturing sector of the State. This sector was mostly dominated by the production of plywood and other forest resources, aside from tea and oil. The railroad served as the primary means of transportation for the products of these industries. However, once the State gained independence in 1947, industrialization in that region dwindled. The only route via which the area was connected to the rest of the country after partition was the narrow 'Siliguri Corridor'. Regulatory hurdles were reduced to motivate the investor to invest in the area. Assam, which once had its primary industry, has since become a peripheral region. The post-colonial Indian State didn't foresee any significant policies to change the core-periphery situation with an industrial base in Assam. Following independence, political considerations started to influence the choice of where to locate large industrial facilities. Without any policy for market connection, the indigenous economies and industries spread across the hills and plains of the North Eastern Region and managed to survive in seclusion. As a result, the central government began to pay more attention to the expansion of the sector and the promotion of regional economic growth. The newly constituted industrial entities were given some financial leniencies by the national government (Sarma and Bezbaruah 2009). Capacity building is a critical component of the region's overall development, and the North Eastern Council (NEC) supports the NE states in this endeavour. The government gave due importance to the development of the region

in the eighth plan period. The North-Eastern Council (NEC) was set up to cater to the development needs of the region in the year 1972.

The region is one of the biodiversity hotspots and largely relies upon the agricultural sector. However, the industrial and other policies were taken up to reduce the imbalance between the agricultural and non-agricultural sector which was created in the post-independence period. A lot of research has been conducted in the industrialisation scenario of the country as well as other comparatively developed States. However, little attention has been paid to the industrialisation aspect in the North-Eastern States of India. For a variety of reasons, the North-Eastern region of the country has remained the least explored. Additionally, there is a dearth of literature on the industrial growth situation in India's north-eastern region. On the issue of NER's backwardness and a comparison of the comparatively developed states' economies with the North Eastern economy, literature is available. There is, however, little research on the comparative evaluation of North-Eastern States' industrial sector development and the strengths and weaknesses of the local industry base. In light of this, the current study's goal is to examine the disparities in the growth of the industrial sector among India's North-Eastern States.

II Reviewed Literature

The literature review section has been divided into two parts. The first part deals with the theoretical literature. In the past few decades, the terms growth spots or growth poles have been gaining importance. Growth poles are defined as centres of coordinated and simultaneous investment across multiple sectors, aimed at driving industrialization within a country and fostering a self-sustaining economic environment. The main theme of the growth pole is that regional economic growth is not consistent. The development of related sectors typically centres on a single pole that is characterised by a core industry. This important sector involves work, output, investments, etc. The growth poles are defined by Perroux (1950) in relation to specific economic space without establishing any relation to geonomics' or geographic space which he dismissed in the year 1950 as hackneyed. According to Perroux, growth is not uniform across regions and it takes place around a specific cluster or pole. These poles consist of core industries. Around these industries, there are linked industries which grow directly or indirectly in relation to the core industries. An Industry is said to be propulsive if it has high interrelation with various other firms along with greater degree of dominance and capacity or size and the growth of these lead industries is dominated by the scalar changes in output. The firms which are being dominated by the propulsive firm are called 'mute' which is a fundamental issue of growth pole notion. By assessing the effect of the steel smelting sector on the economy of the Brazilian province of Minas Gerais, an empirical analysis of the ideas of growth poles and the location of geographic space is made. In the contemporary world, the theory of growth pole is a crucial determinant of strategic planning,

development issues etc. The fundamental assumption of growth pole theory is that the core industries create multiplying effect on other firms that depend on economic opportunities. Creation of links between the industries of the pole is another critical assumption. These links can be forward link or backward link to the core industry. Unlike the other economic growth theories, the Growth Pole theory contributes towards the process of structural transformation which takes place in the economies due to the rise or decline of the industries.

Growth poles promote a nation's sustained industrialization. These investments are coordinated and made at the same time in several sectors; they are not the same as Special Economic Zones (SEZs), which are geographically defined regions of an economy. Through the mechanism of inter-industry linkage, the dominating industries encourage growth in the neighbouring industries. Growth poles are investment strategies that are spatially oriented and help a region's economy grow more quickly. Growth pole is a tool created for planning the development process that is connected to economies of agglomeration and geographic concentration of economic activity (Gavrilă-Paven and Bele 2017). The growth poles are thought to be a more effective instrument for reducing inequality and improving the linkages between the political economy and the physical environment. Such development poles can be created with the aid of a fruitful public-private partnership model (PPP).

When economic activities are studied in terms of their geography, it is called economic geography. The manufacturing or the industry sector is the core of economic geography. The distribution of industries among states or regions can be studied using one of two methods under the industrial geography approach. The first one focused on how a manufacturing industry was distributed across the state, and the second one examined how a manufacturing industry was distributed within a given area, such as a state or region. Since every industry has a locational advantage, generalisations drawn for one industry may not apply to some other industries. Consequently, a synthetic method can occasionally be useful (Mankar 2012). The New economic geography of Krugman (1991) views economic geography as the location of production in space which also encompasses the phenomenon of agglomeration associated with increasing returns. A prominent alternative of the New Economic Geography (NEG) is the number of workers available in the location. High Skilled areas generally attract greater share of workers which is also termed as agglomeration (Head and Meyer 2004). Information exchange is a new problem in new economic geography. This partly reflects where information technology is made and partly reflects how information technology (IT) has affected the distribution of other economic activity. IT consists of computer and communication technologies, among others. The abilities required for specific activities and the places where they are best accomplished are always changing due to new IT (Sheppard 2001). Regional economic development has benefited greatly from the work of New Economic Geography. It includes conventional thoughts regarding various fields, including urban economics, economic location theory, science associated with regions, etc. The

competitive advantage of national and regional economic development is explained using spatial agglomeration. (Fengru and Guitang 2019). Hirschman (1958), Singer (1958), Streeten (1959), Fleming (1955), etc., in the theory of Unbalanced growth for promoting development by unbalancing the economy. The balanced growth hypothesis proposed by economist Ragnar Nurkse hypothesises that in order to promote a balanced regional growth, the government of the underdeveloped or developing nations needs to make sufficient investment to the industrial sector. The present study on this backdrop tries to analyse the disparity among the north eastern states of India considering various indicators and tries to find out the forward and backward states based on the growth pole notion. The second part of this section deals with empirical literaturesurveyed in the Indian context and its States. Lahiri (1969) utilised simple measures to analyse the variances between the States in the context of industrial growth in his work titled 'Some Aspects of Inter-State Disparity in Industrial Development in India: 1956-65.' Nayyar (1978) aims to examine the factors that contribute to India's industrial sector's slow growth. Analytical and descriptive approaches were used in the investigation. The study discovered that long-term issues are not the causes of industrial stagnation. The study examines the causes of the market slowdown in industrial growth, which was the cause of the country's apparent stagnation. This paper also examines the trends in industrial growth and the connections between income inequality, demand, and industrial expansion. Goswami (1981) investigated the industrialisation scenario of the state of Assam by placing focus on three important industries namely tea, oil refining and plywood. A cumulative process of rising income, labour productivity and employment, leading to diversification of output, can be viewed as industrialisation which leads to diversification in the economy. Dadibhavi (1987) attempted to investigate the relationship between per capita income and industrial structure at the national and regional levels, taking into account the years 1950–1951 through 1980–1981 in her analysis. The study's findings indicate that from 1950–1951 to 1980–1981 there was a considerable change in the industrial structure. The study's findings are consistent with those of Colin Clark (1940) and Kuznets (1957). Additionally, the sectoral hypothesis was proven to be unreliable in the study. According to the study, the industrial structure and productivity conditions were favourable in the high-income States of Punjab, Maharashtra, West Bengal, and Gujarat, but unfavourable in the low-income States of Uttar Pradesh, Madhya Pradesh, Orissa, Bihar, and Kerela. In their paper, 'Rural Industrial Development: To Cluster or Not to Cluster?' Barkley and Henry (1997) concentrated on the current state of industrial strategy. The study focused on the various benefits and drawbacks of industrial clustering for various American industries. The study discovered tighter external economies, a better and more practical industrial reorganisation, a better system for connecting businesses, effective use of public resources, etc. were some of the benefits of industrial clustering. The research also revealed the drawbacks of industrial clustering, including the fact that just a few industries are targeted. The study discovered that the industrial clustering policy is not relevant in the

majority of rural communities. Bhattacharya and Sakthivel (2004) aim to answer the question whether growth rates of the major states actually improved. Considering both total and sectoral domestic product in the decades before and after reforms in India, the findings of the study indicate that in the post-reform decades, there had been marginal improvement in the growth rate of GDP. Regional variations in State Domestic Product (SDP) have widened further significantly. The results of the study also indicate that industrial States were growing faster than the backward States and the growth rates among these States shows no converging trends. The results also show that population growth and SDP growth are inversely related. Trivedi (2004) made an effort to study the inter-state industrial performance in India while taking the years 1980–1981 and 2000–2001 into account. Only 10 Indian States were considered for the analysis in the study. The study's conclusions support the existence of disparities in productivity and growth among India's States. The study discovered that States like Bihar and West Bengal were deviating from the national average in terms of the output growth rates of the organised manufacturing sector. BIMARU States, on the other hand, such as Madhya Pradesh and Rajasthan, were better performers in this context, showing a positive insight of these States to uplift themselves from the status of economic backwardness. Pansewan and Routray (2011) examine the industrial development pattern in Thailand considering the time period from 1996 to 2005. Composite indices were developed to examine the industrial development pattern. The results of the study show that industries are mostly concentrated in Bangkok, while the rural areas are not able to agglomerate and expand in industrial prospects even when the government had taken policies to bolster up and evolve the provincial industrial areas. The study also found that in urban areas, most of the capital-intensive industries are concentrated while resource-based industries were concentrated in the remote rural areas. Papola, Maurya and Jena (2011) in their work on "Structural Changes, Industry and Employment in the Indian Economy" found that the industrialisation extent has declined between the States during the period 1981-2009. A significant shift from agriculture to other sectors was visible for almost all Indian States. Structural change leads to faster growth in Gross States Domestic Product (GSDP) and more in case of shift from agriculture sector to manufacturing sector than shift in the service sector. Increasing divergence was also witnessed with industrial growth during the end period of the study. A high degree of correlation was found between the organised and unorganised sectors. Productivity across the States was found to have wide variations to a greater degree across the organised sector than the unorganised sector. Mankar (2012) conducted a study on industrial development in Ratnagiri district of Maharashtra. The basic objective of the study was to analyze the industrial development of Maharashtra as a whole and Ratnagiri district in particular, based on an industrial geographic approach. The study used the minimum standard deviation method introduced by Weaver (1952) to describe the industrial combination region. Moreover, in order to study the concentration of small-scale Industries, the study employed the method by Bhatia (1964) to

calculate the quotient of the location. The study concluded that in the Ratnagiri district, the village and the cottage industries have become a significant source of strengthening the rural economy. Moreover, the study found that due to government efforts, industrial development has shown an upward trend. The small-scale industry concentration index, the SSIs are mostly concentrated in the Mandangad Tahsil of the district. Sharma and Khosla (2013) analysed the extent and magnitude of regional disparities considering the time period 1980-1981 to 2009-2010 focusing on the industrial economy. Discriminant function approach was used in the study to examine the extent and magnitude of the industrial sector. The study found the existence of wide industrial disparities across India. The study reveals that both productivity and physical measures were the factors responsible for increasing regional imbalances during the post-reform period. The recent inclusion of several States on the list of developed ones, suggests that there are favourable conditions for the industrialisation of any State in the nation, so long as State governments set up effective industrial policy. Sharma (2017) carried out an investigation on manufacturing sector disparities in some selected Indian States. The study shows that regional disparities in overall economic growth and development are exacerbated by uneven economic growth. By examining labour productivity, value added, and employment in the manufacturing sector from 2001–2002 to 2013–2014, the paper assesses the performance of the manufacturing industry in the Indian States. Two states were chosen for the study. The findings indicate that still there is inequality between the States, but it is on the decline. Bhattacharjee and Bhattacharya (2018) investigated the North-Eastern economy's industrial environment during and after colonialism. The impact of industrial policy in North East India is examined in the article. The study used secondary data and was conducted during the years of 2004–2005 and 2014–2015. The research demonstrates that the organised sector in North East India has made tremendous progress since the post-industrial policy. To achieve this, the area must develop an industrial base that is appropriate for its topography and environment. In a hill-plain perspective between Assam and the other North-Eastern states, this article highlights several policy challenges. Kumar and Rani (2019) conducted a study on the disparities in socioeconomic development between India's 28 states and seven union territories. In order to create the composite index for the study, 12 social factors were gathered based on the 2011 census data. The composite index was built using the Wroclaw Taxonomic Technique in the study. The research demonstrates that India has a split in social development between the north and the south. According to the research, Kerala has experienced the greatest level of social growth among all the Indian States. For the purpose of comparing the States, they also used HDI values. A study conducted by Kumar and Pattnaik (2020) aims to examine the differences in employment intensity between 18 major Indian states from 1980–1981 to 2013–2014. The study makes use of a variety of statistical methods, including estimation of growth rates and employment elasticity. Arc elasticity was also assessed in the study by dividing the percentage change in employment by the percentage change in output.

Additionally, point elasticity was used in the investigation. The decomposition result demonstrates that there is a significant gap in industrial development amongst Indian states, which is primarily due to labour productivity. Among the eight industrial states of North East India only Assam has been included in the study.

From the literature review it can be found that only few studies were done on disparity in Industrial development in India by constructing a composite index and very less studies were found in the context of North-East India. Focusing on the research gap, the present paper seeks to analyse the inter-state disparities of Industrial development among the eight North-Eastern States of India by constructing a composite index using the Wroclaw Taxonomic Technique.

III Data and Methodology

The present study is based on secondary data which are being collected from the Reserve Bank of India, Handbook of Statistics on Indian States, RBI, (2020-2021), Indiastat and NEDFi data bank. Gross State Domestic Product (GSDP) at factor cost -Industry of the NE States over the period 2007-2008 to 2017-2018 was collected to give a glimpse of the industrial sector's contribution to GSDP. The GSDP for the industry sector has been collected for two base years, i.e., 2004-2005 and 2011-2012. For the sake of computational simplicity, the data has been converted to 2011-2012 base years by using the simple splicing technique. To assess the variations in industrial development among the North-Eastern (NE) States, two-time points were selected at an interval of 10 years, i.e., 2007-2008 and 2017-2018 on the basis of data availability constraint. In this study, seven North-Eastern States, viz., Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Sikkim, and Tripura were considered. The data for all the indicators were not found for the State of Mizoram. As a result, for the purpose of examining variations in industrial development among the NE States, Mizoram was excluded in the present study due to the unavailability of data on industry. Due to lack of accurate data, a total of nine indicators were selected on the basis of uniformity for the seven states for analysis which are mentioned below:
1. Number of factories per 1/10 million population
2. Number of factories per 1000 sq. km
3. Invested capital per 1/10 million population
4. Invested capital per 100 sq. km
5. Total emoluments per 1/10 million population
6. Value of gross output
7. Net fixed capital formation
8. Physical working capital to total invested capital
9. Number of workers employed in industries

To give a comprehensive picture of industrial development, composite indices were constructed using Wroclaw Taxonomic technique developed by Florek, Lukaszewicz, Perkal and Zubrzycki (1952). Studies such as Bhatia and Rai

(2004), Narin, Bhatiaand Rai, (2012), Ohlan (2013), Kumar (2016), Kumar and Rai (2019), etc., have used this method to calculate the composite index. Below is a description of the Wroclaw Taxonomic technique:

Step 1: Since a few indicators with varying measurement units are selected, the indicators were normalized using the following formula-

$$[Z_{ij}] = \frac{X_{ij} - \overline{X_J}}{s_j} \qquad \ldots(1)$$

Step 2: From *[Z_{ij}]*, we chose the best or optimal value for each indicator and compute the pattern of development *[P_{ij}]*

$$P_{ij} = (Z_{ij} - Z_{0j})^2 \qquad \ldots(2)$$

Step 3: Computing the development pattern (C_i)-

$$C_i = \left[\sum_{i=1}^{k} {Pij}/{(CV)j} \right]^{1/2} \qquad \ldots(3)$$

Where, *$(CV)_j$* = Coefficient of variation of X_{ij} for j^{th} indicators.

Step 4: Lastly, the composite index of development is computed as-

$$D_i = C_i/C \qquad \ldots(4)$$

Where, $C = \overline{C} + 3s_i$
Where $\overline{C}$ = mean of C_i and s_i = Standard deviation of C_i.

The composite index lies in between 0 and 1. Composite index nearer to 0 implies a more developed State and nearer to 1 implies less developed State.

Based on the composite index (CI) developed, the States are classified into different development levels:

Highly Developed State: CI ≤ (Mean-Standard Deviation)

Medium Developed State: (Mean-Standard Deviation) ≤ CI≤ Mean

Developing State: Mean≤ CI≤ (Mean+ Standard Deviation)

Low Developed State: CI≥ (Mean+ Standard Deviation)

IV Findings and Discussion

The industry sector in India contributes around 25 per cent to the Gross Domestic Product (GDP) of the nation. The Compound Annual Growth Rate (CAGR) of Gross State Value Added (GSVA) has been calculated for all the States which is regarded to be an accurate measure for the policymakers to undertake sector specific policies and to get a picture of the development scenario of the North-Eastern States shown in Table 1. In India, the NER is the least industrialized and the industry sector has yet to reach its optimal stage. The share of industry to the income of each state of the region often reduces below 15 per cent (Dikshit and Dikshit 2014). With an area of 83,743 sq. miles, Arunachal Pradesh is the largest of the eight states in India's North-Eastern region. The State has enormous mineral potential, but its economy is mostly agrarian in character, based on the terraced farming of rice and the cultivation of other crops including pulses, sugarcane, rice, ginger, oil seeds, cereals, etc. The GSDP of Arunachal Pradesh was $2,824.89 in the year 2021–2022. To encourage industrialization in Arunachal Pradesh, the central government has authorised the North East Industrial Development Scheme (2017) and stressed on the use of artificial intelligence in the industrial development. Meghalaya was an agrarian economy with more than 70 per cent of the population living on agriculture. There has been a sizeable transition from agriculture to the industrial sector in order to build an industrial base. The development of the industrial sector and the State's GSDP have been significantly aided by the industry and mining sectors. The focus area of industrial growth comprises handloom and handicrafts, agro-products, crops processing and planting, Electronic and Information technology, tourism, fishing, spices, oil, meat processing etc. In Meghalaya, the department of Commerce and Industries is tasked for overall development of the industrial scenario of the state which was established in the year 1971. Manipur, the eastern gateway to India connects the region to the rest of the nation through Moreh town. In Manipur, there are forests covering more than 70 per cent of the land. The State borders Nagaland, Mizoram, and the Cachar region of Assam, with bamboo, lumber, and firewood among its main industries and the state shares international border with Myanmar. Manipur has historically been an agrarian state with opportunities for commercial horticultural plantation. Developed industries like handloom and handicrafts contribute significantly to the State's Gross State Domestic Product (GSDP). There are 34,315 Micro, Small, and Medium-Sized Enterprises in 2017 (MSME). To promote industrial development and accelerating economic growth in the State, the State has developed the Industrial and Investment Promotion Policy (IIPPM)-2022. The Zoram Industrial Development Corporation (ZIDCO) is in charge of developing the state's industrial infrastructure as a whole in Mizoram. Five of the eight industrial estates are currently in use, with the other two still being constructed in Mizoram (IBEF 2022). One of North-East India's main economies, Tripura, is well known for its rubber industry. In addition, it is abundant in natural resources including gas, tea, medicinal plants, etc. Under the 2017 Tripura

Industrial Investment Promotion Incentive plan, the State of Tripura has a variety of enterprises. The government has also taken action to build trade routes, improve rail and aviation connectivity, and enhance infrastructure. (Government of Tripura 2022) The climate of Nagaland is favourable for horticulture and floriculture. With bamboo growing, stock making up 5 per cent of the nation's total stock, the bamboo industry is quite significant in Nagaland. The state offers good regulatory and financial advantages for companies like horticulture, mining, tourism, handicrafts, and those centred in the forestry and agricultural sectors. Special Economic Zones (SEZs) are being created in Nagaland to increase the products' marketability. Nagaland has two special economic zones by 2021. The Nagaland Industrial Development Corporation (NIDC) is a government of Nagaland undertaking which works for the industrial development of the State of Nagaland. (IBEF 2022)

In order to get a clear picture of the disparity among the North-Eastern States, the share of industry in each States GSVA has been calculated. This is depicted in Table 1.

Table 1: State-wise Per cent Contribution of Industry Sector to Gross State Value Added in 2007-08 and 2017-18

States	2007-08	2017-18
Arunachal Pradesh	37.00 %	31.1 %
Assam	27.40 %	39.2 %
Manipur	42.06 %	17.6 %
Meghalaya	37.70 %	25.12 %
Nagaland	17.20 %	21.5 %
Sikkim	34.77 %	59.2 %
Tripura	16.08 %	32.2 %

Source: Authors' own computation from Handbook of Statistics on Indian States, 2020-21.

The Table 1 shows that in the year 2007-2008, Industry sector contributes highest in Manipur whereas in the year 2017-2018, industry contributes highest to the GSVA of Sikkim. Sikkim has been the fastest growing State in India during 2015-2016 to 2019-2020 and it has favourable agro-climatic conditions. Sikkim's long-standing primarily agrarian nature has undergone major transformation as the State's socio-political climate has intensified to an industrialised one. Some industries worth mentioning are food processing, eco-tourism, cosmetics, breweries, mattress manufacturing, etc. Manipur has abundant natural resources, but because of its difficult terrain, poor infrastructure, and unpredictable weather, the state's economy has not been able to grow significantly in the industrial sector. Handloom and handicraft production is the sole industry that is worth mentioning in the state. A sizeable portion of the working population's female workforce is employed in the handloom sector. Within the state, as well as in the markets in the United States and abroad, the items are in high demand. In the beginning, the

state's government's objective was to revive and revitalise the traditional handlooms and handicrafts of the nearby ecosystems. There are currently only traditional-oriented enterprises worth mentioning, such as khadi and village industries, handlooms, and handicrafts. The Government of Manipur made the decision to prioritise small-scale and agro-based industries in its policy declaration from 1990, while leaving medium- and large-scale industries unaffected. It is anticipated to help with the goal of spreading out industry and creating jobs. The Manipur Industry and Investment Policy, 2017, was announced on November 17th, 2017. The following goals are included in the formulation of this new policy to support the State's mission to facilitate faster industrial growth and related sectors in Manipur. Assam's GSDP has benefited significantly from the industrial sector. Industries including weaving and hand looming, tea, plywood, cement plants based on readily available limestone, and the paper industry have all played a key role in Assam's industrial development. The weaving industry in Assam produces Chadar, Mekhela, Cheleng, Gamosa, Riha, and other textiles. According to the 4th National Handloom Census conducted in 2019–2020, the state has more than 12.83 lakh weavers and 12.46 lakh handlooms. The state's economy depends heavily on the tea industry, which accounts for over 55 per cent of all tea produced in India. The Assam Industrial Development Corporation Limited has proven essential in this situation. The corporation has worked hard to provide high-quality industrial infrastructure in Assam for the expansion and development of enterprises in the region. Considering its potential, the central government allocated a sum of $5810 million to central resource allocation budget for the development of the state.

Notwithstanding Meghalaya's abundance in mineral and forest resources, industrialization in the state has been excruciatingly slow. From Table 1 it can be seen that the share of industry in GSVA in Arunachal Pradesh and Meghalaya has declined from 37 per cent to 31.1 per cent and 37.7 per cent to 25.12 per cent over the period 2007-2008 to 2017-2018. This is brought on by a lack of finance, severe transportation problem, power shortage, lack of entrepreneurship, and the lack of technical know-how. The government has been working hard, but the state's industrial sector is expanding slowly. Several regulations and programmes that offered incentives and concessions packages weren't of much help in this area. Almost all of the state's public undertaking industries had financial difficulties, and there weren't enough funds for maintenance. The government has therefore chosen to shut down a few of its underperforming industries. One of the NER's industrially underdeveloped and primarily rural states is Arunachal Pradesh. The state, particularly village and SSI units, have been working to diversify industrial units. The distribution of industries, however, does not correspond to the population of different areas. Two significant roadblocks to industrial development are a poor marketing network and infrastructure bottlenecks. Furthermore, the development of unhealthy entrepreneurship has hampered the advancement of industry. Factors like community-based living, communal ownership of land and assets, etc., easy money in exchange for lending trade and

industrial licences to proxy user local firms and industrialists, etc., slowed the development of entrepreneurship. The corruption in the bureaucracy makes the issue worse (Panda 1997). The long-drawn continuation of the region's slow industrial development is mostly due to this poor entrepreneurial development issue. The state has a 60 thousand MW massive hydropower potential. The installed hydroelectric project in Arunachal had a capacity of 544.55 Megawatts in 2022. In addition, the mining and horticultural goods industries offer value to the economy and have a significant export potential. Crops such as maize, millet, wheat, pulses, etc., are some majorly cultivated in the North-Eastern States.

Figure 1: Percentage Contribution of Industry Sector towards Gross State Value Added in the North Eastern States of India in 2007-08 and 2017-18
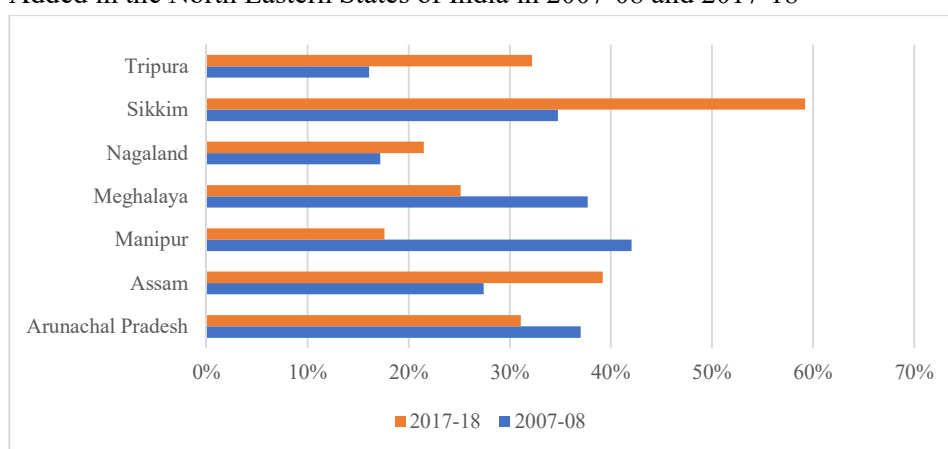
Source: Based on Table 1.

The North-East Indian economy is predominantly agrarian in nature, but it has enormous potential for the industrial sector. However, the agricultural industry has not performed as expected for a number of reasons, including infrastructure and technological obstacles, unfavourable weather along with population explosion. What Ricardo once had written in his famous 'Principles of Political Economy and Taxation', the agricultural sector faces a declining rate of profit because of the increase in population demand. He claimed that although the supply of agricultural goods does not expand at the same rate as the population, the demand for them does. As a result, the barren land has to be brought under cultivation, and the return from the agricultural sector will diminish. This will further result in price increases, which will lower profits and capital formation and impede economic growth. An economy can recover from such a situation with the support of technological advances, inventions in production methods, and other factors, but these have not occurred in the economies of the North-Eastern States, resulting in agricultural backwardness. Along with this, the region lacks large scale industries except for tea and oil. For the purpose of starting high production and

switching over all industrial patterns, small scale industry is more feasible in this situation than large scale industry. The small-scale industry has a prominent role to play and the following Table 2 shows the employment in SSI in the different states on North-East India.

Table 2: State Wise total Employment in Medium and Small-Scale Industries in the North-Eastern States as percentage (%) of the total in NER (2015-16)

States	Arunachal Pradesh	Assam	Manipur	Meghalaya	Nagaland	Sikkim	Tripura	NER as per cent of All India
Percentage (%)	18.72	62.22	10	6.54	6.06	1.54	10.10	2.62

Source: Compiled by the Authors from Handbook of Statistics on Indian States, 2020-21.

Here it is worthwhile to mention that compared to the national average of 48.9 per cent, Sikkimese were employed in agriculture, forestry, and fishing to a degree of close to 62 per cent in 2011–2012. Only 13 per cent were employed in the secondary sector with more than half of them being employed in the construction sector, even though it has been the state where the contribution of industry is highest in the GSVA. The employment transition from agriculture to industry and ultimately to services has been gradual; 26 per cent of the workers were working in the tertiary sector. The large proportion of workers employed in agriculture may be a result of a lack of technological advancement, knowledge, and skills. Besides, job seekers are still hoping to work for the government. In addition, many who were cultivating their land were hesitant to switch to another job because of the high worth of their land due to the high land prices. This might be a significant reason of the modest role played by SSI in Sikkim's employment growth, despite the sector's 39.2 per cent proportion of the state's gross domestic product (GSVA).

Figure 2: CAGR of Gross State Value Added (GSVA) of the North Eastern States of India over the period 2007-08 to 2017-18
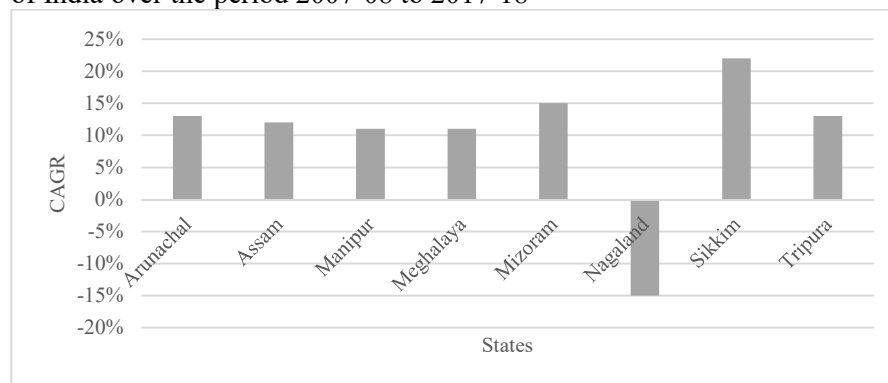
Source: Computed by the authors from Handbooks of Statistics on Indian States, RBI, 2020-21.

Table 3: Descriptive statistics of GSVA-Industry of Origin of the NE States (2007-08 to 2017-18, Base: 2011-12)

	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura
Mean	25930.27	1622005	39451.91	324972.5	6994.18	17700	417708	99408.91
Median	14037	1479535	40531	348229	6609	16087	431783	107836
Maximum	64970	3343622	54581	466490	10578	26407	782910	146648
Minimum	10566	294863	28844	156142	4630	11235	18185	54793
Std. Deviation	19421.16	781405.3	10104.54	108445	2215.245	5237.5	242473	33845.72
Skewness	0.892961	0.730045	0.407395	-0.201193	0.507101	0.6437	-0.42118	0.079957
Kurtosis	2.314829	3.735467	1.636655	1.757494	1.819395	2.0768	2.36811	1.605101
Jarque-Bera	1.67703	1.225022	1.156189	0.781796	1.110282	1.1503	0.50823	0.903519

Source: Authors own calculation using E-Views.

In the above Table 3, descriptive of statistics of GSVA data for the eight North-Eastern States has been shown over the period 2007-2008 to 2017-2018. For Normal Skewness the value must be 0. The GSVA industry of origin data for Tripura and Manipur mirrors normal distribution with skewness being 0.07 and 0.407 respectively which close to 0. Regarding Kurtosis, the value of 3 shows a normal distribution and the distribution becomes mesokurtic. In the above Table, it can be seen that except Assam, the kurtosis value for all the states is less than 3 which implies that the distribution is platykurtic for all of them. A platykurtic distribution implies that the series has values below the sample mean. The distribution in Assam has a long right tail and is leptokurtic, according to the Kurtosis value of 3.73>3. The difference between the series' skewness and kurtosis compared to those from the normal distribution is measured by the Jarque-Bera statistic.

Figure 3: Growth Rate of GSVA Industry of Origin (2011-12 to 2017-18)
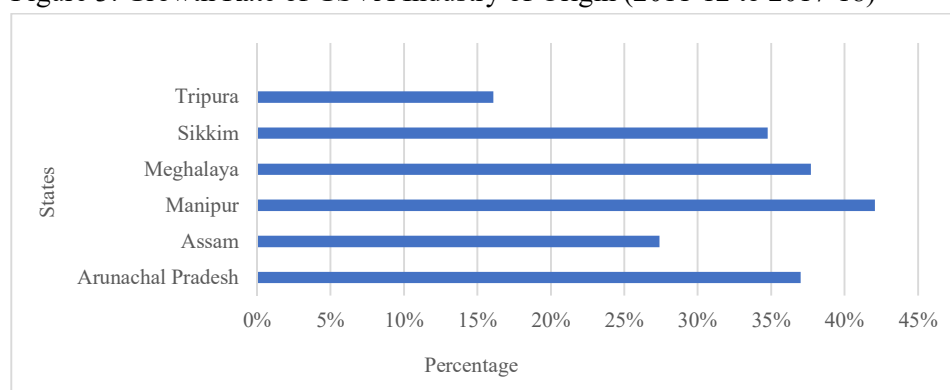
Source: Handbook of Statistics on Indian States, RBI, 2020-21.

Table 4: Industrial development Index (IDI) and Ranking of North-Eastern States

States	Composite Indices			
	2007-08	Rank	2017-18	Rank
Arunachal Pradesh	0.35	5	0.43	5
Assam	0.19	2	0.22	1
Manipur	0.42	7	0.70	7
Meghalaya	0.35	4	0.37	3
Nagaland	0.39	6	0.39	4
Sikkim	0.17	1	0.32	2
Tripura	0.29	3	0.49	6

Source: Authors own computations.

Figure 4: State wise ranking based on Composite Indices
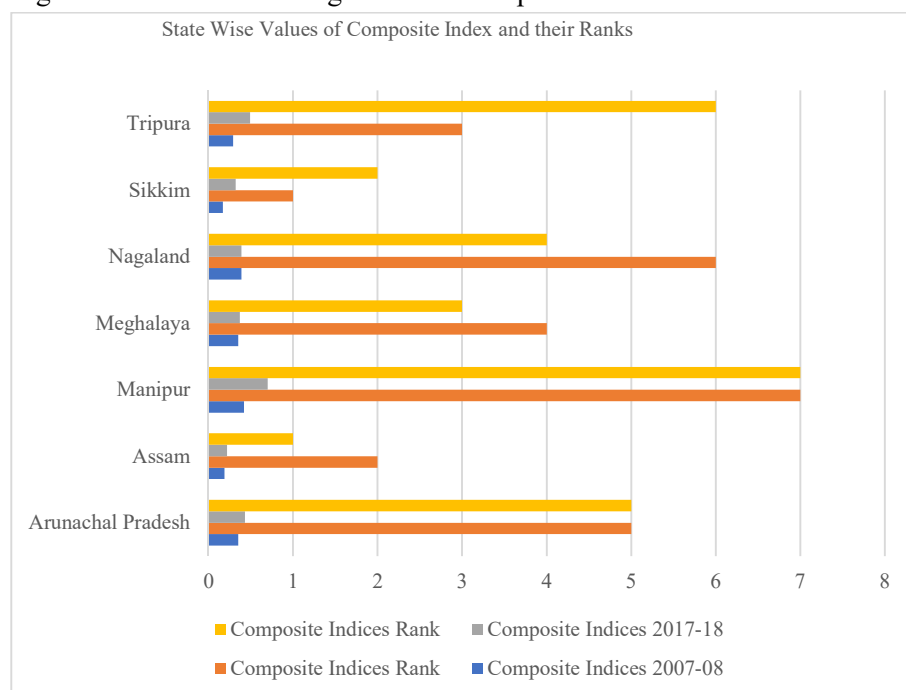
Source: Based on Table 4.

Based on the data collected from the different sources mentioned above, the composite indices of industrial development, i.e., the Industrial Development Index (IDI) over two time points, i.e., 2007-2008 and 2017-2018 are shown in Table 4 which clearly shows that, Assam, Tripura and Sikkim are medium developed and comparatively developed to other NE states since the composite index value lies between 0.19 and 0.31. With Composite index value of 0.17, Sikkim captures the first position followed by Assam with composite score of 0.19. With the composite index score of 0.42, Manipur appears to be in the last

position regarding industrial development. Again, for the year 2017-2018, Assam secured first position with composite index score of 0.22 and lies in the medium developed stage since its value lies between 0.16 and 0.37. Manipur again secures the lowest position with composite index value of 0.70 followed by Tripura and Arunachal Pradesh.

Table 5: Categorization of Development Stages

Category	2007-08	2017-18
Highly Developed States	CI≤0.09	CI≤0.16
Medium Developed States	0.31≤ CI≤0.09	0.37≤ CI≤0.16
Developing States	0.31≤ CI≤0.053	0.37≤ CI≤0.58
Low Developed States	CI≥0.53	CI≥0.58

Source: Authors' own computations.

Table 6: Classification of States into different Development Stages

Category	2007-08	2017-18
Highly Developed States	--	--
Medium Developed States	Assam, Sikkim, Tripura	Assam, Sikkim
Developing States	Arunachal Pradesh, Manipur, Meghalaya, Nagaland	Arunachal Pradesh, Meghalaya, Nagaland, Tripura
Low Developed States	--	Manipur

Source: Authors' Computations.

According to the Table 6, in 2007-2008 Assam, Sikkim and Tripura States fall in the category of medium developed category. Arunachal Pradesh, Manipur, Meghalaya, and Nagaland fall in the category of developing States. None of the States falls in highly developed and low developed category. This is also evident from Table 1 that the contribution of industrial sector to GSVA of Assam and Sikkim was 27.4 per cent and 34.77 per cent which was higher than the other States. Again, in the year 2017-2018, Assam and Sikkim fall in the medium developed category which was also evident from the contribution of industrial sector to GSVA, i.e., 39.2 per cent and 59.2 per cent respectively. Arunachal Pradesh, Meghalaya, Nagaland and Tripura fall in developing category. Alike 2007-2008, no states fall in the highly developed category but Manipur falls in the less developed category. Thus, it can be seen that Assam and Sikkim have turned out to be states with a comparatively higher industrial development than the other North-Eastern States. In the above discussion it is found that Assam and Sikkim can be regarded as the growth poles in the entire region regarding industrial development.

According to Perroux (1950), the link industries emerge mostly through direct or indirect effects, with the core industries serving as the centrepiece. The majority of the industries that predominate in secondary sector in India's north-eastern states include handloom and handicraft, horticulture, bamboo etc. The

NER can benefit from the industry's strength despite its moderate growth. The current study has identified four industries—among many other highly promising ones—where new value chains can help increase the region's export potential while also generating more and better jobs for the populace. These industries were chosen based on the literature and a recent policy framework for mainstreaming North-East India. Among them are fruits and vegetables, spices, bamboo products, and medical tourism. Despite the poor value added of the bamboo sector, it can still be encouraged due to its minimal negative impact on the environment. Aside from that, the North-East can gain from the increase in demand for fresh food, especially for environmentally and socially responsible product, including high-quality, fresh spices and fruits. The most current research also indicates that the area has an around 53 per cent marketable surplus in fruit output that can serve as a source of raw materials for Bangladesh's thriving fruit processing industry. The North-East has seen a rise in the food processing industry which has a significant potential for exports and value addition.

For seamless operation, the food processing industry needs both strong forward and backward linkages. The government of India's Ministry of Food Processing Industries has been implementing a programme called Creation of Backward and Forward Linkages. Perishable horticultural and non-horticultural goods like fruits, vegetables, dairy products, meat, honey, coconut, spices, mushrooms, etc., are covered by the scheme. The programme was put into effect in 2018. The maximum funding per project is $50 million, with the North-Eastern states receiving 50 per cent of the eligible project cost. The scheme's primary goals are to address supply chain gaps in terms of raw material accessibility and market connectivity for the processed food industry while also ensuring seamless and effective back-and-forth integration. The food processing sector and a strong linkage with horticulture, which is absolutely vital in NE states. Due to its high export value, the food processing industry may significantly increase forward links at a cheap cost to consumers. By offering financial support for the establishment of primary processing centres at farm gate and modern retail outlets at the front and along with connectivity through insulated transport, the scheme can go a long way in creating significant forward and backward linkage to the food processing industry.

To support inclusive growth and industrialization in NER, steps have been taken to enhance infrastructure, including roads, water supplies, land, and logistics. Because of its unique feature of having a minimum wage that ranges from ₹5280 for unskilled workers to ₹13800 for skilled workers for both states, Nagaland and Manipur, which fall under the developing category, can draw businesses to grow investment on industries and thereby create a growth pole. The National Skill Training Institute (NSTI) has been established in Tripura by the Ministry of Skilled Development and Entrepreneurship to improve workplace gender awareness and strengthen women's skills. Additionally, this will aid in luring investment to the sectors (Varshney 2022).

Figure 5: Industries across North-Eastern States of India
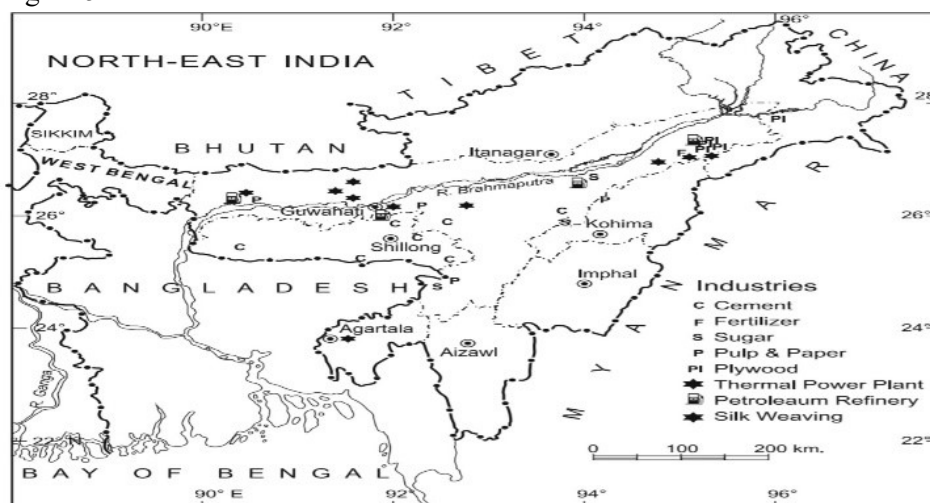
Source: Dikshit and Dikshit (2014), Page No. 675.

Additional initiatives by the central government include the Act East Policy or AEP (Prior Look East Policy), which allows the establishment of various industries and the export of goods to surrounding nations (Barua 2020). In support of the AEP model, the North-Eastern States can continue their partnership with Bangladesh and the ASEAN in the long run to support industrial growth, which can help greatly to boost the export orientation of this region's industrial sector. Yet, although serving as a point of entry for interactions with South Asian nations, the region is not considered to be an essential component of India's regional development framework. However, measures like linking the North-Eastern area with the rest of India through improved infrastructure linkages can go a long way to construct a cross-border production chain network, especially in the export-oriented and high value-added industries with Bangladesh and ASEAN countries. The region's food processing industry has significant value added and export potential. However, the trade between India and ASEAN is largely restricted to manufacturing goods and does not include much in the way of agricultural goods. In India's export to ASEAN, the NE states hence do not have a comparative advantage. To achieve this, interstate connection and market integration must be improved because the significant value added of the food processing sectors, Special Economic Zones (SEZs) can be established in NER for all projects associated with them. However, this model is criticized on the ground that it can be used as a weapon to support resource extraction from the area rather than industrial development.

V Conclusion and Policy Recommendation

The Indian States have experienced disparities for a long time and North-Eastern States are no exception to it. Wide scale variations are also prominent among the different parts of the North-Eastern States due to different factors such as geographical location of the States, insurgency issues, etc. State Government's pro-active participation can help in decentralizing the industrial development among all parts of the region. Transparent and judicious use of funds can ensure optimal allocation of funds for the development of backward areas. According to the findings of the above inquiry, the industrial sector in the North-Eastern States has progressed through time, but there is still much more to be done. In September 2001, the Indian government formed the Ministry of Development of the North-Eastern Region (MDONER), which serves as the main department of the central government for concerns relating to the socio-economic development of the eight states. The government has implemented several programmes and policies to encourage rapid industrialization in North-East India, including the North-East Industrial and Investment Promotion Policy (NEIP, 2007), the Centrally Supported National Bamboo Mission (2006-2007) and others. The North East Industrial Development Scheme (NEIDS), 2017 came into effect on January 1, 2017 for a five-year period, and as of now, it has significantly advanced the cause of industrialization in the area. The programme began following the closure of the NEIIPP (2007). A total of $34123 million has been made available since the NEIP's inception (1997) for the industrial development of the states in the North-Eastern Region. An amount of $1800 million, compared to about 900 million in the fiscal year 2015–2016, had been released to the NER states. An allocation of ₹4600 Crore is included in the budget estimate for industrial development NEIIP (2007) for the current fiscal year, 2022–2023. NEDFi (North Eastern Development and Finance Corporation Ltd) is the designated agency for the distribution of subsidies under various NEIIP subsidy programmes in North-East India. Moreover, $460 million. have been released to the NER states since the commencement of NEIDS. A sum of $300 million. had been released to the states during the financial year 2021–2022, which is around two times what was released during the period 2015–2016. In the fiscal year 2022–2023, there is also a provision for $1500 million. This data shows that there is an upward trend in the funding for industrial growth in the region. With a focus on MSME in manufacturing and services, this programme aims to cover both the service and manufacturing sectors. The states which are showing poor contribution in NER can capitalize in the areas such as Bio-diversity conservation, bio-fuels, Electronics, and IT to gain from Industrial Revolution 5.0 (Phukan 2022). Connectivity with the eight north-eastern states by establishing G2G economic zones can help to achieve the objective of sound partnership with Bangladesh. Thus, to bridge the gap of industrial development and to boost the industrial sector, the States which falls in the development State category should place more

importance on developing infrastructure and should undertake State specific industrial policy for the development of industrial sector in the State.

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Appendix

Data and Calculations

Indicator 1- No. of factories 1/10 million population.
Indicator 2- No. of factories per 100 sq. km of the geographical area.
Indicator 3- Invested capital per 1/10 million populations.
Indicator 4- Invested capital per 100 sq. km of the geographical area.
Indicator 5- Total emoluments per 1/10 million populations.
Indicator 6- Value of gross output.
Indicator 7- Net fixed capital formation.
Indicator 8- Physical working capital.
Indicator 9- No. of workers employed in industries.

Industrial Development Indicators Data for the Year 2006-07

State	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5	Indicator 6	Indicator 7	Indicator 8	Indicator 9
Arunachal Pradesh	11.29	0.01	392.01	5.14	33.21	13487.3	-166.6	2386.8	702
Assam	7.38	0.3	442.49	150.38	26.52	304761.9	1359.7	31961	21999
Manipur	2.75	0.03	6.962	0.72	1.92	296.9	-2.9	46.8	285
Meghalaya	3.28	0.03	263.07	27.20	17.92	12959.3	950.4	705.2	982
Nagaland	5.33	0.06	36.97	4.44	4.59	1182.7	28.4	368.1	372
Sikkim	8.50	0.06	2382.94	181.68	346.58	31203.7	1568.2	3809.2	4854
Tripura	10.13	0.31	138.74	42.33	12.80	7226.8	1015.6	882.2	2156

Industrial Development Indicators Data for the Year 2016-17

State	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5	Indicator 6	Indicator 7	Indicator 8	Indicator 9
Arunachal Pradesh	0.90	1.5	258.14	4.27	386.4	11449.2	34.2	2590.6	2569
Assam	1.33	52.9	1197.25	474.32	26642	629360.6	3617.6	75515	181098
Manipur	6.58	8.4	70.79	9.06	546.2	3629.5	113.8	691.8	6942
Meghalaya	0.40	5.4	1619.37	214.22	2418.2	39519.4	1098.4	10284.4	10517
Nagaland	9.70	11.6	167.58	20	343.7	5174.6	-87.9	1101.6	5109
Sikkim	0.13	10.9	14221.65	524.12	7268.4	168835.9	7173.3	10054.2	13372
Tripura	1.59	55.8	189.46	66.38	1312.9	13795.3	-223.9	1982.7	605994

Calculating the Industrial Development Index for the year 2007-08

$$Z_{ij} = \frac{X_{ij} - \bar{X}_j}{\sigma}$$

State	Indicator (1)	Indicator (2)	Indicator (3)	Indicator (4)	Indicator (5)	Indicator (6)	Indicator (7)	Indicator (8)	Indicator (9)
Arunachal Pradesh	0.54	-0.49	-0.06	-0.29	-0.09	-0.14	-0.48	-0.12	-0.19
Assam	0.05	0.16	-0.04	0.49	-0.12	0.92	0.39	0.92	0.91
Manipur	-0.52	-0.44	-0.25	-0.32	-0.20	-0.15	-0.39	-0.19	-0.22
Meghalaya	-045	-0.44	-0.13	-0.17	-0.15	-0.19	0.16	-0.18	0.18
Nagaland	-0.20	0.38	-0.24	-0.29	-0.19	-0.19	-0.37	-0.19	-0.21
Sikkim	0.19	-0.38	0.91	0.67	0.92	-0.08	0.51	-0.07	-0.19
Tripura	0.39	0.18	-0.19	-0.09	-0.16	-0.17	0.19	-0.17	-0.12

$$P_{ij} = (Z_{ij} - Z_{oj})^2$$

State	Indicator (1)	Indicator (2)	Indicator (3)	Indicator (4)	Indicator (5)	Indicator (6)	Indicator (7)	Indicator (8)	Indicator (9)
Arunachal Pradesh	0	0.45	0.94	0.92	1.02	1.12	0.98	1.08	1.21
Assam	0.24	0.0004	0.90	0.03	1.08	0	0.01	0	0
Manipur	1.12	0.38	1.35	0.98	1.25	1.23	0.81	1.23	1.28
Meghalaya	0.98	0.38	1.08	0.71	1.14	1.14	0.12	-1.1	1.19
Nagaland	0.55	0.31	1.32	0.92	1.23	1.23	0.77	1.23	1.25
Sikkim	0.12	0.31	0	0	0	1	0	0.98	1.21
Tripura	0.02	0	1.21	0.58	1.17	1.19	0.10	-1.09	1.06
CV	1.16	1.96	3.92	3.13	4.85	5.15	2.57	4.97	4.31

$$C_{ij} = \left[\sum_{j=1}^{k} P_i / CV_j \right]^{1/2} \text{Calculating the } P_i / CV_j$$

State	Indicator (1)	Indicator (2)	Indicator (3)	Indicator (4)	Indicator (5)	Indicator (6)	Indicator (7)	Indicator (8)	Indicator (9)
Arunachal Pradesh	0	0.23	0.24	0.29	0.21	0.22	0.38	0.22	0.28
Assam	0.21	0.0002	0.23	0.009	0.22	0	0.004	0	0
Manipur	0.97	0.19	0.34	0.13	0.26	0.24	0.32	0.25	0.29
Meghalaya	0.84	0.19	0.28	0.23	0.24	0.22	0.05	-0.22	0.28
Nagaland	0.47	0.16	0.34	0.29	0.25	0.24	0.29	0.25	0.29
Sikkim	0.10	0.16	0	0	0	0.19	0	-0.22	0.28
Tripura	0.02	0	0.31	0.19	0.27	0.23	0.04	0.22	0.25

Calculating the C_i

State	C_i	$(C_i - \bar{C}_j)^2$	$D_{i=} C_i / C$ Where $C = \bar{C} + 3\sigma C_i$	$(D_i - \bar{D}_i)^2$
Arunachal Pradesh	1.44	0.03	0.35	0.02
Assam	0.82	0.21	0.19	0.01
Manipur	1.73	0.20	0.42	0.01
Meghalaya	1.45	0.03	0.35	0.002
Nagaland	1.61	0.11	0.39	0.06
Sikkim	0.71	0.32	0.17	0.02
Tripura	1.22	0.004	0.29	0.0004
	$\bar{X} = 1.28$	$\sigma = \sqrt{0.904} = 0.95$	$\bar{D} = 0.31$	$\sigma = \sqrt{0.0504} = 0.22$

Calculating the Industrial Development Index for the year 2017-18

$$Z_{ij} = \frac{X_{ij} - \bar{X}_j}{\sigma}$$

State	Indicator (1)	Indicator (2)	Indicator (3)	Indicator (4)	Indicator (5)	Indicator (6)	Indicator (7)	Indicator (8)	Indicator (9)
Arunachal Pradesh	-0.23	-0.34	-0.18	-0.33	-0.22	-0.20	-0.24	-0.18	-0.21
Assam	-0.18	0.57	-0.11	0.52	0.89	0.89	0.29	0.92	0.11
Manipur	0.40	-0.22	-0.19	-0.32	-0.21	-0.21	-0.23	-0.21	-0.20
Meghalaya	-0.28	-0.27	-0.07	0.05	0.08	-0.15	-0.08	-0.06	-0.19
Nagaland	0.75	-0.16	-0.19	-0.30	-0.22	-0.21	-0.26	-0.20	-0.20
Sikkim	-0.31	-0.18	0.92	0.61	0.07	0.08	0.81	-0.07	-0.19
Tripura	-0.15	0.62	-0.18	-0.22	-0.18	-1.95	-0.28	-0.19	0.89

$$P_{ij} = (Z_{ij} - Z_{oj})^2$$

State	Indicator (1)	Indicator (2)	Indicator (3)	Indicator (4)	Indicator (5)	Indicator (6)	Indicator (7)	Indicator (8)	Indicator (9)
Arunachal Pradesh	0.96	0.92	1.21	0.88	1.23	1.19	1.10	1.21	1.21
Assam	0.86	0.003	1.06	0.008	0	0	0.27	0	0.61
Manipur	0.12	0.71	1.23	0.86	1.21	1.21	1.08	1.28	1.19
Meghalaya	1.06	0.79	0.98	0.31	0.66	1.08	0.79	0.96	1.17
Nagaland	0	0.61	1.23	0.83	1.23	1.21	1.14	1.25	1.19
Sikkim	1.12	0.64	0	0	0.67	0.66	0	0.98	1.17
Tripura	0.81	0	1.21	0.69	1.14	8.07	1.19	1.23	0
CV	3.08	2.70	5.02	2.94	4.27	4.53	4.06	4.56	4.67

$$C_{ij} = \left[\sum_{j=1}^{k} P_i \Big/ CV_j \right]^{1/2}$$

Calculating $P_i \big/ CV_j$

State	Indicator (1)	Indicator (2)	Indicator (3)	Indicator (4)	Indicator (5)	Indicator (6)	Indicator (7)	Indicator (8)	Indicator (9)
Arunachal Pradesh	0.31	0.34	0.24	0.29	0.29	0.26	0.27	0.27	0.26
Assam	0.28	0.001	0.21	0.003	0	0	0.07	0	0.13
Manipur	0.04	0.26	0.25	0.29	0.28	0.27	0.27	0.28	0.25
Meghalaya	0.34	0.29	0.19	0.11	0.15	0.24	0.19	0.21	0.25
Nagaland	0	0.23	0.25	0.28	0.29	0.27	0.28	0.27	0.25
Sikkim	0.36	0.24	0	0	0.16	0.15	0	0.21	0.25
Tripura	0.26	0	0.24	0.23	0.27	1.78	0.29	0.27	0

Calculating the C_i

State	C_i	$(C_i - \bar{C}_i)^2$	$D_i = C_i \big/ C$ Where $C = \bar{C} + 3\sigma C_i$	$(D_i - \bar{D}_i)^2$
Arunachal Pradesh	1.59	0.04	0.43	0.004
Assam	0.83	0.31	0.22	0.02
Manipur	1.48	0.008	0.70	0.001
Meghalaya	1.37	0.0004	0.37	0
Nagaland	1.46	0.005	0.39	0.0004
Sikkim	1.17	0.05	0.32	0.003
Tripura	1.83	0.19	0.49	0.014
	$\bar{X} = 1.39$	$\sigma = \sqrt{0.5989} = 0.77$	$\bar{D} = 0.37$	$\sigma = \sqrt{0.0421} = 0.21$

Finding Development Stages for the Year 2007-08

Stages of Development	States
Highly Developed CI≤ (Mean – SD)	----
Medium Mean ≤ CI ≤ (Mean – SD)	Assam, Sikkim, Tripura
Developing Mean ≤ CI ≤ (Mean + SD)	Arunachal Pradesh, Manipur, Meghalaya, Nagaland
Low Developed CI≥ (Mean + SD)	----

Where,
Mean = 0.31
(Mean – SD) = 0.09
(Mean + SD) = 0.53

Finding Development Stages for the Year 2017-18

Stages of Development	States
Highly Developed CI≤ (Mean – SD)	----
Medium Mean ≤ CI ≤ (Mean – SD)	Assam, Sikkim
Developing Mean ≤ CI ≤ (Mean + SD)	Arunachal Pradesh, Manipur, Meghalaya, Nagaland, Tripura
Low Developed CI≥ (Mean + SD)	----

Where,
Mean = 0.37
(Mean – SD) = 0.16
(Mean + SD) = 0.58

Is India Really Moving Towards Gender Heterogeneity?

Poonam Mahajan and Pradeep Kaur

This study focuses on critical mass theory which promotes the appointment of three or more women directors to achieve 'critical mass' and reduce tokenism among corporate boards. It also examines the regulations related to mandatory presence of a woman director in Indian corporate under the Indian Companies (Amendment) Act, 2013.

The data from BSE top 100 companies from the year March 2006 to March 2021 was analysed for difference-in-difference analysis and period from March 2009 to March 2021 was analysed for regression analysis. The interaction term (treatment*time) in difference-in-difference analysis is positive and significant at one per cent level of significance which shows the true effect of treatment i.e., regulation for the mandatory presence of women directors. Results of the two-way fixed effects model with robust standard errors show that critical mass of women directors, has an insignificant relationship on Tobin's Q, which defies the critical mass theory in Indian scenario. It shows a dynamic shift in the corporate board environment, which represents either acceptance of gender equality or altogether irrelevance of gender in corporate boards.

This study addresses the problem of tokenism, relevance of critical mass, and actual difference made by gender diversity regulation.

Keywords: Gender Heterogeneity, Tokenism, Critical mass theory, Indian Companies (Amendment) Act, 2013, Tobin's Q, Diversity.

I Introduction

'*One of the things that I've personally seen that really makes a difference is making diversity a priority from the top board leadership. It could be the CEO, it can be the chairperson if she or he is a different person, it could be the chairperson of nominating, and it could be the lead director. But when someone at the top of the board, someone who is in a leadership position in the board says, 'This really matters, we must make it a priority,' I think you see a real change.'*

-Bonnie Gwin, 2018

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The composition of the board of directors influences a firm's performance (Adams and Ferreira 2009). A Board was composed of only male directors in early times, which led to homogeneity, now they have moved a long way from this situation. The paradigm shift from homogeneity to heterogeneity arose due to the compulsory appointment of a woman director on board by amendment of the corporate legal framework in India. An argument was discussed in an article published in The Wall Street Journal "CEO *vs.* Nun: It's a Draw" about whether diversity is necessary on boards or not. A shareholder raised her voice to support the inclusion of women and other minorities group in corporate boards because it gives a different perspective regarding business decisions, which is not possible with all white male gatherings (*Wall Street Journal* 1996). This voice originated from developed countries and slowly but steadily spread to other nations.

Some researchers appealed to gender diversity from an ethical perspective while many resonated for "business case". Results of these studies were extremely contrasting and varied based on the estimation method used. The impact of CEO gender on performance was analysed and the result showed that the risk level radically reduced when a firm has female CEO (Khan and Vieito 2013). Significant results encouraged some firms to add women directors on board while others remained unswerving on homogeneity on the corporate board. These actions also inspired women to aspire to top positions in the firm by shattering the glass ceiling which seemed non-conformist before. This progression was going at a leisurely pace in developing countries but was rapid in developed countries.

The corporate world accepted and sped up this challenge by adding colour to the board through heterogeneity. The board gender heterogeneity turned out to be a significant and influential subject of a business environment. The government of leading countries such as Norway, France, the USA, etc. took this challenge and furnished a new direction to board heterogeneity, by establishing quotas for the presence of women directors. India too introduced new corporate legislation by amending its Companies Act, 2013 to make the presence of at least one woman director mandatory on Indian corporate boards. Nevertheless, India's cultural environment was miles apart from developed countries. This decision probably gave rise to the problem of tokenism in corporate industries. Many firms started appointing female directors just to comply with regulations while some resorted to the employment of directors from their families themselves.

Indian Scenario

Indian firms are classified as family-owned businesses, private firms, and public sector undertakings. Family and distinct relatives in family-owned businesses, the government in public sector undertakings, and promoters in private firms hold major shares of the company. These share patterns become a major component in deciding the board composition of firms. The family member and promoters of these firms' form part of a corporate board. The majority of shareholders nominate directors through their voting rights. Male directors usually represent the

shareholders in these family businesses. Naturally, homogeneity stemmed from this biased selection. Although, gender heterogeneity is gaining popularity in recent years t it is not yet a widespread characteristic of Indian corporate boards. Many firms are taking initiatives to promote gender heterogeneity and playing their part in the ubiquitous debate but numbers are quite few.

The legal framework of India and mandatory regulations formed the foundation of a shift in the board composition of Indian firms. The Companies (Amendment) Act, 2013 was a big revolutionary step in this direction as it mandated the appointment of a woman director in corporate boards. Clause 49 of SEBI also amended based on the Indian Companies (Amendment) Act, 2013 to facilitate this change. Predominantly, it started as a practice of appointing women directors to check the boxes of initiative and compliance that enhanced the issue of tokenism. Moreover, some business houses appointed women directors from their households to fulfil this regulation.

Gender diversity is a debatable issue of concern all over the world and not limited to developing nations. US ex-president Trump's cabinet was criticized for lack of gender diversity and Oscar academy award nominations for lack of racial diversity. Homogenous groups frowned upon in these globalized groups (Milkman, *et. al.* 2018). In most of the cases, women directors were appointed to maintain the image of diversity in media, which further contributes to tokenism or "twokenism". A study of S&P 500 companies conducted revealed that two women directors are termed as "twokenism" which is new tokenism in developed countries.

Some provided counter-argument that there is no pool of women directors to go ahead with their appointment (Singh, Terjesen and Vinnicombe 2008). Kota (2019) claimed that 13 per cent (622) of women directors exist among the total directors (4960) in the NIFTY 500 in India. Many largest Asian businesses such as Samsung, Softbank, Baidu, etc., had all-male boards until 2019. There are many qualified women candidates but they face a glass ceiling while climbing the corporate ladder. Even if a women director is appointed, it is in a non-executive capacity to comply with norms and a majority of them belong to promoters' families (Kota 2019).

Women employees are actively participating in India's workforce but there is a lag in reaching leadership roles or in attaining top positions in the corporate world despite higher qualifications. (Haldar, Datta and Shah 2020) studied that 19 percent of women on board did not pursue study after graduation but 46 per cent pursued doctoral degrees and 51 per cent went to prestigious institutes like the Indian Institute of Management, Indian Institute of Technology, and foreign business schools. Despite highly professional and qualified groups, a big question arises "Why is this qualified pool not getting positions in upper echelons"? The author further emphasized the term 'leaky pipeline' to explain the scenario where women are not getting director positions through normal career progression due to the presence of endogenous factors.

The glass ceiling, cultural ideologies, and religious restraints are responsible factors for homogeneity at the workplace in the Indian environment. Cultural ideology also plays an imperative role in the glass ceiling in patriarchal societies like India (Mishra and Mishra 2016). Women directors are required to have strong human and social capital related to promoters to make their presence known. India is yet to implement the legislation in the true spirit that is not possible until the presence of "tokenism" and "twokenism" eradicated. Rules related to governance structure are still ineffectual in the Indian economy. Even though there are regulations and guidelines, nothing is being done to fight the obstacle of the glass ceiling, tokenism, and promote critical mass.

It provided a venue for further analysis of the following research questions, addressed in the present study. Research questions are as follows:

1. Do regulations for compulsory appointment of women directors on Indian corporate boards shatter the glass ceiling under the Indian Companies (Amendment) Act, 2013?
2. What is the impact of homogeneous boards on firm value?
3. What is the impact of tokenism on firm value?
4. Do the presence of three or more directors, i.e., critical mass of women directors, matter on the corporate board?

The following objectives address the aforementioned research questions:

a) To perform pre and post-analysis to analyze the impact of the Companies (Amendment) Act, 2013 on the presence of women directors on Indian corporate boards.
b) To analyze the presence, application of tokenism, and relevance of critical mass theory in Indian corporate boards by examining the relationship between the presence of women directors and firm value.

This study investigates the current scenario in BSE top 100 companies to perform pre and post-analysis by using the Difference-in-Difference analysis method. It depicts that the compulsory appointment of a woman director leads to an upward trend as opposed to a time when no such regulation was in place. Investigation of a critical mass of women directors shows an insignificant impact on firm value in the Indian context. This study dismisses the importance of gender in the corporate board by analyzing homogenous board, tokenism, twokenism, and critical mass. Qualification of individual directors is more relevant than gender. The potential contributions of this study are multi-fold. First, it raises concern about the tokenism issue in developing economies such as India. Second, it establishes the significance of regulation, mandated appointment of a woman director. More importantly, it empirically analyzes the relevance of critical mass, homogeneity, and tokenism in corporate boards. To conclude, it answers the question, "Is gender relevant in Indian corporate board?".

The remainder of the paper is organized as follows. Section II provides the conceptual framework and hypothesis development. The sample selections and variables used in the study are then discussed in Section III of research

methodology, findings of the study in Section IV, and concluding remarks in Section V with implications of the study in the last Section.

II Conceptual Framework and Hypothesis Development

Tokenism theory and Critical mass theory

Tokenism in the organisational setup is born from gender differences and biases entrenched in gender stereotypes. It is originated from gender based functional differences, discrimination and role expectations (Cook and Glass 2018). Rosabeth Moss Kanter gave the concept of token in book called 'Men and Women of the Corporation' to elaborate on these gender differences and biases. The tokenism theory states that organisations include minority groups in the corporate board to avoid criticism and give an illusion of fair treatment of that minority group. (Kanter 1978) and (Milkman, Chugh, Akinola and Chang, 2018). This minority group is usually considered as a 'token'. Women have often found to be a minority group in corporate boards. One of the reasons for this being that efforts of women are not recognized and chances of promotion have not been provided to them (Mattis 2004) – i.e. the Glass ceiling. This causes ignorance, isolation, and minority status of women. However, the cause is not an under- qualification but their under representation, immense scrutiny, and presence of "old boys' club". They are often not trusted and their judgments are not given due weightage. Minor mistakes are highlighted but major achievements require immense hard work for recognition, which may lead to underperformance of women directors to maintain their invisible status and keep a low profile. The homogenous group has informal networks that have not been penetrated by women directors. Thus, they may experience social isolation and remain deprived of important discussions. It may lead to a less important role of women according to stereotypical categories. Tokenism speaks volumes about unjust treatment received by the minority presence of women directors at higher positions.

Corporate boards employed one or two women directors to comply with regulatory guidelines and to become advocates of gender diversity. Appointment of one woman director to give mirage of gender diversity is not justified. Male peers underestimate and isolate female colleagues as concluded by survey of officers of Midwestern Municipal Police Agency (Stichman, Hassell and Archbold, 2010).

Tokenism theory paved the way for critical mass theory that states that minority group can create mark among majority when at least 33 per cent or 3 directors (in case of corporate boards) of them are present.

Critical mass theory advocates for the presence of at least three women directors to make an impact on board decisions (Torchia, Calabrò and Huse. 2011). Many studies also supported the assertion of the presence of at least three women directors to have their opinions heard (Ben-Amar and McIlkenny, 2015,

Fernandez-Feijoo, Romero and Ruiz-Blanco, 2014, Post, Rahman and Rubow, 2011). Chakroun and Chtioui (2018) also found positive effects of the presence of at least three women directors and notable changes in corporate boards. Amoreli and Garcia- Sanchez (2019) also stated the relevance of critical mass.

The study borrows postulations of these theories to analyse the impact of the presence of women directors as a token and as critical mass on the performance of the firm.

Hypothesis Development

Dimension 1: Corporate Board with All Male Directors– Homogeneity

Corporates are still considered, as "all boys club" as proportion of women is low even in developed nations. Countries like Peru and Morocco still have only all-male boards. Gender discrimination is unlawful in many developed countries and in India but still, it is prevalent in different strata of society. The Glass ceiling effect does not allow women to be part of the upper rungs of the corporate ladder. Women are not entrusted with corporate responsibilities; that is considered as risky investment, as it is felt that women will leave the role to fulfill family responsibilities. As Cook and Glass (2017) suggested, top positions are mostly occupied by male directors in homogenous boards which symbolize glass cliff patterns.

Tajfel and Turner (1985) and Williams and O'Reilly (1998) established that homogeneous group are more cooperative and have less emotional conflicts. Earley and Mosakowski (2000) supported the claim and found that homogeneous groups communicate more due to similarity in their opinions.

However, Liu, Wei, and Xie (2014) conducted a study on Chinese firms and argued that gender diverse firms have better firm performance. There is positive correlation in well-diversified board with firm value as summarized by D. Greene, V.J. Intintoli and K.M. Kahle (2019). Smith, Smith and Verner (2006) also advocated that gender diverse boards improve firm competitive advantage by improving the image of the firm, which leads to improvement in firm value. Gender-diversified boards with women directors were found to have better decision making skills due to regularity in attendance, strengthening board independence, unique perspective and insight into better understanding of customers' needs which will lead to positive prospects for firms' accounting and market performance (Campbell and Mínguez-Vera, 2008; Eversheds Report, 2013; Abdullah, Ismail and Nachum, 2012; McMillan-Capehart, Aaron and Cline, 2010; Moreno-Gómez, Lafuente and Vaillant, 2018; Sghaier and Hamza 2018).

Additionally, Bernardi and Arnold (1997), Krishnan and Parsons (2008) found women directors to be better at monitoring as they are more ethical and pay attention to detail. Gul, Wu and Yang (2013) added that they lead to transparent and accurate financial reports. Moreover, Huse and Solberg (2006), McInerney-Lacombe, Bilimoria and Salipante (2008) analysed that diverse boards more

readily discuss tough issues than all male boards. Even though some studies wholeheartedly support homogeneous boards the exponents of gender diverse boards are in majority.

This study is an attempt to arrive at consensus by conducting empirical analysis of the significance of homogeneous boards in this longitudinal study. Following hypotheses are form to achieve the aforementioned:

H1: *Homogenous boards (all-male directors) negatively influence the firm value.*

Dimension 2: A woman director in corporate board – **Tokenism**

Many studies concluded that tokenism is the after effect of regulation and quotas established to maintain the presence of women directors on the corporate boards. The regulations introduced in the Companies (Amendment) Act 2013 made the presence of women directors compulsory in Indian companies' boards. Companies were running against time to adhere to the regulation as deadline was April 2015. Most of the companies resorted to appointing their family members to comply with this compulsion while some saw this as an opportunity of adding well-qualified directors on board and promoting gender-balanced boards.

Kagzi and Guha (2018), Sanan (2016), Srivastava, Das, and Pattanayak (2018) studied this topic in the Indian context. Chauhan and Dey (2017) concluded that tokenism exists in Indian boards as women are appointed to comply with the regulation. Findings of aforementioned studies also suggest that significance of female directors is shadowed under patriarchal society like India.

Kanter (1978) emphasized that women are under intense scrutinization and suffer from negative evaluation bias due to gender stereotypes and their token status. Any action performed by women directors is dissected, which forcethem to perform well. Second, they feel isolated from informal communications, as they are not part of "boys club". Kanter (1978) called it boundary heightening. Women directors are delegated Gender stereotyped-roles and expected to embrace it wholeheartedly. Moreover, women in leadership are still not accepted. Kanter (1978) called this term 'role encapsulation'(Yoder, 1991).

Fraga and Silva (2012) evaluated board performance of Brazilian firms and concluded that firms with even one female director are more likely to succeed as compared to firms that do not employ female directors at all. Terjesen, Couto, and Francisco (2016) studied 3,876 public firms in 47 countries and analysed that female presence makes a positive effect on firm effectiveness.

Srivastava, Das and Pattanayak (2018) also established that the negative impact of female directors on firm value is due to the fewer number of women directors in Indian companies and their tokenism status. However, Kagzi and Guha (2018) and Sanan (2016) found no significant association of gender diversity with firm performance and social performance. Different studies employed different methodologies to compute the effect of gender heterogeneity, which is one of the reasons for mixed results. Both developing and developed countries have their

share of diversified results and there is huge complexity to reach a consensus. Therefore, there is a need for concord through the longitudinal study.

The effect of tokenism, its impact on firm performance and the relevance of regulation implemented by India about gender diversity are analysed through following hypotheses:

H2: *Indian gender diversity regulation positively influences the presence of women in Indian corporate boards.*

H3: *Tokenism (presence of one-woman director) negatively influences the firm value.*

Dimension 3: Two women directors in corporate board - **Twokenism**

Rosenstein and Wyatt (1990), Block (1999) and Catalyst (2004) comment on favours of gender diversity concerning firm performance but Jehn and Bezrukova (2003) and Bo¨hren and Stro¨m (2005) proved that the converse is true. Finally, the studies of Watson et al. (1993), Shrader, Blackburn and Iles (1997), Richard (2000), Smith, *et. al.* (2006) and Rose (2007) show there is no effect of gender diversity on firm performance.

Kanter (1978) argued that if the absolute size of the skewed group is small, tokens can also be solo but it is not essential, two could be 'token' as it is difficult for them to generate an alliance that can become powerful in the group. You (2019) drawing on the same perspective compiled that one is token, two is a minority and there is a voice in three. The term 'twokenism' used in literature to represent the presence of two women directors. Pathak and Purkayastha (2016) raised the opinion that traditional boards are "old boys" clubs, which makes it difficult for outsiders especially women to change the status quo. Most of the resources and information get passed informally in this club; thus women fail to contribute to important discussions. Presence of one or two women directors is not enough to tear apart this informal group of male directors and be part of significant group decisions. However, many studies claim that this perceived bias may motivate them to perform really well.

Loyd, White and Kern (2008) provide additional concern that there is immense stress and isolation faced by a duo as they face inter-group pressure from the majority group. Moreover, the women directors also need to provide social support to one another. Chang, Milkman, Chugh and Akinola (2019) also agree that twokenism is new tokenism. Appointment of two women directors to give illusion of diversity and present a better image, that corporates are involved in board gender diversity is more that of regulatory acceptable level. However, this appointment is to avoid immense scruntization of the firm. Even though presence of two women directors is new tokenism, there is still a dearth of studies analysing its impact on firm value. Most of the recent studies have neglected twokenism, i.e., new form of tokenism. Thus, there is a need for this study, to examine this

neglected relationship. It demands empirical examination of the impact of twokenism on firm value of Indian corporate boards. The following hypothesis is formed to achieve the aforementioned:

H4: *Twokenism (presence of two women directors) negatively influences the firm value.*

*Dimension 4: Presence of three or more directors to symbolize **Critical mass***

Kanter (1978) established that there is a need of three or more women directors to affect the group dynamics and avoid the bias exhibited by male directors. This presence of at least three or more directors is termed as 'critical mass'. In contrast, Dahlerup (1988) conducted empirical analysis and found that specific percentage of women is not responsible for change in organisation but the 'critical acts'. Author argue that concept of critical mass is not supported in the subject of political science.

However, Joecks, Pull and Vetter (2013) supported the argument of gender-diversified boards and advocated importance of critical level of women directors to obtain favourable performance. Authors called the presence of three or more women as 'magic number' of women on corporate boards. Brammer, Millington and Pavelin (2009) established that there is need for firms to reflect on their image of gender diverse boards on consumers for favourable corporate reputation. Erkut, Kramer and Konrad (2008); Konrad, Kramer and Erkut (2008) advocated that presence of at least three women directors influence board dynamics and increase the likelihood of having their voices heard. These studies are founded on discussion based findings and interview of women directors. It can be said that when there are at least three or more women directors, then they do not just present 'women's point of view' but are seen as individuals with their skills and experiences. Farrell and Hersch (2005), Burgess and Tharenou (2002), Burke (1997) presented that women add value to homogenous board in case there is balanced board with adequate number of women directors which advertise significance of critical mass in a corporate board. Wiley and Monllor-Tormos (2018) conducted an empirical analysis and proved that board gender diversity yields higher firm performance when three or more women directors are present on a corporate board.

To conclude, most of the studies advocate the importance of critical mass to have positive impact on firm performance. Drawing on the aforementioned theories and literature review, following hypothesis is formed to analyse significance of critical mass for its contribution to firm value:

H5: *Critical mass (at least three or more women directors) positively influence the firm value.*

Conceptual Model

Figure 1: Conceptual Model
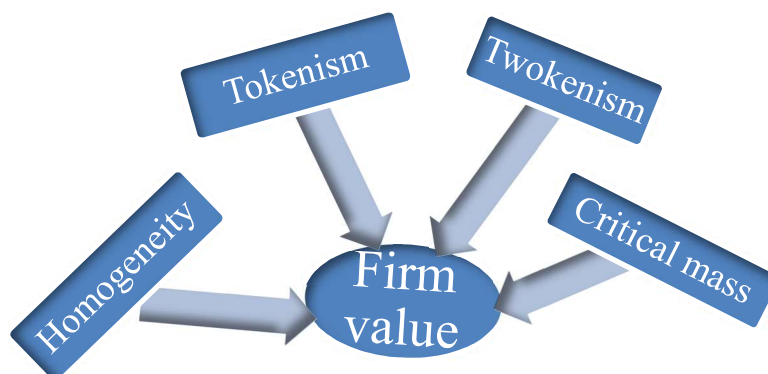
Source: The author.

Conceptual model formed to achieve these research hypotheses

III Research Methodology

Sample Selection

The sample of study constitutes BSE top 100 companies as collected on 2nd July 2019. Datasheet excludes all the banks and financial institutions, as these are liable under different regulations and governed by different authorities. Companies which do not have data pertaining to sample years available, were removed. This led to a filtered sample of 992 firm-year observations comprising of 62 firms for 16 years. The sample period is from March 2009 to March 2021 that led to a final sample of 756 observations. Further, lagged values of explanatory variables are considered for regression analysis

Variables used in the study

Pre and Post Analysis: Two Categorical variables**,** Treatment and time are used. "Time" variable took the value of "1" after 2013 to represent the Companies (Amendment) Act, 2013 regarding gender heterogeneity and "0" for a period before the regulation. Time is "1" for the period from 2014 to 2021 and "0" from 2006 to 2013 as 2013 considered as an event year. "Treatment" variable takes the value of "1" for the treatment group, i.e., companies who appointed women directors after Companies (Amendment), Act and "0" for control group, i.e., companies who have women directors before Companies (Amendment) Act, 2013.

Tokenism and Critical Mass Analysis: Table 1 shows a brief explanation of variables selected for the regression model for tokenism and Critical mass analysis.

Table 1: Variables Used in the Study

Dependent Variable	
Tobin's Q ratio	$\dfrac{Market\ Value\ of\ Equity + Book\ Value\ of\ Debt}{Book\ value\ of\ Assets}$
Independent Variable	
Male Director (MD)	Categorical variable takes value of '1' when all directors are male and there is no presence of woman director or '0' otherwise (represent homogenous board)
Female Director (FD)=1	Categorical variable takes value of '1' when only one female director is present or '0' otherwise (represent tokenism)
Female Director (FD)=2	Categorical variable takes value of '1' when only 2 directors are present or '0' otherwise (represent twokenism)
Female Director (FD)at least 3	Categorical variable takes value of '1' when three or more female directors are present or '0' otherwise (represent critical mass of women directors)
Control variables	
Total Board Size (TBD).	Board size is recorded from the board composition of firms reported in the annual reports of company as on 31st March of each financial year
Firm age (AGE)	Natural logarithm of total number of years of selected Indian companies starting from firm's incorporation year till Mar 31, 2021 has been taken
Firm size (SIZE)	Natural logarithm of total assets
Leverage	Debt/Equity ratio

Source: The author.

IV Analysis and Results

Difference –in-difference Estimator (DID)

This study employs Difference-in-difference (DID) estimation method to examine the effect of Companies (Amendment) Act regarding compulsory presence of women director in Indian corporate boards on treatment firms and control group. The DID approach tests for changes in the presence of women directors between 'treatment group' that compulsorily appointed women directors after the regulation and 'control group' that voluntarily appointed women directors before the regulation. The sample for difference-in-difference analysis consists of 304 observations for control group and 688 for treatment group. The DID model is explained as follows:

$$FD_{it} = \beta Treatment_{it} + YTime_t + \delta did + Covariates + \varepsilon_{it}$$

Where FD = number of female directors on Indian corporate boards for individual i and time t, α = constant term, β = treatment group specific effect, Y = time trend

shared by control and treatment group, did = DID estimator which is true effect of treatment, Covariates = control variables such as total board size, age, size and leverage and ε is the residual term.

Pre-test Assumption – Parallel Trend Assumption

This assumption states that the treatment and control group may have different outcomes after the treatment but their trend in pre-treatment outcome should be same. It means that the difference between "treated" and "control" group are constant over time in the absence of treatment that is amendment of Companies Act, 2013 in this case. Major highlight of this amendment was the mandatory presence of a woman director in corporate boards, which is also the focus of this study. Graph 1 is not a statistical test but a visual inspection, used to prove parallel trend of "treated" and "control" group over period of many years. The intercept shows year "2013" to represent amendment in Companies Act, 2013.

Graph 1: Parallel Trend Assumption
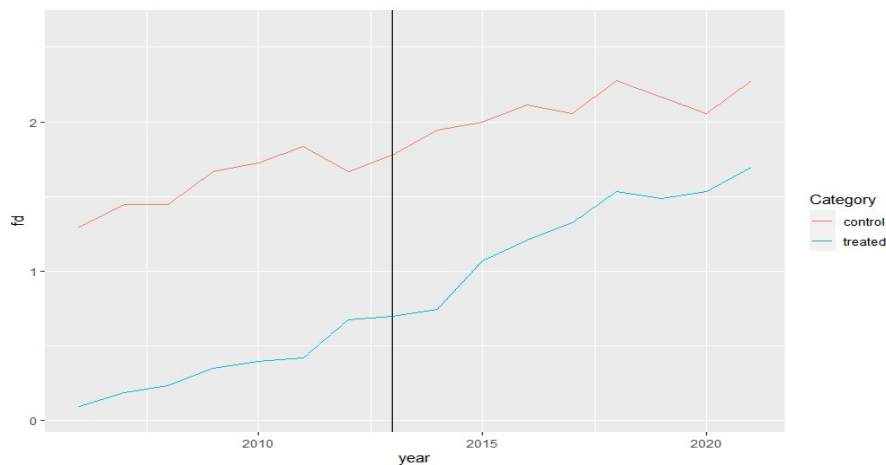
Source: The author.

Difference-In-Difference Estimation

Table 2 shows the results of the difference-in-difference estimator of the effect of gender diversity regulation on the presence of women directors in selected treated and control groups. It shows that regulations related to gender diversity have a positive and significant impact on the increasing presence of women directors in Indian corporate boards. It supports H2. The interaction term (treatment*time), i.e., DID is positive and significant at a one per cent level of significance which shows the true effect of treatment, i.e., the positive impact of this regulation. It analyses the change in appointment of women directors from a voluntary decision to legal compulsion.

Table 2: P Difference-In-Difference Estimation

Variable	FD
Time	0.52455 (4.51e-07) ***
Treatment	-1.19357 (< 2e-16) ***
DID	0.45318 (0.000146) ***
Constant	0.37288 (0.235510)
Adjusted R-squared	0.3493
Observations	992
Number of groups	62

Notes: *, **, *** statistically significant at 10 per cent, five per cent and one per cent respectively. (The values in parenthesis are p- values).
Source: The author.

Results depict that the appointment of women directors was more in companies with no women directors, as compared to firms that already had women directors on their board, due to regulations introduced by the Indian government. It would have taken many years for firms to appoint women directors without such regulation. This amendment sped up the process of heterogeneity in corporate boards of Indian companies.

Correlation Analysis

Table 3 shows that there is no multicollinearity as the correlation between the variables do not exceed 0.80. There is weak correlation between presence of woman director and Tobin's Q, which is a proxy for firm value, but causation between female directors and firm value are not significant. There is significant but negative correlation between control variables and firm value but only total board size (TBD) is found to be negatively insignificant which shows the irrelevance of a number of board members in relation to firm value.

Table 3: Correlation Analysis

Variables	TOBINSQ	FD	TBD	SIZE	AGE	LEVERAGE
TOBINSQ	1.000000					
FD	0.047742 (0.1329)	1.000000				
TBD	-0.041527 (0.1913)	0.149193 (0.0000)***	1.000000			
SIZE	-0.423130 (0.0000)***	0.132144 (0.0000)***	0.135224 (0.0000)***	1.000000		
AGE	-0.135180 (0.0000)***	-0.000966 (0.9758)	0.135074 (0.0000)***	0.314315 (0.0000)***	1.000000	
LEVERAGE	-0.371988 (0.0000)***	-0.040653 (0.2008)	0.059013 (0.0632)*	0.180029 (0.0000)***	-0.058771 (0.0643)*	1.000000

Notes: *, **, *** statistically significant at 10 per cent, five per cent and one per cent respectively.
Source: The author.

Regression Analysis

Model Specifications

The following model, employs regression analysis between firm value and presence of women director where lagged explanatory variables are used:

$$\text{TobinsQ}_{it} = \beta_0 + \beta_1 \text{presence of women director}_{it-1} + \beta_2 \text{control variables}_{it-1} + \gamma_i + \delta_t + \varepsilon_{it}$$

Table 4 depicts regression analysis of the presence of women directors on firm performance of selected companies. There is heterogeneity across cross-sections and periods as examined by maximum Likelihood ratio. The rejection of null hypothesis of Hausman test shows the suitability of the fixed-effects model. Therefore, Two-Way Fixed Effects Model with Robust Standard Errors are employed to analyze the impact of the presence of women directors on Tobin's Q. Another reason for the selection of this model is the presence of first-order autocorrelation where disturbances in one period interconnected with previous periods (Woolridge 2002). Greene, 2002 emphasized the appropriateness of a fixed-effect model with robust standard errors to deal with autocorrelation in case of these disturbances. Further, the problem of endogeneity is rectified by employing lagged variables of explanatory variables.

Table 4: Two-way Fixed Effect Models with Robust Standard Errors to Analyse Tokenism and Critical Mass Theory

Variable	Model 1 (MD)	Model 2 (FD=1)	Model 3 (FD=2)	Model 4 (FD atleast3)
c	6.871412 (0.2047)	6.838217 (0.2127)	6.910674 (0.2003)	6.972482 (0.2045)
MD(-1)	-0.033195 (0.9082)	--	--	--
FD=1(-1)	--	0.033195 (0.9082)	--	--
FD=2(-1)	--	--	-0.362925 (0.2801)	--
FD at least3(-1)	--	--	--	0.110515 (0.8308)
TBD(-1)	2.490512 (0.0009)***	2.490512 (0.0009)***	2.566146 (0.0009)***	2.490556 (0.0010)***
SIZE(-1)	-1.492400 (0.1335)	-1.492400 (0.1335)	-1.510119 (0.1242)	-1.510915 (0.1358)
AGE(-1)	-0.224942 (0.8820)	-0.224942 (0.8820)	-0.244980 (0.8670)	0.236675 (0.8723)
LEV(-1)	-1.699883(0.0000)***	-1.699883(0.0000)***	-1.709768(0.0000)***	-1.707038(0.0000)***
Adjusted R-Sq.	0.801404	0.801404	0.801804	0.801420
Obs.	756	756	756	756

Note: *, **, *** statistically significant at 10 per cent, five per cent and one per cent respectively.
Source: The author.

Two-way Fixed Effect Models with Robust Standard Errors to Analyse Tokenism and Critical Mass Theory

The Datasheet consists of 819 observations where the period from March 2009 and March 2021 is considered. Use of lagged explanatory variables led to final sample of 756 observations.

Model 1 show the result of the analysis where all-male directors are present on board with no woman directors. Total board size and leverage are negatively significant at a one per cent level of significance among the control variables. The results show an insignificant effect of homogeneity on the market value of the firm as represented by Tobin's Q. Thus, the result supports H1. It shows a negative sign of coefficient that represents that homogeneous board has an inverse relationship with performance. It shows the irrelevance of homogeneous boards that is all-male boards, during present times.

Model 2 and model 3 also show the consistent result with the exception of positive signs of the presence of a woman director (FD=1). This sign may be just due to anticipation about what difference a woman director can make to the corporate board and thus, to firm value. The results of models 2 and 3 show that boards with one and two women directors also have an insignificant effect on the market value of the firm. Results support H3 and H4.

Model 4 shows the quite contrasting result, which defies critical mass theory. It shows the insignificance of the presence of three or more woman directors over firm value. Thus, the model does not support H5. It may be happening due to changing times and the acceptance of corporate boards to embrace heterogeneous boards. The irrelevance of gender and emphasis on qualification in the corporate board may be the cause of these contrasting results. India prepared an independent directors database, which includes directors based on their qualifications irrespective of their gender. Companies can choose this database to select their independent directors. This leap towards the irrelevance of gender may explain the results showing insignificance of both homogenous and heterogeneous boards but importance on qualification of individual directors.

Overall, this study concludes that the Companies (Amendment) Act, 2013 has a significant impact on the appointment of women directors but it also gave rise to the problem of tokenism. However, results show that presence of three or more women directors has an insignificant effect on firm value. To summarize, "India is moving towards gender equality" or "irrelevance of gender is found in corporate boards of Indian companies". This study emphasizes diversified boards where the presence of both genders has equal pertinence.

V Discussion and Conclusion

We have conducted pre and post-analysis of the presence of women directors for the policy evaluation of the Companies (Amendment) Act, 2013. Findings reveal that the appointment rate of women directors was higher among firms that mandatorily appointed the directors as compared to firms that voluntarily appointed women directors before the amendment in the act as based on a sample of BSE100 companies. Amendment of Companies' Act, 2013 led to employment of women directors to meet the new regulatory requirement. The vast majority of firms employed women from their families as independent directors of the firm. Only a few firms established a superior example for others by maintaining

diversified boards. In many studies, scholars established inconclusive results of this ubiquitous debate. This study analyzes tokenism and critical mass of women directors by employing two way fixed effects model with standard errors. Results show the insignificant impact of homogenous boards, token status, and critical mass theory in the Indian environment.

Many studies give justified results that critical mass matters and has a positive impact on firm performance (Lafuente and Vaillant 2019). This study advocates for gender-balanced boards based on the results obtained. Social responsibility of corporate firms advocate that both male and female directors should get equal opportunity for an appointment and judge purely based on qualifications. This study raises the important issue of tokenism, which is the need of the hour with recent changes in corporate governance and supports a gender-balanced approach with emphasis on qualification and experience. It advocates equal opportunity for ideas and opinions of each director. Still, this study has some limitations such as use of categorical variables to study the impact of tokenism and the relevance of critical mass. Further, future studies can carry out longitudinal analysis for tokenism exploration and critical mass reliability in developing economies with other proxies and methodologies. The significance of women directors in the case of turbulent times also makes good research area. Each economy is different from another due to many socioeconomic factors, which make all the distinctions in analysis.

VI Implications of Study

This study raises the issue of homogeneity and its detrimental impact on firm value. Earlier practices of all-male directors are not suitable for the functioning of a firm in a diverse environment. The introduction of a single woman director is also not proper, as it will only lead to tokenism. Findings suggest that regulators should take steps to ensure the achievement of a balanced diverse corporate board to remove gender bias altogether and emphasize on qualification and unique skills of directors. This study also highlights the importance of regulation like the compulsory appointment of women directors implemented by the India Companies (Amendment) Act, 2013. India started conducting online proficiency self-assessment tests for independent directors to ascertain their expertise and proficiency. It is a great move for the appointment of qualified directors. India is reaching towards gender equality to reach a stage where gender will never be criteria for significant decisions.

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Anticipating an Impending Crisis: ARIMA-Based Forecasting of Total Fertility Rate of West Bengal, India

Jeet Saha and Zafar Iqubal

This research paper examines the alarming decline in the Total Fertility Rate (TFR) in West Bengal, a state in India, which has reached a remarkably low level of TFR- 1.4. This TFR is even lower than that of several developed European countries. Utilizing the ARIMA forecasting model, the study provides future projections of the TFR in West Bengal until 2030. The findings highlight the urgency of addressing the implications of such low fertility rates on the state's population structure, social dynamics, and economic development. This paper emphasizes the need for targeted interventions and policies to counter the declining TFR trend. The findings of this study provide valuable insights for policymakers, researchers, and stakeholders concerned with sustainable demographic development in West Bengal.

Keywords: Total Fertility Rate, Demographic Trends, Demographic Transition, Forecasting, ARIMA

I Introduction

A prominent demographic indicator that provides important insights into population dynamics and reproductive human behaviour is the total fertility rate (TFR). It serves as a widely-used gauge for current fertility rates and represents the typical number of children a woman will have over her lifetime in a certain geographic region (Singh, Singh and Singh 2020). The study of TFR is essential in giving policymakers insights for effective population management, resource allocation, and social development because unchecked population growth has negative effects (McClamroch 1996).

Future population growth can be predicted and population health can be evaluated by analysing the TFR trend. Replacement fertility, which is defined as having 2.1 children per woman in developing nations, denotes a population level that precisely replaces itself from one generation to the next (Craig 1994). For long-term stability in population growth and a balanced age structure, replacement fertility must be maintained. On the other hand, sub-replacement levels of reproduction, such as TFR below 2.1, create serious issues since they lead to a rise

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in the proportion of elderly people, which puts a burden on social security, healthcare systems, and the local economy as a whole (Morgan 2003).

The most populous nation in the world, India, has recently witnessed a TFR that is just below replacement ratio (United Nations 2022). Considering the size of India's population, this is good news. However, it is anticipated that India won't achieve its population peak until 2064 (United Nations 2022). Numerous demographers and institutions have made sound estimates for India's population, showing that its growth trend is intrinsically steady. Notably, some Indian states, including Uttar Pradesh and Bihar, continue to have TFR levels that are much higher than replacement fertility, but others such as Tamil Nadu and West Bengal have far lower fertility rates. These inter-state differences in TFR can have major repercussions on the country's demographic structure, including differences in population growth, economic disparities, gender disparities, imbalanced dependency ratios, and possible implications on interstate migration.

The fourth-most populated state in India, West Bengal, has a worrying TFR of 1.4 in 2020, the state on which our study is especially focused. Our investigation seeks to evaluate the seriousness of this fertility level and project its long-term future. Over the past three decades, West Bengal's TFR has significantly decreased, dropping from 4.5 in 1975 (Basu and Amin 2000) to 1.4 in 2020 (Sample Registration System 2020). According to Bongaarts (2002), many women in affluent nations want to have only two children. West Bengal, despite not being a developed state in India, has observed a similar trend. In addition, some women are content with having just one child due to the son preference engendered by the patriarchal structure of Indian society (Dharmalingam, Rajan and Morgan 2014). These elements together have almost forced West Bengal to deal with the problem of "lowest-low fertility," which is a fertility rate below 1.3 and was a topic of discussion in the 1990s in the European context (Kohler, Billari and Ortega 2002). Demographers in the 1990s were unable to anticipate the rapid decline in fertility that has been observed in Europe, which has had important ramifications (Eun 2007). Therefore, it is essential to comprehend and manage this significant issue on the declining total fertility rate of West Bengal.

II Literature Review

According to Morgan (2015), a sizeable chunk of the world's population lives in nations with fertility rates below replacement. Wilson (2004) noted that low fertility rates are more common in East Asia, Western and Central Europe, and are likely to cause population decreases in the future. In developing nations like China, Thailand, Brazil, and some regions of India, below replacement fertility rates have also been noted. Eun (2007) focused on the negative economic and social effects of low fertility, such as difficulties in the labour market and alterations to daily living, which are particularly pronounced in South Korea. Low fertility rates, according to Coale (1986), not only have economic repercussions, such as a shrinking labour force and higher transfer payments, but they also have important

social repercussions, such as fewer collateral relatives for children and a shorter parental lifespan of dependent children. Specially in the Indian context, increasing sex bias in favour of male children in the Indian context has been linked to decreased total fertility rates (Das Gupta and Mari Bhat 1997).

Despite regional differences in timing and speed, India is currently going through a fertility transition (Paul and Kulkarnni 2006, Chauhan, Mohanty and Mishra 2019). Indian population fertility has been continuously dropping (Dash and Nagdeve 2020). According to Mohanty, Chatterjee, Das, Mishra and Chauhan (2019), below replacement fertility rates were present in 32 per cent of districts, which together made up 38 per cent of the population, as of 2011. The main causes of India's decreased fertility, according to Singh, Shekhar, Bankole, Acharya, Audam and Akinade (2022), were marriage, contraception, abortion, and post-partum infertility. The total fertility rate of India was predicted by Tripathi, Mishra and Upadhyay (2018) using the ARIMA model. We use the ARIMA model to estimate the same for West Bengal in this study,.

The TFR in West Bengal is among the lowest in India (Chatterjee 2019). From Stage 1, which is marked by high but declining fertility, to Stage 5, which denotes low and steady fertility below replacement levels, the state has changed. By 2005, West Bengal had replacement fertility (Debnath, Barman, Roy and Islam 2021) but the fertility rate in West Bengal continues to fall. TFR of this state is significantly influenced by social and cultural factors, including religion and female literacy (Basu and Amin 2000, Haque and Patel 2016, Chouhan, Saha and Zaveri 2020). The case of the Kolkata district in West Bengal serves as an illustration of how historical causes and diffusion processes also contribute to the low fertility rate (Chatterjee 2020). A cross-sectional survey conducted in the Howrah region of West Bengal found that respondents lacked knowledge about family planning and did not have desired number of children compared to what they had hoped for (Jha, Baur, Haldar and Dasgupta 2014). Thus, the fertility rate in West Bengal is impacted by this lack of educated decision-making. According to Morgan (2015), fertility below 1.5 is considered extremely low, and it is noteworthy that West Bengal's fertility rate is even lower.

Using the Autoregressive Integrated Moving Average (ARIMA) model developed by Box and Jenkins (1970), the goal of this study is to predict the future Total Fertility Rate (TFR) of West Bengal. The ARIMA model is a common extrapolation technique used in many fields, including economics, finance, social issues, and demography. It relies solely on historical time series data to project future values (Datta 2012).

The ARIMA model has been effectively used in earlier studies to predict TFR in various regions. For example, Waseem and Yasmeen (2016) used the ARIMA model to predict Pakistan's total fertility rate, while Shitan and Ng (2015) used it to predict Malaysia's total fertility rate. The ARIMA model has also been applied to demography to forecast future values of numerous variables (Saboia 1977, Mumbare, Gosavi, Almale, Patil, Dhakane and Kadu 2014, Chang and Lai 2019).

By applying the ARIMA model to the historical TFR data of West Bengal, we seek to provide insights into the future fertility trends of the state. This forecasting effort will help us better understand West Bengal's population dynamics and reproductive behaviour. The findings will also be helpful for scholars and policymakers who are tackling the issues of population control, resource distribution, and social development in the area.

III Data and Methodology

Data

This analysis relies solely on secondary data obtained from reputable sources. The historical time series data used in this study was acquired from the Economic and Political Weekly Research Foundation India Time Series (EPWRFITS) database. EPWRFITS is widely recognized for its accurate, timely, and comprehensive time series data on the Indian economy and social indicators. Additionally, to compare West Bengal's fertility with countries experiencing similar fertility challenges, we utilized the World Development Indicators provided by the World Bank. Other sources, including the Sample Registration System 2020, National Family Health Survey-5, and Global Data Lab Database, were also incorporated into this study.

For the forecasting analysis, a total of 39 samples were selected. Traditionally, it was believed that a minimum of 50 samples was necessary for reliable ARIMA forecasting (Kenny, Meyler and Quinn 1998). However, recent advancements in the field have demonstrated that smaller sample sizes can also be used for accurate ARIMA forecasting (Abdullah 2012).

Methodology

Several East Asian and Western European nations are currently dealing with low fertility rates, which is causing a number of issues. It is required to contrast West Bengal's Total Fertility Rate (TFR) with that of other nations in order to demonstrate the severity of the state of the fertility problem there. Even though we accept that West Bengal is a part of a bigger country and doesn't suffer the same severe effects as countries with less mobile labour markets, this comparison offers important insights into the effects of low fertility rates. In order to highlight how special West Bengal's circumstance is, we also compare the TFR with those of other Indian states.

For the purpose of forecasting future fertility, we utilized the ARIMA model, which is a widely employed class of models for time series forecasting (Iqbal, Bakhsh, Maqbool, Ahmad 2005). Our analysis was conducted using EViews 12 software. To perform the ARIMA forecasting, we employed data from 1981 to 2019, obtained from the EPWRFITS database. An ARIMA (p, d, q) model comprises three components: autoregressive, integrated, and moving average.

For better model fitting, we applied a logarithmic transformation to the original variable prior to differencing.

Let, X_t= TFR of West Bengal at period t.

Y_t= $LogX_t$ = Log (TFR of West Bengal at period t)

The autoregressive part in ARIMA component refers to the dependency of the dependent variable on its lagged values or past values. In AR(p), p is denoted as autoregressive order. It stated the number of lagged observations of dependent variable to be included in the model. So, the AR(p) can be written as:

$$Y_t = \delta + \theta_1 Y_{(t-1)} + \theta_2 Y_{(t-2)} + \ldots\ldots + \theta_p Y_{(t-p)} + \varepsilon_t \qquad \ldots(1)$$

Where, Y_t is the value of the time series at period t. δ is the constant or intercept term $\theta_1, \theta_{2,\ldots,} \theta_p$ are the coefficients of the autoregressive term at lag 1,2,…,p. ε_t is the forecast error which has some important characteristics such as randomness, independence, constant variance, normally distributed and stationarity.

Noteworthy, for ARIMA forecasting we need stationary time series. But demographic time series variable shows stationarity rarely. When a time series is stationary, we can directly apply Autoregressive Moving Average or ARMA. In ARMA, the degree of differencing (d) is 0. . However, when the data is non-stationary we need to difference the time series. We found through Unit root test that, our time series which is the total fertility rate of West Bengal is non stationary at level. At first difference (d=1) it is stationary.

The third component of an ARIMA model is called moving average (MA). MA model assumes the value of a time series in the current period is a linear function of current and past residuals. The MA can be defined as

$$Y_t = \mu + \varepsilon_t + \theta_1 \varepsilon_{(t-1)} + \theta_2 \varepsilon_{(t-2)} + \ldots + \theta_q \varepsilon_{(t-q)} \qquad \ldots(2)$$

Where, ε_t is the residuals at time t. μ is the constant term. $\theta_1, \theta_{2,\ldots,} \theta_q$ are the moving average coefficients.

Thus, the ARIMA (p,d,q) can be expressed as,

$$Y_t = \delta + \theta_1 Y_{(t-1)} + \theta_2 Y_{(t-2)} + \ldots\ldots + \theta_p Y_{(t-p)} + \varepsilon_t + \theta_1 \varepsilon_{(t-1)} + \theta_2 \varepsilon_{(t-2)} + \ldots + \theta_q \varepsilon_{(t-q)} \qquad \ldots(3)$$

As our time series is Stationary in first difference, we can rewrite the ARIMA (p,d,q) equation as ARIMA (p,1,q) :

$$\Delta Y_t = \delta + \theta_1 \Delta Y_{(t-1)} + \theta_2 \Delta Y_{(t-2)} + \ldots\ldots + \theta_p \Delta Y_{(t-p)} + \varepsilon_t + \theta_1 \varepsilon_{(t-1)} + \theta_2 \varepsilon_{(t-2)} + \ldots + \theta_q \varepsilon_{(t-q)} \quad \ldots(4)$$

There are four stages of Box Jenkins iterative approach (Abonazel and Abd-Elfah 2019) namely

a) **Model identification**: Here we confirm that the concerned variable is stationary (at level or at differencing), we also check whether there are any seasonal components in the time series. And through correlogram of Auto-Correlation Function (ACF) and Partial Auto-Correlation Function (PACF) we identify the lags of AR and MA components.

b) **Model estimation**: Once p, d, q is found for the model we employ maximum likelihood estimation method to estimate the parameters in the model.

c) **Diagnostic checking**: Here we check for whether our residual is white noise. We check the normality of the residuals, ljung box test is also checked. We compare the AIC, SBIC, and symmetric MAPE. Adjusted R square value of several models choose the best model based on these criteria.

d) **Forecasting**: Finally, with the best fitted ARIMA model we forecast the future value from the known value.

IV Result and Discussion

Analysis of the current fertility of West Bengal

The Total Fertility Rate (TFR) of West Bengal has experienced a significant decline in recent decades, currently hovering just above the "lowest-low fertility" level, which is a cause for concern. Various factors contribute to this decreasing fertility trend, including urbanization, shifting attitudes and ideals, increasing per capita income, and rising population density. While the determinants of falling fertility are beyond the scope of this study, we encourage further comprehensive research on this topic.

The declining TFR in West Bengal and its comparison with India's overall TFR transition are depicted in Figure 1. West Bengal's TFR decreased by 67 per cent between 1981 and 2020, falling to a third of its previous value throughout those four decades. TFR at the national level has decreased 56 per cent during this period. This is concerning because West Bengal has historically seen continuously low fertility rates going all the way back to the British era. Even today, Kolkata district, which had the lowest fertility rate during the British period, continues to maintain the lowest fertility rate in India.

The Human Development Index (HDI) scores of states that closely mirror West Bengal in terms of TFR are especially high. Kerala and West Bengal are frequently compared in terms of their reproduction rates, however Kerala has a much higher HDI score 0.752 as of 2021 compared to West Bengal's HDI score 0.624 as of 2019 (Global Data Lab 2023). The HDI score for West Bengal is lower than the national average and is on par with Kiribati. Other low-fertility states and union territories, such Goa, Sikkim, and Himachal Pradesh, have HDI values comparable to those of Eastern European nations. High HDI scores can be found in Tamil Nadu, Punjab, and Andhra Pradesh as well. Therefore, the low TFR in these states can be attributed to development effects. Furthermore, West Bengal,

with its fertile Gangetic delta region, is naturally conducive to higher fertility rates. Hence, the low TFR of West Bengal attracts the attention of demographers.

A comparison of the total fertility rate (TFR) of West Bengal with certain countries and regions that frequently attract attention due to their TFR and the problems associated with it reveals the alarming situation in West Bengal. However, it is important to note that we do not claim that West Bengal will encounter the exact same problems as these countries. Being a part of a larger country, the state benefits from comparatively higher labour mobility. Additionally, other demographic indicators such as the death rate differ between these countries and West Bengal. Although comparing a state with countries may not provide a complete picture, it does give a general idea of the concerning TFR in the state.

Figure 1: Total Fertility Rate of India and West Bengal
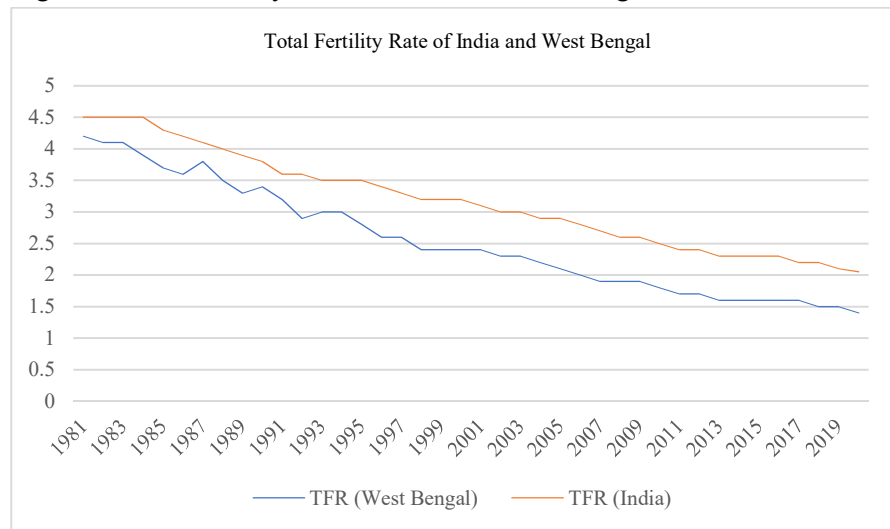
Source: EPWRFITS.

Table 1 shows the low TFRs of different countries and compares them with West Bengal. Countries and regions such as Japan and East Asia, China, and Europe have long been the subject of discussions on low fertility rates (Suzuki 2019, Boiling 2008, Wu 2020, Guo and Gu 2014, Cai 2010, Bilari and Kohler 2004). However, there is limited research on the low fertility rate of West Bengal. Nevertheless, it is a fact that the TFR of West Bengal is even lower than that of the European Union, the United Kingdom, Germany, Norway, Sweden, and other developed countries in Western Europe. It is only slightly higher than Japan, which is grappling with a shrinking population.

Table 1: Total Fertility Rate of Different Regions

Region	TFR	Region	TFR
India	2.05	Germany	1.53
Denmark	1.68	Russia	1.51
Sweden	1.67	European Union	1.50
U.S.A	1.64	Norway	1.48
OECD members	1.59	Switzerland	1.46
Australia	1.58	West Bengal	1.40
United Kingdom	1.56	Japan	1.33
Netherlands	1.54	China	1.28

Source: World Bank; Sample registration system, 2020.

ARIMA Forecasting of Future TFR of West Bengal

Model Identification

To assess the stationarity of the time series, we first use the correlogram at the level (See Figure 2). The autocorrelation function (ACF) and partial autocorrelation function (PACF) indicated that the variable is non-stationary at the level.

Figure 2: Correlogram at Level
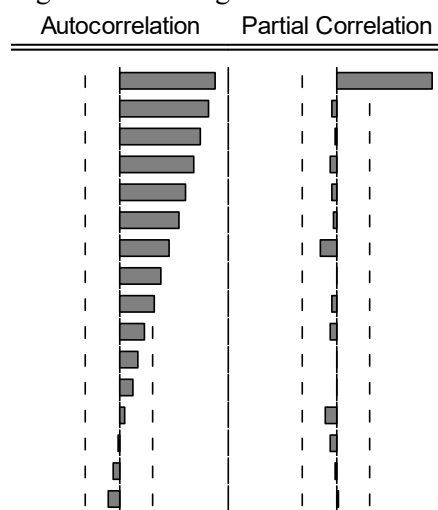
Source: The authors.

After that, we performed official unit root tests to validate the stationarity. By using these tests, you can find out if a time series variable displays a unit root, which denotes non-stationarity. Statistical characteristics like mean and variance that are present in non-stationary time series change over time and are not constant.

For unit root testing, we used the Augmented Dickey-Fuller test (ADF) and Phillips-Perron test (PP) (See Table 2). The presence of a unit root in the time series serves as the null hypothesis in both tests. Stationarity is demonstrated by the null hypothesis being rejected. We included both the trends and intercept in the unit root tests because our variable has a trend component (Aljandali and Tatahi 2018). The findings make it clear that our variable exhibits stationarity in the first difference, allowing us to proceed to the next step.

Table 2: Unit Root Test

Unit Root Test	ADF test (t statistics)		PP test (t statistics)		Conclusion
	Intercept + trend	Intercept only	Intercept + trend	Intercept only	
At Level	-3.43	-0.79	-3.36	-1.04	Non-stationary
At First Difference	-7.56*	-7.42*	-9.87*	-8.77*	Stationary

Notes: *, ** refers rejection of null hypothesis at one per cent and five per cent respectively.
Source: The authors.

Finding the Lags

Based on the correlogram of the variable in the first difference, we can identify the potential values for the autoregressive (AR) and moving average (MA) components of the ARIMA model. In this case, the possible values for both the AR and MA components are 2 and 5, as depicted in Table 3 and Figure 3. This suggests that the potential models that could be considered for this data are ARIMA(2,1,2), ARIMA(5,1,2), ARIMA(2,1,5), and ARIMA(5,1,5). These models represent different combinations of lag values for the AR and MA components and can be further evaluated to determine the best-fitting model for forecasting the total fertility rate of West Bengal.

Figure 3: Correlogram at First Difference
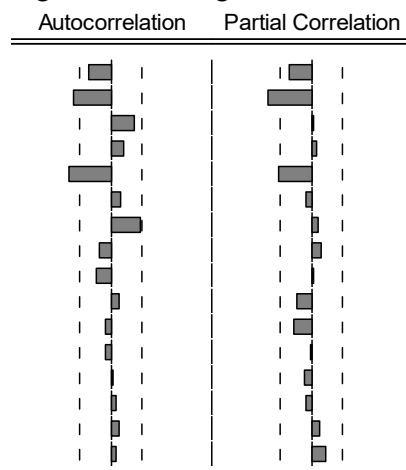
Source: The authors.

Table 3: Identification of Lag and Potential Model

D	P	Q	Models
1	2,5	2,5,	ARIMA (2,1,2), ARIMA (5,1,2), ARIMA (2,1,5), ARIMA (5,1,5)

Source: The authors.

Estimation and Evaluation

Based on the estimation and evaluation in Eviews, the ARIMA(2,1,5) model was selected as the final model based on criteria such as AIC (Akaike Information Criterion), SBIC (Schwarz Bayesian Information Criterion), and adjusted R-square (Nyoni 2018) (See Table 4). This model has a parsimonious structure with only two variables.

In the ARIMA(2,1,5) model, the MA(5) coefficient is found to be significant at a 5 per cent significance level, indicating a negative effect on the dependent variable. The AR(2) coefficient is significant at a 10 per cent significance level and also has a negative effect on the dependent variable. The intercept term is also found to be significant and negatively affects the dependent variable.

Overall, the selection of the ARIMA(2,1,5) model is supported by its superior fit based on the evaluation criteria, as well as the significance of the independent variables in the model. The results of the ARIMA(2,1,5) model are depicted in Table 5.

Table 4: Model Evaluation

Model	AIC	SBIC	Adjusted R square
ARIMA(2,1,2)	-3.76	-3.59	0.08
ARIMA(5,1,2)	-3.90	-3.73	0.21
ARIMA(2,1,5)	-3.91	-3.74	0.22
ARIMA(5,1,5)	-3.83	-3.66	0.16

Source: The authors.

Table 5: Estimation based on ARIMA(2,1,5)

| Variables	Coefficient	Standard Error	t-statistics	p-value
intercept	-0.03	0.002	-10.913	0.00
AR(2)	-0.30	0.164	-1.846	0.07
MA(5)	-0.42	0.191	-2.200	0.03

Source: The authors.

Diagnostics of the Model

Stability Test

All the AR and MA root lie inside the unit circle which suggests the ARMA process is stationary and invertible (See Figure 4). When in an ARIMA model the

concerned inverse roots of the characteristics polynomia lie in the unit circle, the model is stable.

Figure 4: Inverse Roots of AR/MA Polynomials
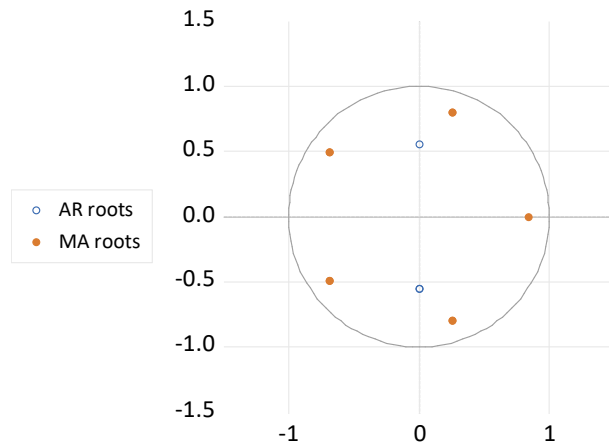
Source: The authors.

Correlogram of Residuals and Squared Residuals

In the correlogram of residuals all the spike lies within the standard error bound which suggests that all the information has been captured (See Figure 5 and Figure 6). In the correlogram of squared residuals all the lags are flat and p value above 0.05 indicates there are no autocorrelation.

Figure 5: Correlogram of Residuals

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.289	-0.289	3.4345	
		2	-0.026	-0.120	3.4636	
		3	0.045	0.002	3.5515	0.059
		4	-0.048	-0.040	3.6559	0.161
		5	-0.048	-0.077	3.7606	0.289
		6	0.038	-0.007	3.8309	0.429
		7	0.120	0.139	4.5345	0.475
		8	-0.076	0.009	4.8270	0.566
		9	-0.098	-0.125	5.3256	0.620
		10	0.029	-0.059	5.3699	0.717
		11	-0.050	-0.058	5.5102	0.788
		12	-0.008	-0.031	5.5138	0.854
		13	-0.023	-0.077	5.5451	0.902
		14	0.027	-0.034	5.5921	0.935
		15	0.105	0.138	6.3237	0.934
		16	0.052	0.183	6.5125	0.952

Source: The authors.

Figure 6: Correlogram of Squared Residuals

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.041	0.041	0.0675	0.795
		2	-0.058	-0.060	0.2108	0.900
		3	0.055	0.060	0.3408	0.952
		4	-0.044	-0.053	0.4255	0.980
		5	-0.040	-0.029	0.4988	0.992
		6	-0.039	-0.046	0.5712	0.997
		7	-0.125	-0.122	1.3410	0.987
		8	0.007	0.014	1.3431	0.995
		9	0.145	0.133	2.4471	0.982
		10	-0.079	-0.084	2.7865	0.986
		11	0.176	0.195	4.5211	0.952
		12	-0.013	-0.076	4.5312	0.972
		13	-0.178	-0.151	6.4605	0.928
		14	-0.235	-0.279	9.9686	0.764
		15	-0.072	-0.057	10.313	0.800
		16	-0.120	-0.116	11.308	0.790

Source: The authors.

Normality of Residuals

In Figure 7, the p value is above 0.05, which confirms the normality of residual. Our p value is 0.748 and Jarque-Bera is 0.579 which clearly indicates residuals are normally distributed. The normality of residuals is an important assumption for valid statistical inference, efficient estimation and constructing of valid confidence and prediction intervals.

Figure 7: Normality of Residuals

Series: Residuals	
Sample 1982 2019	
Observations 38	
Mean	-0.000178
Median	-0.001675
Maximum	0.074761
Minimum	-0.056429
Std. Dev.	0.030794
Skewness	0.217081
Kurtosis	2.578942
Jarque-Bera	0.579162
Probability	0.748577
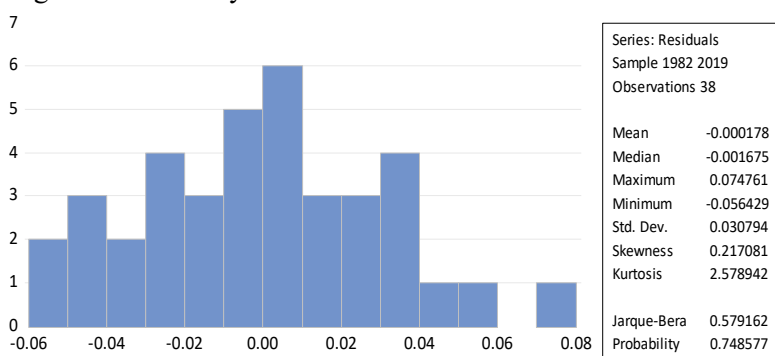
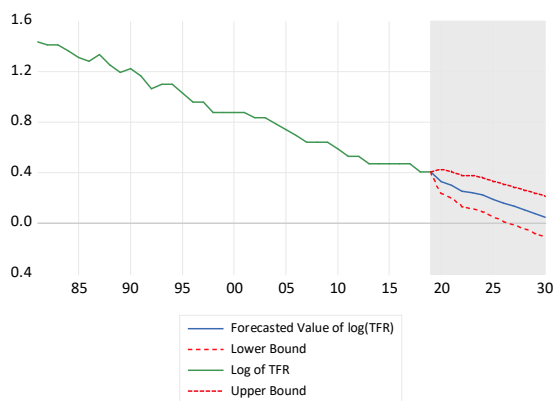Source: The authors.

Forecasting

Finally, we forecast our future values of the time series. We transformed our variable into logarithmic form for better model fitting. So, when we want to have forecasted value in the original scale, we exponentiated the transformed variable.

Value of upper bound and lower bound are taken by adjusting standard error from forecasted value. Figure 8 depicts the forecast of the log of TFR, while Figure 9 shows the forecast of TFR for West Bengal. Furthermore, Table 5 shows the forecasted values of TFR.

Our forecasted values indicating the downward trend of the total fertility rate of West Bengal continues. From 1.5 in 2019, the TFR reaches at 1.05 by 2030 which is extremely low TFR. Currently, there are not even ten countries worldwide with such low level of TFR.   Such a low level of TFR will have a significant impact in economy, society and polity. The need of the hour is that policymakers should urgently look after this issue.

Figure 8: Forecast of Log of TFR of West Bengal

Source: The authors

Figure 9: Forecast of TFR of West Bengal
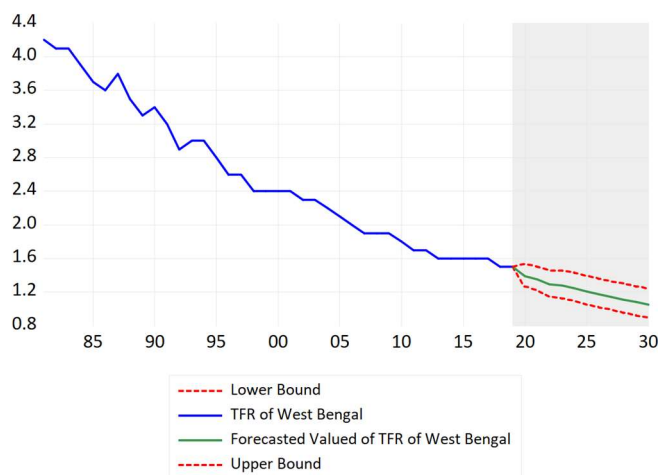
Source: The authors.

Table 5: Forecasted Value of TFR of West Bengal

Year	Forecasted Value	Upper Bound	Lower Bound
2020	1.39	1.53	1.26
2021	1.35	1.50	1.21
2022	1.29	1.46	1.14
2023	1.28	1.46	1.12
2024	1.25	1.43	1.09
2025	1.21	1.39	1.05
2026	1.17	1.36	1.02
2027	1.14	1.33	0.98
2028	1.12	1.30	0.95
2029	1.08	1.27	0.92
2030	1.05	1.24	0.89

Source: The authors.

V Conclusion

Our analysis highlights how seriously worrying the total fertility rate (TFR) in West Bengal is. The application of an ARIMA model has proven the TFR's persistent decreasing trend, calling for immediate attention and successful policy responses. Such a low TFR has ramifications in the social, political, and economic arenas, among other areas. Our findings lead to the following policy recommendations to solve this important problem:

a)   Considering the enormous diversity of the nation in terms of ethnicity, culture, and society, achieving demographic stability in India should be sought with an emphasis on regional balance. To meet the particular requirements of various regions, a decentralised population policy is required.

b)   Comprehensive sex education initiatives ought to be put into place to raise public understanding of the value of sound TFR, reproductive health, and prudent family planning.

c)   In order to ensure that the ageing population has simple access to reproductive health information and high-quality treatment, more investment in healthcare and family planning services is crucial.

d)   To increase knowledge and promote sound judgement, targeted family planning initiatives should be created and put into action.

e)   Strengthening the social security system is crucial to address the future challenges posed by an aging population.

f)   To prevent potential labour shortages, skill development programmes should be in line with future labour needs.

g)   Improvements in maternal and child healthcare services are necessary to reduce infant and maternal mortality rates.

h)   Empowering women to make informed decisions about their reproductive choices is essential for addressing the low TFR.

i) Introducing financial incentives, such as tax benefits, could incentivize family formation and childbearing.

j) Government support should be extended to infertility treatments to assist individuals and couples facing fertility challenges.

Given the neglected nature of this topic, we invite further research to comprehensively understand the population dynamics of West Bengal. The TFR reduction presents both opportunities and difficulties, and further study in this area will help us understand these issues better and develop evidence-based strategies.

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Willingness to Participate in Ecotourism Development: Local Community's Perspective

Rajdeep Deb and Himanshu Bhusan Rout

One of the major challenges in initiating development of a specific destination in tourism is the rate of participation of the local residents. The current paper attempted to study the willingness of the local community to participate in ecotourism development of Reiek, Mizoram. To study the objective, the researchers focused exclusively on the individuals residing in Reiek. A simple random sampling method was employed to choose 377 respondents from the local community. The findings revealed that the community's willingness to participate in ecotourism development was positive and supportive. However, no conclusive evidences were found to say that demographic variables of the respondents influenced their willingness to participate in ecotourism development of Reiek. Relevant discussions on policies, such as the significance of participation of human beings in ecotourism development could also be based on this study. Lastly, the current study is expected to help scholars, policy makers, and practitioners to carry out research in this direction to address various issues usually dominant in the field of ecotourism.

Keywords: Ecotourism, Willingness, Participation, Local community, Reiek, Mizoram

I Introduction

Ecotourism contributes positively to maintenance of ecosystems and the local economy's growth and development along with strengthening the local community's sociocultural aspects (Pornprasit and Rurkkhum 2019). The progress in ecotourism development vastly pivots around the participation of local population. Although, the literature has ample evidence that supports the significance of social participation in ecosystem management (Mountjoy, Whiles, Spyreas, Lovvorn and Seekam 2016), one of the major concerns of the researchers is with the rate of participation only (Charlson and Horwitz 1984). Effective long-term implementation of community-based ecotourism needs substantial

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community involvement (Jamal and Stronza 2009) and collaboration (Okazaki 2008). However, studies claim that the long-term engagement rate tends to diminish gradually (Morton, Cahill, and Hartge 2005, Galea and Tracey 2007). This research attempted to address the issue and considered the local community agency as one of the ecotourism drivers.

The phenomenon of ecotourism became a trend in the later part of 1980s (Wild 1994, p.12), but there exists ambiguity with the conceptualizations of the term (Dimitriou 2017, p.28). This argument finds support from Bjork (2000), who affirms that literature is still limited when it comes to kinds of areas that fall under ecotourism. Moreover, the conceptual clarity over the term ecotourism has little to do with the growing consumption of the term (Bottrill and Pearce 1995). In fact, the growing number of ecotourism definitions indicate that the concept is perceived differently by people (Orams 1995). There is a vast and ever-increasing literature on ecotourism worldwide that has touched upon various issues related ecotourism including definition, dimensions, and relation with other form of tourism and environmental management principles (Boyd and Butler 1996).

Ecotourism holds a vital position in the tourism industry of Mizoram. The initiative of the state and the Centre towards unlocking the northeast's largely unexplored eco-tourism potential, particularly in Mizoram, is evident. Moreover, Mizoram Government has been emphasising the importance of promoting responsible tourism, travel, and sustainability, and had recently framed a policy to that effect known as the Mizoram Responsible Tourism Policy, 2020 (India Today 2022). The importance of ecotourism in the state can be gauged from the fact that the Chief Minister of Mizoram, Shri Zoramthanga, had strongly voiced in support of Mizoram's ecotourism rapid growth and at the same time exuded confidence that the 'Mizoram Responsible Tourism Policy, 2020' will ensure that tourism in the state will scale greater heights (The Morung Express 2020). However, ecotourism sometimes creates some concerns regarding its success owing to inadequate understanding about its implementation and the unfitting use of nature (Pineda-Vides, Padilla, Granobles, Echeverri-Rubio, Botero and Suarez 2023). As such, the research focused upon community's willingness to participate in ecotourism development mainly because it can offer as a precondition for developing ecotourism (Palmer and Chuamuangphan 2018). Also, the local community is regarded as a fundamental basis for sustainable tourism development given that the it can affect its success or failure (Pineda, *et. al.* 2023). The current study was mainly focused on Reiek, considered to be one of the most unexplored and virgin tourist destinations in North-east India and especially Mizoram, which carries tremendous ecotourism potential and can propel the flow of tourists to the state. The study on this tourist destination is also critical in the sense that research in this area is highly constrained.

II Significance of the Study

This study tries to make notable contributions toward tourism planning literature from the perspective of research and practices. Also, the study holds prominence since there exists constrained empirical investigation in the field of ecotourism research in this part of India. So, pursuing empirical based study on the phenomenon in a state situated in one of the tourism-dependent regions of India-the Northeast, the study contributes to the matter. Currently, only limited studies have focused on exploring the willingness of local communities to participate in ecotourism development. Therefore, more empirical exploration in this direction can lead to better understanding on these issues, while supporting the extant literature in this field. Moreover, the information drawn from the study is expected to help scholars, researchers, practitioners, and policy makers seeking to unravel and understand the role of local communities in fostering the planning of ecotourism development process. On the other hand, this study can also provide some significant penetration into the dynamics of ecotourism planning and local community participation from the local residents' perspective. Lastly, the results of this study can be applied to all tourism destinations with similar features like the ones included in this research.

III Theoretical Underpinning

It is mainly described as a sustainable type of tourism, which is witnessing a phase of fast growth in the tourism industry (Sharpley 2006, Yeo and Piper 2011, Cobbinah 2015). Moreover, it presents a window to know destination through the nature and indigenous culture; implements the framework of sustainable tourism in terms of social, economic, and environmental nature (Pleșoianu, Grecu and Popescu 2018), enabling sustainable development of the region (Pavlidis, Solomou, Stamouli, Papavassiliou, Kritsis, Kiourt, Sevetlidis, Karetsos, Trigas, Kougioumoutzis, Goula, Proutsos, Pistikos, Theodoridis, Galanopoulos, Paraskevas, Foskolou and Papadopoulos). The theoretical framework applicable in the study includes:

The Social Exchange Theory

Wang, Pfister and Morais (2006) describe the social exchange theory as a broadly acknowledged and suitable hypothetical framework by academicians to delineate community attitude and perception toward the effect of tourism growth. However, from the tourism approach, the theory advocates that residents' attitude regarding tourism and their ensuing extent of support towards its development will be guided by their hopes with respect to costs or gains occurred against the service they provide (Ap 1992, Andereck, Valentine, Knopf and Vogt 2005). In fact, tourism impacts were seen with optimism when the sharing of resources is greater for the

local community, whereas tourism impacts were seen with suspicion if the sharing of resources is lower for the community (Ap 1992). Further, Wang and Pfister (2008) argue that many attitudinal studies stress upon examining the variation in communities' attitudes based on their socio-economic and demographic characteristics.

Theory of Planned Behaviour

Ajzen (2001) affirms that in the theory of planned behaviour, individual behaviour is guided by behavioural faith, normative identity, and control beliefs. According to Lippa (1990), attitude is often viewed as an estimated reaction towards a specific thing, whereas Tsai (2010) claims that attitude is regarded as an intervening entity in social psychology studies and an imaginary factor that can be deduced but cannot be directly discerned. The subjective norms are considered to be the outcome of normative faith and willingness to comply (Ajzen and Fishbein 1991), while normative faith shows the compulsion felt by the people to behave or not to behave in a particular way related to those individuals or organizations key to them (Tsai 2010). The willingness to comply is the motivation of individuals to follow the important expectations of others when making decision whether to comply with certain actions or not (Adeleke 2015). Tsai (2010) further elaborated that the motive of individuals is influenced by attitude, subjective norm, and perceived behavioural control (as cited in Adeleke 2015, p. 318). If an individual has no money and time to spare, his recreational motive will be strained and will affect his real behaviour (Tsai 2010).

IV Literature Review

Ecotourism – The Concept

Ecotourism has emerged as one of the most acceptable forms of sustainable tourism as well as a representative of responsible consumption across the globe (Negacz 2021). The basic themes of ecotourism are generally segmented into environmental conservation, community support, cultural dimensions, and economic incentives. Moreover, countries tend to promote ecotourism development owing to exogenous market pressures (Boyd and Butler 1996). Undoubtedly, ecotourism is an integral subset of sustainable tourism and carries immense potential to be developed as a major segment in the tourism domain in general (Choi and Sirakaya 2006). But, the inadequate comprehension of the concept of ecotourism has created a vagueness among scholars and practitioners in the field (Lee and Jan 2017). There is a vast and ever-increasing literature on ecotourism worldwide that has touched upon various issues related ecotourism including definition, dimensions, and relation with other form of tourism and environmental management principles (Boyd and Butler 1996).

The term ecotourism is defined by the International Society for Ecotourism (TIES) as "a responsible travel in natural areas that preserves the environment and supports local communities, involving interpretation and education" (What is Ecotourism 2022) and responds to emerging trends. The World Tourism Organization in its recent report emphasized the need to enhance accessibility in preserved locations by underpinning the competitiveness and sustainability of tourist places, bringing a change in tourist's attitudes, and uniting environmental intelligence into tourism via acute innovations and digital technology (UNWTO 2021). Mateoc-Sîrb, Albu, Rujescu, Ciolac, Ramona., Tigan, Brinzan, Mănescu, Mateoc and Anda (2022) view ecotourism as opposite to conventional tourism, which primarily occurs in protected places, whereas Remus, Ovidiu and Puiu (2009) assert that ecotourism is a reciprocal relationship between nature and tourism services.

Ecotourism as an academic field has received less attention in developing nations compared to that of developed nations (Choi and Sirakaya 2006). Moreover, there exist contradictions and different opinions of the contribution of ecotourism to environment preservation and its capacity to act as a tool for sustainable development. Despite the conflicting evidences, the concept of ecotourism is essential since it can perform as an economic incentive along with fulfilling social and environmental needs (Horng, Hu, Teng and Lin 2012).

Willingness to Participate in Ecotourism Development

The study of tourism from the perspectives of local community began in 1980s (Rasoolimanesh and Jaafar 2016), whereas today the objective is to develop casual relationships (Çelik and Rasoolimanesh 2021). Undoubtedly, tourism has got an enormous push over the last few decades, which has also witnessed the increasing role of local communities towards achieving sustainable tourism (Harun, Chiciudean, Sirwan, Arion and Muresan 2018). According to Lepp (2007), residents' pro-tourism behavioral intention is largely influenced by the attitudes manifested by the residents (Nunkoo and Gursoy 2012). Going one step ahead, Martín, Sánchez and Herrero (2017) argue that residents' attitude toward tourism and tourists also positively affect behavioral support for tourism development.

To stimulate support from local communities, it is very important to encompass local people in the decision-making process (Harrill 2004), otherwise strained relationship may develop between local communities, tourists, and tourist site (Asmamaw and Verma 2013, González-Ramírez, Gascó and Llopis 2019). The attitude of the local community towards ecotourism vastly decides its willingness to participate (Adeleke 2015). Nigatu and Tegegne (2021) further argue that community participation is central to realizing sustainable tourism as well as ecotourism, therefore involves "public participation in decision making and residents' benefits from tourism" (p. 1422). This result is in sync with the finding of (Tesfaye 2017, Harun, *et. al.* 2018). Hence, the role of local communities in fostering tourism development in a specific site is important and

cannot be exaggerated (Fridgen 1991, as cited in Nigatu and Tegegne 2021). Choi and Sikaraya (2006) state that local communities' attitude towards tourism is a key determinant for sustainable tourism development. A denying attitude towards tourism growth usually arises from weak relationship between local administration and residents (Rastegar 2010) and barriers to ecotourism (Karmas 2014, as cited in Adeleke 2015), while optimism toward tourism development results in increasing support from residents (Wang and Pfister 2008). Although every member of the local community does not have the identical attitude towards tourism, in many cases it depends on the reliance on the sector as well as the extent of participation (Türker and Ozturk 2013, San Martín, García de los Salmones, Herrero and Pérez 2018, González-Ramírez, *et. al.* 2019).

Residents' level of education and nature of job could also decide their attitude towards tourism (Androitis and Vaughan 2003). For example, residents who are entrepreneurs often have the habit of prioritising the economic gains coming from tourism development, while the non-entrepreneurs focus on non-financial characteristics (Cawley and Gillmor 2008, González-Ramírez, *et. al.* 2019). As a matter of fact, it is the residents' socio-demographic composition (Kariuki 2013). and encounter with tourism activities that to a great extent determine how they develop a notion about costs and benefits of tourism (Adeleke 2015).

After probing extent literatures on the subject, it was found that research, involving large samples of tribal people of North-east India, to evaluate their willingness to participate in ecotourism research were highly constrained. Therefore, the study aimed to investigate the local community's willingness to participate in ecotourism development of Reiek, Mizoram. Additionally, the study also tried to examine how demographic background affected the willingness of local community to participate in ecotourism development of Reiek.

Based on the above discussion, we hypothesized:

Hypothesis 1(H_1): There is no difference in mean willingness between the males and females to participate in ecotourism development.

Hypothesis 2(H_2): There is no difference in mean willingness between age groups to participate in ecotourism development.

Hypothesis 3(H_3): There is no difference in mean willingness between occupations to participate in ecotourism development.

V Research Methods

Study Area

Reiek in Mizoram was considered as the ideal place for this study. The place Reiek, a mountain and tourist destination is located at 29 km from Aizawl, the

capital of Mizoram. The altitude of the mountain above the sea level is 1,465 metres (refer to mizoram.nic.in). Reiek Hill is surrounded by thick lush green temperate trees and bushes. Fig. 1 below depicts the map of the Reiek community reserved forest.

Figure 1: The Study Area, Reiek, Mizoram, India
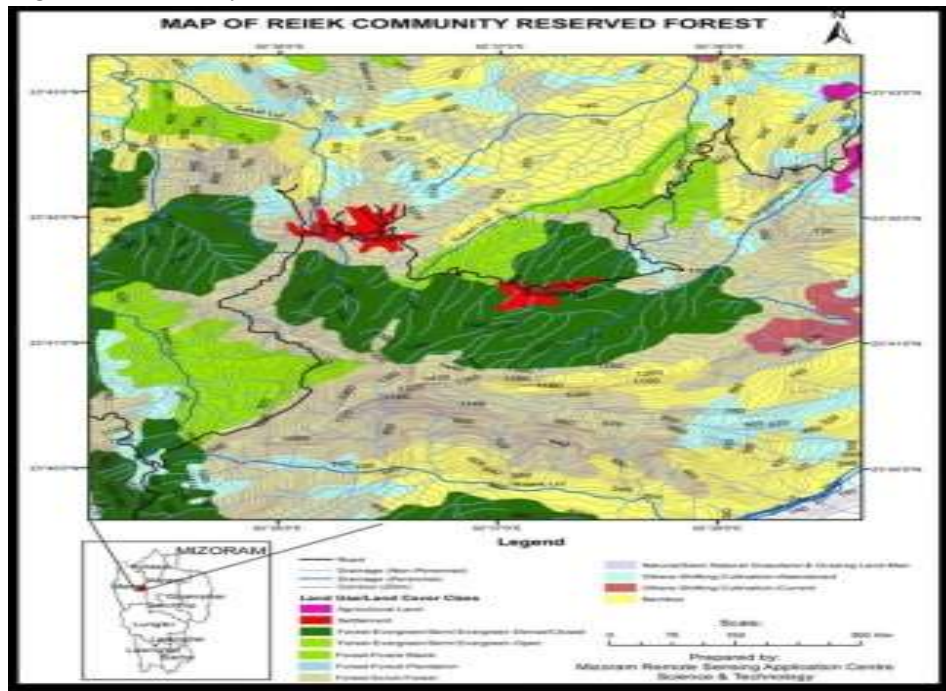
Source: Muansanga and Lalremsanga (2020, p. 9).

Reiek has a typical Mizo village consisting of the distinctive traditional huts of the different Mizo sub-tribes, Mizo chieftain's house, and a bachelor's dormitory. The houses are fully furnished giving the visitor a peek into the culture and the lifestyle of Mizos. A few Mizo modern houses have also been constructed nearby to show the changes that have taken place in the Mizo way of life in keeping pace with the modern developments. According to 2011 census of India, total Reiek population is 17,867. Out of 17,867 people living in this Block, 9,119 are male and 8,748 are female. So far as activities at Reiek are concerned, visitors can do many activities such as homestays, hiking, bird watching, sightseeing, camping and other activities in touch with nature. The place is also known for organizing Anthurium Festival - a festival promoting an indigenous flower of the same name and the rich Mizo customs and traditions at Reiek Tlang (Hill) to tourists. Although regarded as one of the perfect destinations for ecotourism in the state, Reiek has not developed up to the mark compared to other similar destinations in the region. However, as per the demand-supply rating among the tourist sites in

Mizoram, Reiek is considered to be the second most popular tourism site after Hmuifang Tlang (Deka and Pachuau 2015).

Data Collection and Sampling

This research is based on primary evidence, produced out of people who had a direct association with the phenomenon and focused on a societal issue of concern. A survey-based assessment was employed to acquiring desired willingness. The data collected in this study were based on 1) study area visit and observation, i.e., physical visit of Reiek in order to have first-hand information about the place; 2) informal meeting with the tourism officials and residents of Reiek village and nearby areas; and 3) conducting surveys on site and adjoining places. The data triangulation method was adopted to improve research standing and encourage results objectivity.

Data about local communities' willingness to participate were gathered with the help of structured questionnaires during the winter season of December 2020 to February 2023. The statistical population for the current study comprised all the residents among local community of Reiek, Mizoram. Further, the appropriate sample size needed to be representative of the responses of 17867 people (Reiek population as per Directorate of Economics and Statistics 2020, Government of Mizoram) is between 375 and 377 (according to Krejcie formula 1970). A simple random sampling method was employed to choose 377 respondents from the local community. However, to discard redundancy, only one respondent was selected as a representative from each household in Reiek to participate in the survey. Additionally, secondary materials including written and graphic materials related to the area, books, articles in magazines, local newspaper, local official documents such as published reports, maps, village layout among others were also referred and used for the purpose of studying both the objectives.

Table 1 below depicts the various demographic characteristics of the participants. In total, 377 questionnaires were administered among the participants, of which 185 were returned (response rate of 49.07 per cent). After initial screening, 29 questionnaires were rejected due to either incompleteness or not meeting the inclusivity criteria set for this study.

Table 1: Demographic Profile of Respondents Residing in Reiek

Characteristics	Category	Frequency	Per cent
Gender	Male	83	53.2
	Female	73	46.8
Age (years)	<30	109	69.9
	>30	47	30.1
Occupation	Students	91	58.3
	Non-students	65	41.7

Source: Authors' work (2023).

Instrument for Data Collection

Local communities' willingness to participate in ecotourism development was measured with five items (Table 1). Respondents rate their level of agreement with questionnaire statements   on a 5-point Likert-type scale ranging from 1 (=strongly disagree) to 5 (=strongly agree). This study derived five items from the survey of Adeleke (2015), which was modified by the researchers to fit the study area. Prior to using the questionnaire for the final survey, several pre-tests of the questionnaires were conducted to align it in the context of socio-cultural and environmental features of the study area.

Data-Analysis Tools

The data analysis was done with the help of descriptive statistics; percentage, mean, standard deviation, and crosstabs. Also, inferential statistics such as correlations, independent t test were used to examine the willingness of local community. The questionnaires completed in all respects were then subjected to further analysis with the help of IBM Statistical Package Social Science (SPSS) 20.0.

VI Results and Discussion

The embracing of tourism development by the local community is crucial for the tourism sustainability of a destination (Androitis and Vaughan 2003, Adeleke 2015). Further, Andriotis (2002) argued that residents of any host area may show inclination towards participating in ecotourism activity due to the benefits derived from these kinds of activities. Therefore, it is highly crucial to understand the viewpoints of the residents about the necessity of developing ecotourism in a destination.

Table 2 shows that around 83 per cent of the respondents expressed their willingness to attend education and training on ecotourism. This behaviour of the respondents reflected the employment generating ability of ecotourism. Similarly, nearly 84 per cent of the participants were found to be interested to engage in ecotourism business in the studied area. This shows the growing importance of tourism entrepreneurship among the local population. As a matter of fact, all the measurement items signal towards the greater degree of willingness to participate in ecotourism activities in the studied area. Moreover, the table also reveals that "I support decisions on ecotourism development in Reiek" was the most dominating factor with the highest mean score 4.58, whereas the lowest mean went to the item "I am willing to attend ecotourism education and training" with a mean score 3.78.

Table 2: Willingness of Local Community to Participate in Ecotourism Development in Reiek

Items	N	Mean	Level of agreement in frequency & percentage				
			Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
I am willing to attend ecotourism education and training.	156	4.28	12 (7.7%)	3 (1.9%)	11 (7.1%)	33 (21.2%)	97 (62.1%)
I am willing to engage in ecotourism business in Reiek.	156	4.33	9 (5.8%)	4 (2.6%)	12 (7.7%)	99 (63.4%)	32 (20.5%)
I support decisions on ecotourism development in Reiek.	156	4.58	3 (1.9%)	3 (1.9%)	8 (5.2%)	29 (18.6%)	113 (72.4%)
I am willing to contribute to the conservation of natural resources and environment in Reiek.	156	4.47	4 (2.6%)	2 (1.3%)	11 (7.1%)	38 (24.4%)	101 (64.6%)
I am always ready to participate in ecotourism development and planning in Reiek.	156	4.53	3 (1.9%)	4 (2.6%)	11 (7.1%)	28 (17.9%)	110 (70.5%)

Source: Authors' work (2023).

Furthermore, a correlation analysis was conducted to study the association between demographic variables (gender, age, and occupation) and willingness. Based on the results shown in Table 3, the overall willingness variables presented a weak correlation with the demographic variables. This is because the value of correlation coefficients was in the range from 0.003 to 0.194.

Table 3: Correlation between Demographic Variables and Willingness

	Items		Gender	Age	Occupation
Spearman's rho	I am willing to attend ecotourism education and training.	Correlation Coefficient	.037	.065	.051
		Sig. (2-tailed)	.647	.418	.528
		N	156	156	156
	I am willing to engage in ecotourism business in Reiek.	Correlation Coefficient	.011	.033	.070
		Sig. (2-tailed)	.890	.678	.388
		N	156	156	156
	I support decisions on ecotourism development in Reiek.	Correlation Coefficient	-.061	.017	-.003
		Sig. (2-tailed)	.448	.830	.974
		N	156	156	156
	I am willing to contribute to the conservation of natural resources and environment in Reiek.	Correlation Coefficient	-.015	.194[*]	.162[*]
		Sig. (2-tailed)	.856	.015	.043
		N	156	156	156
	I am always ready to participate in ecotourism development and planning in Reiek.	Correlation Coefficient	.003	.062	.028
		Sig. (2-tailed)	.967	.439	.725
		N	156	156	156

Note: *Correlation is significant at the 0.05 level (2-tailed).
Source: Authors' work (2023).

From the above table, it may be drawn that the results between gender and willingness showed positive association for three items and negative association for two items. However, no items showed significant p-value, i.e., p values less than .01 and .05. For willingness and gender correlation, the highest correlation

coefficient recorded was -.061 which was not significant, since p-value (.448) is greater than .01 and .05. These results indicate that the willingness of the respondents to participate in ecotourism development was not influenced by their gender. Moreover, for the demographic variable age, all the five items were found to be positively correlated with the willingness. However, only one item "I am willing to contribute to the conservation of natural resources and environment in Reiek "showed significant p-value (.015), which is less than .05. Based on these results, it can be concluded that the age had some degree of influence on the willingness of the respondents. For willingness and age correlation, the highest correlation coefficient recorded was .194, which was found to be significant, since sig.= .015 (p < .05). Other than that, the correlation coefficients between occupation and willingness were also found to be mostly positive. From the analysis. it was drawn that only one item "I am willing to contribute to the conservation of natural resources and environment in Reiek" had a significant p-value (.043), which is less than .05. These results indicate that the nature of occupation slightly influenced the willingness of the target population to participate in ecotourism development of Reiek. For the attitude and occupation correlation, the highest correlation coefficient recorded was .162 which was significant, since sig.=.043 (p < .05).

Furthermore, an independent t-test was conducted to find out whether willingness to participate in ecotourism development varied between males and females (Table 4). The table shows that male respondents were slightly more willing to participate in ecotourism development than were female respondents (4.47 versus 4.36). After analysis, it was empirically proven that a statistically insignificant difference existed between the means of males and females with t value = -.827, and sig.=.409 (p<.05). Hence, the hypothesis (H$_2$) was not rejected.

Table 4: Result of Independent t Test

Item	Gender	N	Mean	Std. Dev.	df	t	Sig.
Willingness to participate in ecotourism development.	Female	73	4.36	.926	154	-.827	.409
	Male	83	4.47	.688			

Source: Authors' work (2023).

Additionally, another independent t-test was conducted to find out whether willingness to participate in ecotourism development varied between age groups below 30 and above 30 (Table 5). The table shows that respondents above 30 years of age were slightly more willing to participate in ecotourism development than were respondents below 30 years of age (4.48 versus 4.39). However, the t test found statistically insignificant difference in the item (sig.=.530 i.e., p<.05). Hence, the hypothesis (H$_2$) was also not rejected.

Table 5: Result of Independent t Test

Item	Age	N	Mean	Std. Dev.	df	t	Sig.
Willingness to participate in ecotourism development.	Below 30	109	4.39	.862	154	-.629	.530
	Above 30	47	4.48	.669			

Source: Authors' work (2023).

In order to find out whether willingness to participate in ecotourism development varied between occupation, students and non-students, an independent t-test was conducted (Table 6). The table shows that respondent non-students were slightly more willing to participate in ecotourism development than were students (4.55 versus 4.32). Moreover, it is evident that the significance value was .073 (i.e., p = .073), which is above .05. This signifies that there was a statistically insignificant difference between the means of the different types of occupation. Hence, the hypothesis (H_3) was not rejected.

Table 6: Result of Independent t Test

Item	Occupation	N	Mean	Std. Dev.	df	t	Sig.
Willingness to participate in ecotourism development.	Students	91	4.32	.917	154	-1.807	.073
	Non-students	65	4.55	.654			

Source: Authors' work (2023).

Based on the insights derived from the above analyses, it can be inferred that the evidences were not supportive enough to say that the demographic variables of the respondents influenced their willingness to participate in ecotourism development of Reiek.

Additionally, the study also calculated the willingness score to understand how the respondents across demographic variables such as gender, age, and occupation were willing to participate in ecotourism development in the studied area (Table 7).

Table 7: Willingness Score among the Respondents by Their Demographic Variables

Demographic variables	Category	Willingness score (mean ± std. dev.)	*P* value
Gender	Female	4.36 ± .93	>0.05
	Male	4.47 ± .69	
Age	Below 30	4.39 ± .86	>0.05
	Above 30	4.48 ± .67	
Occupation	Students	4.32 ± .92	>0.05
	Non-students	4.55 ± .65	
Overall willingness score		4.43 ± .79	

Source: Authors' work (2023).

After calculating, willingness score was found to be 4.43±0.79. A higher score indicated a greater willingness to participate in ecotourism development.

VII Summary

The study attempted to assess the local community's willingness to participate in ecotourism development of Reiek. The findings revealed that the community's willingness to participate in ecotourism development was positive and supportive. The findings are in line with the past studies (Karanth and Nepal 2011, Abeli 2017, Junus, Hambali, Iman, Abas and Hassin 2020, Mohanty, Mishra and Tiwari 2021). However, no conclusive evidence was found to say that demographic variables of the respondents influenced their willingness to participate in ecotourism development. However, the chapter attempted to provide an illustration on how local community viewed ecotourism development in Reiek.

Despite having several merits, the study was not free from limitations. The findings of the current study should be carefully viewed mainly because of, 1) the results drawn from this study were specific to the state of Mizoram, and Reiek in particular. So, the conclusion drawn may not be suitable for generalization to wider group except destinations with similar features like the studied area. In view of these concerns, it is of utmost significance to undertake further research in this direction so that issues connected to the willingness to participate can be explored, 2) the cross-sectional layout of this study led to complexity while differentiating causes and outcomes, 3) the determinants influencing the willingness to participate in ecotourism development are still under-examined, and 4) some ecotourism research may concentrate on specific population groups which were not incorporated in the survey data employed by the researchers. So, the outcomes might show different results in a situation where the same survey was carried out on the population not considered or described in this study. These findings may prove to be beneficial in developing strategies to improve the participation of local population in ecotourism activities. Relevant discussions on policies, such as the significance of participation of human beings in ecotourism development could also be based on this study.

Lastly, this study is expected to help scholars, policy makers, and practitioners to carry out considerable research in this direction to address various issues usually dominant in the field of ecotourism. The study may also prove to be useful for those people who are interested to take a part in the ongoing development process and facilitate the development of tourism in Mizoram in the 21st century.

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Assessing the Vulnerability of Inland Fishermen to Flood Hazards: A Case of Kuttanad Region of Kerala

Shalini Thomas, Justine George and Rajesh George

This study focuses on the livelihood issues of inland fishermen in the presence of severe floods since 2018. The study addresses the vulnerability of fishermen in the above context by using the vulnerability index developed by Hahn. The study results show that the dependency ratio, proximity to drinking water sources, and the availability of health facilities significantly impact vulnerability, in which social connections and livelihood diversification are essential in developing resilience against floods. The study provides specific viable suggestions for policymakers to address the looming crisis of inland fishing households in the Kuttanad region of Kerala.

Keywords: Vulnerability, Livelihood, Inland fishermen

Introduction

India's rural population depends on natural resources for their livelihood and, therefore, is highly vulnerable to natural disasters. Floods are among the country's most prominent and economically devastating natural disasters (Sam, *et. al.* 2017). With the Western Ghats on the eastern side and coastal areas on the western side, Kerala, a state in Southern India, is highly vulnerable to natural hazards such as floods, and approximately 14.8 per cent of the state's area is at risk of flooding (Walia and Nusrat 2020). Floods have a differential impact on various population segments, and their impact is more significant among poor and marginalised groups (Sam, *et. al.* 2017). Inland fishermen often get less attention in the policy circle. Over sixty per cent of the state's inland fishermen reside in Kuttanad (Sudhish 2022), a low-lying region spanning Alappuzha, Kottayam, and Pathanamthitta districts. The Kuttanad region is highly prone to floods (Jose 2019), and the constant occurrence of floods has been miserably affecting the life of inland fishermen in the Kuttanad region. Usually, the rainy season brings abundant fish, but heavy floods have disrupted this pattern, leading to a decline in

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inland fishing and adversely affecting the livelihoods of the fishermen (Achutha Menon 2018).

Vulnerability studies are highly significant to understand the impacts of natural hazards on the lives and livelihood of the people. The concept of vulnerability was first applied in natural disasters (Lu, *et al.* 2022). Floods, landslides, earthquakes, fires, and volcanoes are classic examples of natural hazards, and the regions exposed to natural hazards are highly vulnerable (Ahsan and Warner 2014). Kerala has been getting heavy rainfall during the southwest monsoon for several years. Nevertheless, Kerala experienced massive floods in 2018, severely impacting people's lives in the Kuttanad region. Nearly two lakh persons were evacuated, and more than fifty thousand houses were wholly or partly drowned. Even though Kerala witnessed frequent floods after 2018, nothing was more intense than that. The floods that occurred in 2019 also caused massive evacuation and trouble. Frequent flooding severely impacts the lives of communities that depend on natural resources for their livelihoods, and the Kuttanad region underwent tough challenges during the June, July, and August 2018 floods. Rainfall was intense in the Idukki district from June to August 2018. The rivers that debouch into the Vembanad Lake of the Kuttanad region, namely, Pamba, Achenkovil, Manimala and Meenachil, originat from Idukki. The excess runoff from these rivers (1.63 bcm-billion cubic meters) was far beyond the carrying capacity of Vembanad Lake (0.6 cm). This resulted in a rise in the water level of Vembanad Lake and the surrounding areas (Kerala State Planning Board, 2019). The satellite images of the Kuttanad region extracted in February 2018 and August 2018 present the severity of the flood. (Figure 1).

Figure 1: Satellite Figures of Kuttanad– on February 6th, 2018 (left) and on August 22nd, 2018 (right)
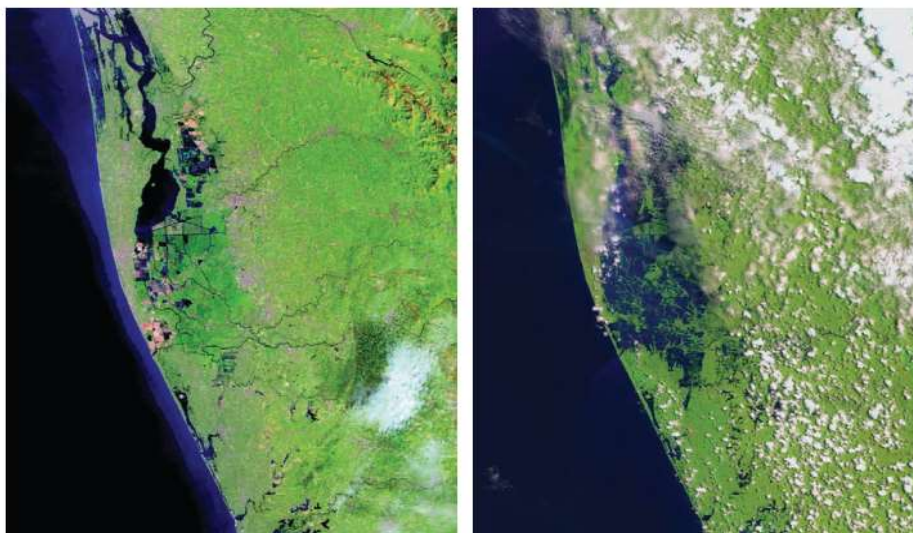
Source: Kerala State Planning Board.

Inland fishermen are found to be highly vulnerable, especially in flood-prone areas like Kuttanad, and the floods cause several sediments and waste materials to be deposited in the water resources, affecting the water quality, which in turn endangers the life of aquatic species and affects the fishery-based livelihoods of the fishermen. During floods, the fishing grounds get submerged, posing severe challenges. However, it is difficult to access fish-rich areas during flood periods, severe damage has been reported to fishing equipment like fishing crafts, nets, and related things. Livelihood loss in the context of floods resulted in intense financial loss to the fishermen, which increased the debt burden of the fishermen's population.

The article is divided into six sections: Section II discusses the research problem following the introduction; Section III discusses the overview of the framework of vulnerability; Section IV discusses the sampling and data collection; Section V discusses the construction of the Livelihood Vulnerability Index; Section VI discuss the analysis and results of the study and followed by the concluding remarks and discussions.

II Research Problem

The situation of marginalised and less privileged classes remains pathetic even after completing three decades of globalisation. Fishermen communities are among Kerala's most vulnerable and poverty-ridden groups compared to other population segments (Economic Review 2022). Broadly, the fisheries sector is classified into the marine and inland fisheries sectors, and among them, inland fishermen often get less attention than their marine counterparts. The recent floods in Kerala put severe pressure on the lives of inland fishermen, and the study hereby attempts to identify the natural disaster-flood vulnerability of inland fishermen of the state. Sample units needed for the study are collected from the inland fishing villages of the Kuttanad region. There are two reasons for selecting Kuttanad for intensive study: firstly, more than sixty per cent of the inland fishermen of the state rely on Vembanad Lake for their livelihood; secondly, Kuttanad is one of the most flood-prone regions of the state. Water logging and related problems are rampant in Kuttanad during the rainy season due to the high intensity of rivers such as Pampa, Meenachil, Achankovil, Manimala and Vembanad Lake, the largest lake in the state, are situated in the Kuttanad region.

Many studies on vulnerability focus more on the agricultural sector, but a limited number of similar studies focus on the vulnerability of the fisheries sector (Agostini, *et. al.* 2012). Furthermore, most existing fisheries-based vulnerability studies primarily concentrate on the marine sector, often paying less attention to the inland fisheries. The present study aims to bridge this gap by analysing the vulnerability of inland fishing households in four rural villages of Kuttanad. However, vulnerability is a broader concept considering both vulnerable regions and vulnerable groups (Downing, *et. al.* 1996). Therefore, the study is highly

significant in the context of severe floods and focuses on a vulnerable group, the inland fishing households, in a vulnerable region, Kuttanad.

III Framework of *Vulnerability*: An Overview

Vulnerability is a multi-dimensional, complex, and contextual concept *(Barnett, et al.* 2008, Bhattacharjee and Behera 2018, Downing, *et. al.* 1996). The idea of vulnerability has attracted the attention of academicians and researchers worldwide in dealing with climate change and natural hazards (Agostini, *et. al.* 2012). The vulnerability concept has its initial origin in natural disasters *(Lu, et. al.* 2022), and the idea exposes the actual potential of a system to withstand unexpected and uncontrolled events or hazards. It has several manifestations- poor households in rural areas with limited coping strategies in   an unfavourable situation (Reed, *et. al.* 2013).

Vulnerability doesn't have a well-developed theoretical support *(Downing, et al.* 1996), and the earliest definition of vulnerability was given by Chambers in the year 1989. He explained vulnerability as the system's exposure to shocks and stress and its difficulty in adopting various coping mechanisms (Chambers 1989). The definition of Intergovernmental Panel on Climate Change (IPCC, 2001), which puts vulnerability as a function of exposure, sensitivity, and adaptive capacity, has served as the starting point of many vulnerability studies (Brugere and De Young 2015, Houghton, *et. al.* 2001) Numerous literatures are there considering exposure, sensitivity, and adaptive capacity as the main components of vulnerability (Bhattacharjee and Behera 2018; Chakraborty 2016, Ford, *et. al.* 2006, Hahn, *et al.* 2009, Sam, *et. al.* 2017a, Schr¨oter, *et. al.* 2005, Smit and Wandel 2006), in which exposure refers to the dimension and period in which a system or household is affected by climate-related events, such as floods (Ebi, *et. al.* 2006) and sensitivity refers to the level at which climate change affects or influences a system. On the other hand, adaptive capacity is the system's ability to cope effectively and   acclimatise to the impacts and threats posed by climate change (Varadan and Kumar 2015). Different human and ecosystems have various adaptive capacities (Schr¨oter, *et. al.* 2005) and individuals or households having limited adaptive capacities are said to be highly vulnerable. Certain studies include risks, expected impacts and losses (Heltberg, *et. al.* 2009), potentiality (Downing, *et. al.* 1996) and entitlements (Bhattacharjee and Behera 2018, Downing, *et. al.* 1996) as vulnerability components.

Most vulnerability research rests upon the traditional disciplinary schools of thought, such as risk-hazard, resilience, and political economy/ecology schools. While exposure and sensitivity are the key elements of the risk hazard school, the resilience school emphasizes the focus points of thresholds of change, reorganization, and the capacity to learn and adapt. Political economy/ecology school is centred around capacity, sensitivity, and exposure (Brugere and De Young 2015). The Department for International Development (DFID) sustainable livelihood framework, which highlights the significance of the five capitals

(physical, social, human, natural, and financial), identifies vulnerability as being formed by external shocks and hazards (DFID, 1999). Another framework is called the institutional framework, where vulnerability is explained in terms of the interactions among the institutions and collective units within their physical atmosphere for coping with external stresses, both climate and other causes (Ostrom 2011).

Vulnerability is a measure of human welfare (Downing, *et. al.* 1996) and numerous studies use indices for assessing vulnerabilities (Ahsan and Warner 2014, Amos, *et. al.* 2015, Brenkert and Malone 2005, Chakraborty and Joshi 2016, Edmonds, *et. al.* 2020, Fischer and Chhatre 2015, Hahn, *et. al.* 2009; Heltberg, *et. al.* 2009, Pandey and Jha 2012). Apart from vulnerability assessments, vulnerability indices attempt to identify various strategies to reduce vulnerability (Schr¨oter, *et. al.* 2005)   using the LVI developed by Hahn (Hahn et al., 2009) with slight modification. The conceptual framework of the study is given in Figure 2.

Figure 2: Conceptual framework (Own formulation)
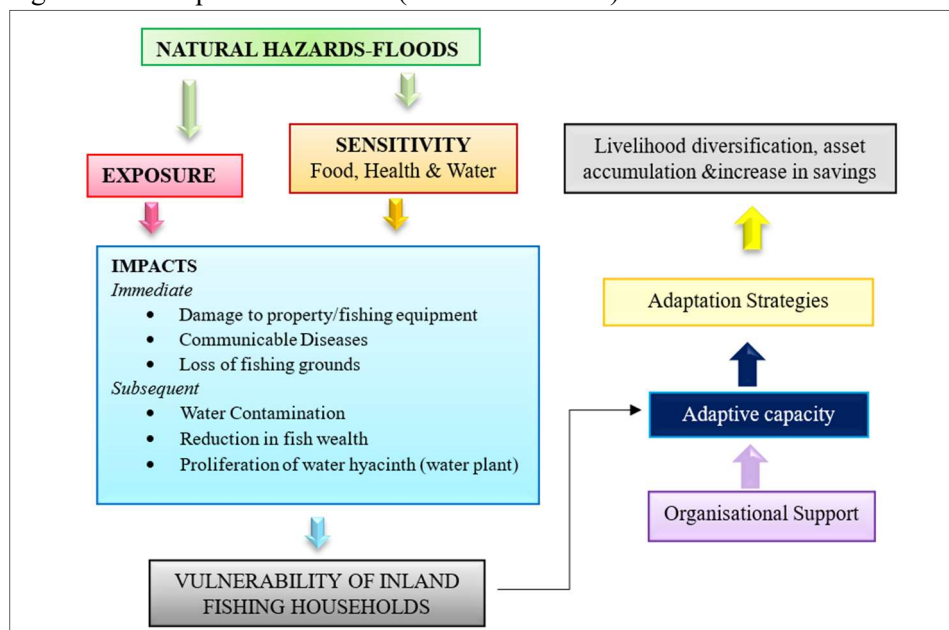
IV Sampling and Data Collection

Sample units required for the study were identified through the multi-stage sampling method. The Kuttanad region was selected for intensive study due to its high vulnerability to floods (Agostini, *et. al.* 2012b, Arunachalam 2018) and most inland fishers in the State depend on the Vembanad Lake in the Kuttanad region for their livelihood (Sudhish 2022). Kuttanad region comprises 24 inland fishing

villages (Directorate of Fisheries 2020) spread over Alappuzha, Kottayam and Pathanamthitta districts. Since the share of Pathanamthitta is very meagre regarding fishing villages and the number of fishermen, that district is ignored in the present study. For the intensive study, sample units are selected from the four inland fishing villages: Alappuzha District (Thanneermukkom and Kavalam) and Kottayam District (Kumarakom and Vaikkom). Fifty fishing households were randomly selected from each of the four villages. The data was collected during the period November-December 2021.

V Livelihood Vulnerability Index

This study uses the LVI index developed by Hahn (Hahn, *et. al.* 2009)with slight modifications, and the significant factors used in this index are Socioeconomic status, livelihood status, social connection, health, food, water, and flood. The components under the considered factors are termed sub-factors in the study. (Table 1) The primary socioeconomic status comprises three sub-factors: dependency ratio, household heads' educational status, and consumption expenditure. The dependency ratio illustrates the extent to which dependents (individuals under 15 and over 65 years of age) rely on the working-age population (those aged between 19 and 64 years). Individuals between 15 and 19 years of age are excluded from the calculation of the dependency ratio because they are in a transitional phase from dependency to independence. Most of them are pursuing education, gaining work experience, and are financially independent to some extent. In this study, the dependency ratio is calculated based on the work of Hahn (Hahn, *et. al.* 2009, Sam, *et. al.* 2017) A high dependency ratio indicates high vulnerability (Sam, *et. al.* 2017). The study considers the percentage of household heads with only elementary/primary education as an indicator of household vulnerability. This is because the education level of the household head plays a crucial role in determining their access to better livelihood opportunities and their ability to develop practical coping skills.

Table 1: Major Factors and Sub-Factors with Description

Major factors	Sub factors	Description
Socio-economic status	Dependency ratio	The ratio of the dependent population (under 15 and over 65) to the working-age population (between 19 and 64)
	Percentage of households whose heads have not attended high schools	The percentage of household heads with an upper primary or lower education level or no schooling (0 years of education).
	Percentage of households who struggle to meet household expenditure	Percentage of households who expressed their struggle in meeting monthly household expenditure
Livelihood Status	The percentage of households where fishermen travel longer distances to reach the fishing site.	Percentage of households in which fishermen need to travel 15 minutes or more to reach the fishing site
	Livelihood diversification index	The average of the reciprocals of the households' livelihood activities plus one

Major factors	Sub factors	Description
Social Connection	Average of borrow lend ratio	The borrow-lend ratio is determined by calculating the ratio of households that borrowed money in the last six months to those that lent cash during the same period. If a household has borrowed and lent within the past six months, the borrow-lend ratio is 1:1, indicating a value of 1. On the other hand, if a family only borrowed money during the period without lending, the ratio becomes 2:1, with a value of 2. Conversely, if the household solely engaged in lending and had no borrowing, the ratio becomes 1:2, equivalent to 0.5.(Hahn)
	Average receive-give ratio	The ratio of the number of aids received by the households in the past six months increased by one to the number of aids given by the households in the past six months, which also increased by one.
Health	Average time to reach hospital	Time required to reach the nearest health facility in minutes by using the available mode of conveyance
	Percentage of family members having a chronic illness	Percentage of households with at least one chronic illness like diabetics, heart disease, cancer, arthritis, bronchitis, asthma, etc.
Food	Average of crop diversity index	Reciprocal of the number of livelihood activities of the households after adding one
	Percentage of households whose primary source of food is inland fish.	Number of households that consume inland fish at least once a day.
Water	Percentage of households who do not have natural water source	Number of households who do not have a natural water resource for their own
	Average time to drinking water source	Time required to reach the primary source of drinking water in minutes
Natural Disaster-Flood	Average No. of times the entire family left the house because of flood during the last six years	Number of times in which the entire family of the household left home because of flood in the last six years
	Percentage of households who face livelihood difficulties due to flood	Households reported facing livelihood difficulties because of floods during the last six years
	A proportion of households encountered property damage because of floods within the past six years	Number of households with property (house and fishing equipment) damage during the past six years

Source: Primary Survey.

The components of livelihood status, consist of the average time spent to reaching to the fishing site and livelihood diversification. When fishermen take a lot of time to reach their fishing sites, it can adversely affect their livelihoods. However, in the Kuttanad region, surrounded by vast water bodies, fishermen can reach their respective fishing sites with little difficulty. Nonetheless, some fishermen travel long distances from nearby water bodies to reach Vembanad Lake for fishing. In this study, fishermen who take 15 minutes or more to reach their fishing sites are considered vulnerable. After adding one, the livelihood diversification value is the inverse of the households' livelihood activities (Sam, *et. al.* 2017) in which livelihood diversification is one of the most important coping

strategies to mitigate the impacts of floods (Bhatta and Aggarwal 2016, Bhattacharjee and Behera 2018, Mishra and Mishra 2010, Sam, *et. al.* 2017)

The lend and receive-give ratios are the sub-factors that come under the significant component of social connection (Hahn, *et. al.* 2009). The borrow-lend ratio is determined by calculating the ratio of households that borrowed money in the last six months to those that lent cash during the same period. If a household has borrowed and lent within the past six months, the borrow-lend ratio is 1:1, indicating a value of 1. On the other hand, if a family only borrowed money during the period without lending, the ratio becomes 2:1, with a value of 2. Conversely, if the household solely engaged in lending and had no borrowing, the ratio becomes 1:2, equivalent to 0.5. The receive-give ratio is calculated by dividing the number of aids received by households in the past six months, incremented by one, by the number of aids given by families in the same period, also incremented by one.

Health is an essential human capital that increases adaptive capacity and resilience, and the geographical accessibility of health centres is crucial for timely assistance (Peters, *et. al.* 2008). However, proximity to the nearest healthcare facility, including primary health centres, is a significant indicator of health vulnerability. The health status also includes households with at least one member with chronic diseases such as diabetes, heart disease, cancer, arthritis, bronchitis, asthma, and other related conditions.

Floods and the associated livelihood issues adversely affect the food security of natural resource-dependent households (Beringer and Kaewsuk 2018). The leading component includes food, crop diversity, and households with primary dietary sources such as inland fish. Crop diversification increases agricultural resilience by lessening vulnerability to environmental challenges (Lin 2011). The households with inland fish as their primary food source show their inability to consume diversified dietary options, indicating vulnerability. Natural water sources and average time to drinking water are sub-factors under the significant component, water.

Flood is a significant component that includes three sub-factors: the number of times the entire family leaves the house because of a flood during the last six years, the households that face livelihood difficulties due to flood, and encountered property damage/loss from floods within the past six years. In some cases, at least one or two persons in an inland fishing household stay in their own house during the flood situation; they may need to look after their assets and pets, they may not be comfortable staying at relief camps, sometimes they prefer not to stay at the houses of their friend or relatives who are residing in a faraway place. However, floods harm the livelihood of inland fishermen, disrupting fishing activities, causing damage to equipment and infrastructure, depleting fish stocks, and potentially necessitating displacement and relocation. Under the significant factor of property damage, damage to the house or (Sam, *et. al.* 2017) a complete ruin of the entire fishing equipment, or both, only during the last six years are considered in this study.

The initial step in constructing the index involves standardizing the sub-factors, measured in different units, using the standardization formula. (Hahn, *et. al.* 2009)

$$\frac{F_v - F_{min}}{F_{max} - F_{min}}$$

Where F_v is the sub-factor value of village v, F_{min} is the minimum score in all the villages and F_{max} is the maximum score in all the villages. The corresponding sub-factor values are averaged to obtain each major factor value.

The livelihood vulnerability of each fishing village is the weighted average of all seven major factors.

$$LVI_v = \frac{\sum_{i=1}^{7} w_{Ai} A_{vi}}{\sum_{i=1}^{7} w_{Ai}}$$

LVI_v is the livelihood vulnerability index of village v. A_{vi} is the index value of one of the significant village factors and w_{Ai} is the weight of each considerable factor in a village indexed by *i.* The vulnerability scale in this study ranges from 0 (indicating the least vulnerable) to 1 (representing the most vulnerable).

VI Analysis and Results

The standardised values of the sub-factors, the indexed values of the elements and the overall LVI index of each village are placed in Table 2.

Kavalam (0.45) is more vulnerable in socio-economic status than other villages, and this is because of the high dependency ratio and difficulty in meeting household consumption expenditures. The average family size of inland fishing households in the study area is 4.4, higher than the average rural household size of 4.2 in Kerala (Census 2011). Regarding the high school education status of the household heads, Thanneermukkom is the most vulnerable (0.48). Notably, the villages belonging to the Kottayam district, namely Kumarakom and Vaikkom, exhibit less vulnerability in terms of the educational status of household heads compared to those in the Alappuzha district. Kottayam district ranks first in the state in literacy rate, 97.21 per cent (Census 2011). Among the four villages regarding socio-economic status, Vaikkom is the least vulnerable, scoring 0.36, primarily due to its low dependency ratio. A low dependency ratio indicates a lesser burden on the working-age population to support dependents.

Table 2: Standardised Values of Sub-Factors and the Overall LVI for Each Village

Significant Factors and Sub Factors	Thanneermukkom	Kavalam	Kumarakom	Vaikkom
Major factor 1 Socio-economic status	0.42	0.45	0.38	0.36
Dependency ratio	*0.25*	*0.27*	*0.235*	*0.175*
Percentage of households whose heads have not attended high schools	*0.48*	*0.44*	*0.31*	*0.33*
Percentage of households who struggle to meet household expenditure	*0.54*	*0.65*	*0.60*	*0.58*
Major factor 2 Livelihood Status	0.36	0.36	0.395	0.42
The percentage of households where fishermen travel longer distances to reach the fishing site.	*0.26*	*0.16*	*0.35*	*0.35*
Livelihood diversification index	*0.46*	*0.56*	*0.44*	*0.49*
Major factor 3 Social Connection	0.385	0.35	0.335	0.4
Average receive-give ratio	*0.22*	*0.22*	*0.22*	*0.25*
Average of borrow lend ratio	*0.55*	*0.48*	*0.45*	*0.55*
Major factor 4 Health	0.16	0.385	0.185	0.185
Average distance to the health centre	*0.12*	*0.59*	*0.21*	*0.17*
Percentage of family members having chronic illness	*0.20*	*0.18*	*0.16*	*0.20*
Major factor 5 Food	0.62	0.735	0.375	0.45
Average of crop diversity index	*0.64*	*0.57*	*0.48*	*0.59*
Percentage of households whose primary source of food is inland fish	*0.60*	*0.90*	*0.27*	*0.31*
Major factor 6 Water	0.44	0.665	0.185	0.215
Percentage of households that do not have natural water source	*0.86*	*0.90*	*0.33*	*0.39*
Average distance to drinking water source	*0.02*	*0.43*	*0.04*	*0.04*
Major factor 7 Natural Disaster-Flood	0.35	0.48	0.32	0.33
Average No. of times the entire family left the house because of flood during the last six years	*0.31*	*0.35*	*0.27*	*0.28*
Percentage of households that face livelihood difficulties due to flood	*0.54*	*0.79*	*0.33*	*0.44*
A proportion of households encountered property damage because of floods within the past six years	*0.20*	*0.30*	*0.36*	*0.27*
LVI	0.39	0.49	0.31	0.34

Source: Primary Survey.

The subcomponents of the significant factor of livelihood status are livelihood diversification and average time taken to reach the inland fishing site. More than 65 per cent of the wives of inland fishermen benefit from the MGNREGA scheme, which ensures jobs for more than 90 days per year. Nonetheless, the scheme is criticized for its unproductive employment generation. Other members of the households work in government sectors, private firms, and self-employed units. However, some fishermen also participate in farming,

painting, and construction work alongside their fishing activities. The government is assisting fishermen households to earn additional livelihood options; for instance, the Society for Assistance of Fisher Women (SAF), an organization under the Fisheries Department, provides training facilities for fisherwomen insewing, soap, detergent, and pickle making. However, in most cases, such training remains less useful because of the need for marketing opportunities. The livelihood diversification index indicates that Kumarakom is the least vulnerable, followed by Thanneermukkom. Regarding livelihood diversification, Kumarakom (0.44) is the least vulnerable, followed by Thanneermukkom (0.46).

Proximity to the fishing location is also an indicator of vulnerability. Most fishermen travel long distances to get plenty of catch, though waterbodies surround them. Through years of experience, traditional fishermen know fish wealth, local fishing grounds, migratory patterns, and ecological changes; but now they are worried about the intensive illegal fishing practices of individuals outside the fishing community. These practices include the usage of banned nets with small mesh sizes, which have become increasingly common in Vembanad Lake. During the COVID-19 pandemic, several newcomers entered the fishing sites using banned Chinese nets. Illegal fishing practices are prevalent in several parts of the Kuttanad region, which compelled the Fisheries Department to launch intensive patrolling in Vembanad Lake, seizing many banned fishing gears.

In Kumarakom and Vaikkom, many fishermen take a significant amount of time to reach their fishing sites since they travel long distances within the Vembanad Lake to reach the exact fishing locations. On the other hand, in Kavalam, fishermen reach their fishing locations with little time spent travelling. Regarding the overall livelihood status vulnerability, Kavalam and Thanneermukkom are the least vulnerable, with a value of 0.36. Vaikkom (0.42) has the highest vulnerability score regarding livelihood status. This vulnerability is due to the higher values in proximity to fishing sites (0.35) and livelihood diversification (0.49), indicating that fishermen in Vaikkom face challenges in accessing fishing resources and diversifying their livelihoods.

Regarding social connection, the villages display similar scores, with Vaikkom (0.4) having the highest score, indicating the most heightened vulnerability. The average receive-give ratio and borrow-lend ratio determine the social connection status. The average receive-give ratio values of the three villages are the same (0.22), with Vaikkom (0.25) only slightly different from those above. This situation vividly demonstrates that the inland fishing households share a similar family background and social setup. Therefore, the government can implement appropriate policies tailored to the inland fisheries sector without encountering significant difficulties. The high borrow-lend ratio indicates financial vulnerability, but they do not have regular banking practices, although almost all the fishermen have a bank account. The Fisheries Department introduced Matsya Thozhilali Sambadhya Samashvasa Padhathi to promote fishermen's small savings. Under this, the household that pays periodical premiums will get more than double the amount in instalments through the aid of

Central and State governments. However, only some fishermen are willing to avail themselves of the benefits offered by this scheme.

In terms of health status, Kavalam is the most vulnerable. In some places of Kavalam, people must travel long distances by boat and bus to avail themselves of health facilities. In Kavalam, the average distance to health facilities is higher at 53.8 minutes compared to other villages, making it more challenging for residents to access necessary healthcare services. During floods, communicable diseases like Malaria, dengue fever and cholera are common among fishermen. Therefore, it strains the fishing families, already burdened with several chronic diseases. In addition, Kavalam has the highest vulnerability in terms of chronic illness. In the study area, approximately 16.95 per cent of inland fishing households are affected by chronic illnesses like diabetes, heart disease, cancer, arthritis, bronchitis, and asthma.

Food is an important indicator showing the household's vulnerability. In more than fifty per cent of the sample inland fishing houses, the primary dietary source is inland fish. Small land holdings (generally less than six cents[1]) hinder the fishermen from intensive cultivation. Along with paddy cultivation, the households also grow vegetables such as beans, brinjal, bitter gourd, drumstick, and snake gourd on their premises. Tapioca, plantain, and yam are also commonly cultivated.

Regarding crop diversity, Thanneermukkom is highly vulnerable, with a score of 0.64, followed by Vaikkom (0.59) and Kavalam (0.57). However, Kumarakom is the least susceptible, with a score of 0.48 regarding crop diversity. Households' consumption of inland fish is also considered to assess food vulnerability. In Kavalam, 90 per cent of inland fishing households rely primarily on inland fishing for their dietary needs, and this reliance on inland fish as the primary food source highlights their inability to dietary diversity. The overall food vulnerability score reveals that Kavalam (0.735) is the most vulnerable, followed by Thanneermukkom (0.62)

Regarding water status, the term 'poverty amidst plenty' is aptly attributed to Kuttanad, surrounded by water bodies. Water supply is inadequate in most parts of the Kuttanad region, leading to the widespread use of boats to transport potable water through Vembanad Lake. The situation is even more intense in the low-lying areas like Kavalam. Flooding and waterlogging have damaged pipelines, most constructed through paddy fields. Water leakages are common because of improper water management (Vaidyanadhan 2020). The water vulnerability score of Kavalam is the highest (0.665), followed by Thanneermukkom (0.44). In Kavalam, 90 per cent of the fishing households do not have a natural drinking water source. Regarding water vulnerability, Kumarakom (0.185) is the least vulnerable, followed by Vaikkom (0.215).

Since Kuttanad is one of the most flood-affected regions in Kerala, the inland fishing households in any part of the region are severely affected by the floods. The flood index score, a significant factor reflecting vulnerability to floods and waterlogging, indicates that Kavalam (0.48) is the most vulnerable region to

floods. Frequent floods and associated waterlogging necessitate the evacuation of fishermen and their families from their homes. However, even during such situations, at least one or two family members usually remain within their houses.

Over the past six years number of times the entire family members had to leave their homes is approximately 1.9; but regarding damage to properties such as housing and fishing equipment, Kumarakom and Vaikkom are the most vulnerable among the inland fishing villages.

A five-year study conducted by the Centre for Aquatic Resource Management and Conservation found that the Vembanad Lake, along with other water bodies, has been experiencing a decline in its water-carrying capacity. Specifically, the lake area diminished significantly from 365 square kilometres in 1990 to 206.30 square kilometres in 2020. Furthermore, the study revealed an alarming reduction of 85.3 per cent in the water retention capacity of the lake, decreasing from 2617.5 million cubic meters in 1990 to 384.66 million cubic meters in 2020 (Martin, 2023). The presence of harmful sediments and pollutants in the floodwater of the Kuttanad region, including soil particles, chemicals, fertilizers, pesticides, and various contaminants, has harmed the diversity of fish species in the water bodies. In the 1980s, there were around 150 different fish species, but by 2020, that number had decreased to approximately 90 (Martin, 2023). A fisherman with over 40 years of fishing experience in Kumarakom reported an 80 per cent dip in catch during the last five to six years. Floods have led to the entry of various invasive fish species, such as Nile Tilapia, Arapaima, and Alligator gar, into Vembanad Lake. These invasive alien species (IAS) pose a severe menace to the native fishes of the lake (Sudhish 2022).

Additionally, the Charru Mussel, another bio-invasive species in Vembanad Lake, poses a severe risk to the thriving Pearl Spot population, known for its high returns in the fishery. The floodwaters that carry nutrients and other organic materials into the water bodies resulted in the proliferation of water hyacinth, a highly invasive free-floating water plant. It creates challenges for fishermen by disrupting navigation, causing damage to fishing gear, and reducing access to fishing sites.

Considering all the significant factors, the overall livelihood index reveals that Kavalam (0.49) is the most vulnerable inland fishing village, followed by Thanneermukkom (0.39), and it should be noted that in terms of flood vulnerability, Kavalam is much higher than the other three villages. This is primarily due to its high vulnerability in terms of food and water and necessitates immediate attention to Kavalam. The values of the significant factors are presented in a spider diagram (Figure 3), with a scale ranging from 0 (least vulnerable) to 1 (most vulnerable).

Figure 3: Vulnerability Spider Diagram
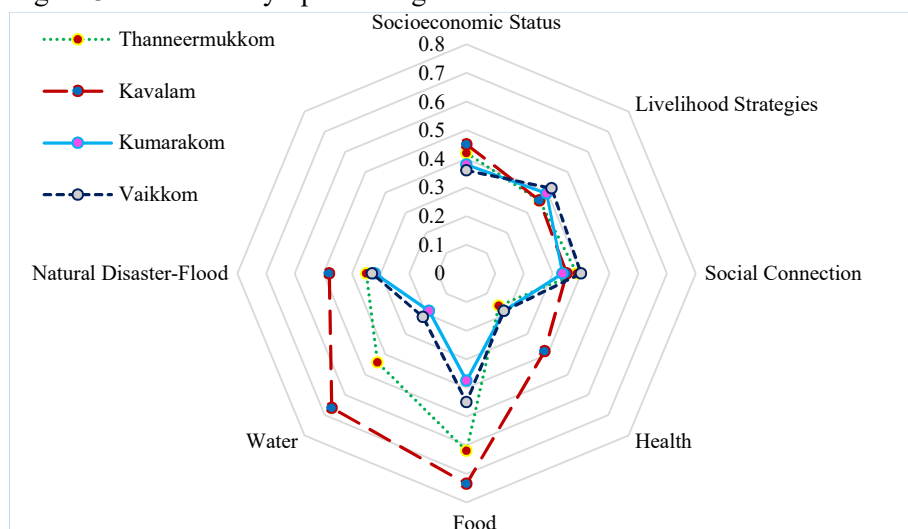
VII Concluding Remarks and Discussions

This study focuses on the livelihood issues of inland fishermen of Kuttanad during severe floods since 2018. In addition, the study attempts to identify and suggest various adaptive strategies against uncontrolled external events such as floods and similar hazards. The study addresses the vulnerability of fishermen in the above context by using the vulnerability index developed by Hahn to assess the same. The study results show that the dependency ratio, proximity to drinking water sources and the availability of health facilities significantly impact vulnerability, in which social connections and livelihood diversification are essential in developing resilience against floods.

Ex-ante (before the floods) and ex-post (after the floods) coping mechanisms can be used to mitigate the risk of floods. Occupational diversification, savings, insurance, and crop diversification are ex-ante adaptation measures of inland fishermen in the Kuttanad region. On the other hand, some people partly or wholly move from flood-prone low-lying regions to other areas as part of their ex-post adaptation mechanism. In addition, the crisis forced the affected people to go for livelihood diversification. The primary indicators for measuring flood sensitivity of the study are water, food and health, and it found that many parts of the Kuttanad region are severely affected by water scarcity. However, the pipelines carrying water, often passing through paddy fields, experience multiple leaks, exacerbating the water problem. The latter can be addressed by regular maintenance, construction, and placement of bigger pipelines in appropriate areas. A priority-based approach should be adopted regarding drinking water charges, with special consideration given to poor and marginalized groups like those of fishermen. There has been a significant decline in fish wealth due to the constant floods.

We suggest that many capacity enhancement and awareness programmes should be arranged for the fishermen's households at the government level to cope with the challenges of floods. They must be initiated primarily by local bodies. Since livelihood diversification is one of the most successful adaptation strategies, many employment opportunities should be made available for the fishermen. Even though under the Society for Assistance to Fisherwomen (SAF) scheme, many women from fisher households are receiving training facilities on making soaps, detergents, and bakery items, they need more marketing facilities to generate income from their products. The water plant water hyacinth creates severe problems for the fishermen, and the recent floods resulted in the massive proliferation of this aquatic plant. In Neelamperoor village of Kuttanad, an agreement has been made between the local government and a private firm (ROPE) in Tamil Nadu regarding selling dried hyacinth to the firm (Paul 2023).It has proven highly successful as it helps get additional income sources, and this model can be extended to the other villages of Kuttanad with the help of the participation of fishermen. MGNREGA workers can also be included in this productively used for this venture. Overall, the study focuses on the vulnerability aspects of inland fishing households and successfully examines various dimensions of vulnerability. Therefore, the study provides specific viable suggestions for policymakers to address the looming crisis of inland fishing households in the Kuttanad region of Kerala.

Footnotes

[1.]   Unit of land area-1 cent = 1/100th of an acre,1 cent = approximately 435.6 square feet or 40.47 square meters.

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The Complementarity of English Language Skills: Effects on Wage Returns, Education, and Job Market Experience in India

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The paper analyses the impact of English-speaking skills on wage returns in India. The effect of English language skills on earning is found to be increasing with educational qualifications and labour market experience in India. The findings of the study manifest that there exists a complementarity between English speaking skills and both educational qualifications and labour market experiences in India.

Keywords: English language skills, Wage returns, Labor market, India, Educational qualifications, Work experience

I Introduction

Language skills form an integral part of human capital as the acquisition of which enhances the quality of the workforce. It has the potential to increase labour productivity, leading to enjoying higher labour market returns. It is seen that the labour markets greatly reward language skills especially in certain occupations that require linguistic skills, especially in English. Thus, workers with language skills are more likely to get highly remunerative jobs and they have a superior position in the job market as their bargaining power in negotiating wages is strong. There are many studies previously conducted to assess the returns to foreign language skills and such studies include the works done by Dustmann (1994) in Germany, Chiswick and Miller (1995) in Australia, Berman, Lang and Siniver (2003) in Israel, Dustmann and Fabbri (2003) in the UK and Bleakley and Chin (2004) in the U.S. These studies, exclusively conducted among the immigrant communities found that the immigrants with destination country language skills receive positive language earning premium from the labour markets. Likewise, there is a lot of research work examining the foreign language premium among native workers as well. Saiz and Zoido (2005) studied the returns to foreign language skills using a sample of US college graduates, and Ginsburgh and Prieto-Rodriguez (2011) conducted a study covering several European countries and found the positive returns to English language skills. Willams (2011) manifested

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positive returns to English, French and German languages at the workplace in twelve European countries. Lang and Siniver (2009), examined the return to English skills in Israel and returns to Hebrew language skills among immigrants from Russia and found positive returns to these language skills for both immigrants and natives. There are a few other studies analysing the return to English language skills in developing countries. Those studies include the works by Levinsohn (2007) and Casale and Posel (2011) in South Africa, Toomet (2011) in Latvia and Estonia, and Paolo and Tansel (2013) in Turkey. These studies found that English language skill is a significant factor in wage determination in developing countries.

India is a developing country and the study of returns to English speaking skills in India is quite interesting for many reasons, such as the existence of diversity in languages and culture, colonial history, and the very long reign of the British Empire in the country. Though there were English, Hindi and Urdu as official languages in the country during the British era, all administration and legislation in English. After independence in 1947, India could not avoid the English language and it continued to be the official language of all administration, courts, government and business transactions. When the Indian Constitution came into power in 1950, it declared English and Hindi as official languages and envisioned that English would be replaced in favour of Hindi within fifteen years. But, until today, the English language remains to play a very important role in every sphere of Indian life. In recent years, especially since the early 1980s, the role and importance of English language skills have expanded as the economy opened to the world. So, it is a well-known fact that there are substantial wage returns for English language skills in India, but due to the lack of availability of data on wages and English language skills, we don't know the extent to which the English language contributed to wage earnings in earlier periods in India. Recently, some studies quantified the return to English language skills in India. Munshi and Rosenzweig (2006) conducted a study in Maharashtra and estimated the returns to English-medium education and found that returns to attending an English-medium school are higher by 25 per cent for both males and females. Kapur and Chakraborty (2008), conducted a study in West Bengal of India and showed that weekly wage falls by 1.6 per cent for a one per cent decrease in likelihood of learning the English language. It is implied that a 68 per cent reduction in weekly wages is the result of a language policy change. Chakraborty and Bakshi (2016) found an eight per cent reduction in weekly wage for a 10 per cent lower likelihood of learning English at the primary level. Instead of returns to 'English medium school', Azam, *et. al.* (2013) estimated the returns to 'English language skills' using India Human Development Survey 2004-2005. This study found that, compared to those who do not speak English, hourly wages are higher by 34 per cent for those who speak fluent English and 13 per cent higher for those who speak a little English. Women receive more returns than men as the average returns among women are higher by 22 per cent and 10 per cent for fluency in English and little fluency in English respectively. Recently, Refeque and Azad

(2022) conducted a study based on India Human Development Survey 2011-2012, and the findings are similar to those of Azam, *et. al.* (2013).

English speaking skills are the complements to the other human capital variables such as education and experience. English language skills help increase the return to education and experience. The greater the English language proficiency, the greater would be the return to education and job experience. The average rate of returns to education will be higher for those who have English language skills compared to those who have no English skills and vice versa. Similar to education, the average rate of returns to experience also increases with increase in fluency of English language skills and *vice versa*. Though the existing literature documents the positive returns to foreign language skills such as English and other languages, the complementarity of English with education and experience are not much discussed. Some studies have identified the effect of language skills across individuals, education, and occupations (McManus, *et. al.* 1983, Dustmann and van Soest 2001). While some other studies evidenced the effect of language skills on return to education, occupations and experience for immigrant and native workers (McManus 1985, Chiswick and Miller 1999, Berman, *et. al.* 2003, Lang and Siniver 2006). The extant study specifically focuses on the impact of English language skills on returns to education and experience in India. In order to assess the complementarity of English skills with experience, the age of the sample respondents is taken as a proxy for experience. This paper addresses the questions: How do returns to English language proficiency vary across educational levels and age distributions? Are English language skills complementary or a substitute for education and experience in India? Such a study becomes extremely relevant as systematic and comprehensive empirical studies on the impact of English speaking skills on returns to educational qualifications and job market experience are unexplored in the literature.

II Data

This study used the data set from the latest India Human Development Survey (IHDS) conducted in 2011, focusing on the data of household heads in the age group of 15 to 65. The study considered only those observations for whom the information is recorded regarding English language skills and removed all other observations from the data set. The study used a final data set of wage earning, education, skills, and other demographic variables of 51817 household heads from India Human Development Survey, 2011-2012. The IHDS data set on English language skill shows that 74.22 per cent of respondents have no English language skills, 19.55 per cent of the respondents reported little English skills and 6.23 per cent of respondents reported as Fluent English skills.

III Method

The main objective was to estimate wage functions using the Heckman (1976, 1979) two-step sample selection correction model. This model corrects the sample selection problem that arises due the restriction of samples that are reported to be having a wage in the cohort 15-65 years. In this model, first step is the estimation of participation function and second step is the estimation wage function. The estimation of wage equation will have the selectivity problem if wage function is estimated only using those respondents. Heckman Sample Selection Model corrects this selectivity issue.

The estimated equation is:

$$\ln w_i = \alpha + \gamma_1 E_i + \gamma_2 E N_i + \gamma_3 Z_i + \delta X_i + \mathcal{E}_i \qquad \ldots(1)$$

Where w is the log of hourly wage, E_i is education, EN_i is English speaking skills; Z_i stands for the vector of all other socio-demographic variables and X_i is all control variables used in the estimation. As there can be under-estimation or over-estimation of wages depending on the total number of working days in a month, monthly wage is not an appropriate variable (Agrawal 2011) and therefore this study uses the log hourly wage which captures wage per hour for a work done.

In the Heckman Sample Selection Model, we first estimate the participation function, where the dependent variable is labor market participation, assigned a value of 1 if the respondent is employed and 0 if unemployed. The independent variables include education, English-speaking skills, other socio-demographic factors, and identifying variables. The selected identifying variables are family size, marital status, non-labor income, and land ownership. The results from this estimation step are used to derive the inverse Mills ratio (λ), which is then included as an additional independent variable in the wage function during the second stage. Therefore, the final estimation of the wage equation is based on Equation 2:

$$\ln w_i = \alpha + \gamma_1 E_i + \gamma_2 E N_i + \gamma_3 Z_i + \delta X_i + \theta \lambda_t + \mathcal{E}_i \qquad \ldots(2)$$

In equation 2, inverse mills ratio (λ) is added as additional independent variable as a result of the application of Heckman two step sample selection model.

IV Result and Discussions

Impact of Educational Qualifications and English-Speaking Skills on Log Hourly Wage

The study estimated wage functions by applying Heckman sample selection model for the sample who are aged 15 to 65. The results are given in Table 1 by adding

controls in each column. column 1 of Table 1 presents the average log hourly wage with respect to level of education and English language proficiency. Compared to the log hourly wage of the respondents who have lack of English language skills, the individuals who speak limited English earn 0.16 log points more hourly wage, and individuals who speak English fluently earn 0.52 log points. As far as the level of educational qualification is concerned, column 1 of Table 1 found that, compared to the individuals whose education is below matriculation, the average hourly wage of the individuals with matriculation is 0.17 log points higher, and those who have an educational qualification of higher secondary earn 0.37 log points and those who have degree and above earn average log hourly wage by 0.52 log points. In Column 2 of Table 1, study controls for demographic variables such as age, religion, and caste. The controlling of demographic variables improves the returns to education for all levels of educational attainment and improves the result of returns to limited fluency in English and no change is visible in returns to fluency in English. Adding the location of the individuals, helps to control local labour market situations and leads to reduction in the estimated coefficients for levels of education and English language skills. Finally, in Columns 4 and 5, the study adds state fixed effects and regional fixed effects to control for inter-state and inter-regional differences in India's labor market situation. This adjustment improves the estimated coefficients for individuals with degree and above educational attainment. It also reduces the estimated coefficients for individuals with limited or fluent English-speaking skills. Column 5 presents the fully controlled model. It suggests that, compared to individuals with educational qualifications below matriculation, the log hourly wage is 12.7 per cent higher for those with higher secondary education. For individuals with degree and above qualifications, the log hourly wage is 49.4 per cent higher. Additionally, the wage is 18.8 per cent higher for those with higher secondary education.

It is 18.8 per cent higher for educational qualifications of higher secondary and 49.4 per cent higher for degree and above. As far as English language skill is concerned, column 5 of Table 1 show that, compared to lack of skill in English, individuals with limited fluency in English earn log hourly wage of 12.9 per cent; the same for those who are fluent in English is 45.3 per cent on average. These findings show a meaningful insight that the returns to education increases with increase in level of education and the return to education is higher at higher levels of educational qualifications. Additionally, it is also derived from this result that English language skills also provide high returns. The average returns for limited fluency in English is equal to average returns to matriculation. The average returns to fluency English approximate the returns to the degree and above category of education. This manifests the importance of English language skills in the labour market of developing countries like India.

Table 1: Impact of Educational Qualifications and English Speaking Skills on Log Hourly Wage

	No control	Demographic control	Rural/urban control	State Fixed Effect	
Education: Matriculation	0.179***	0.202***	.167***	0.146***	0.127***
	(0.020)	(0.010)	(.010)	(0.01)	(0.01)
Plus-Two	0.184***	0.230***	.207***	0.205	0.188***
	(0.025)	(0.013)	(.0124)	(0.013)	(0.013)
Degree & above	0.374***	0.463***	.463***	0.485	0.494***
	(0.031)	(0.016)	(.015)	(0.015)	(0.015)
Limited English	0.167***	0.178***	.151***	0.135	0.129***
	(0.017)	(0.009)	(.009)	(0.009)	(0.009)
Fluent English	0.520***	0.519***	.490***	0.474	0.453***
	(0.031)	(0.017)	(.016)	(0.016)	(0.016)
30-44		0.242***	.270***	0.265	0.283***
		(0.008)	(.008)	(0.008)	(0.008)
45-65		-0.150***	-.340***	-0.397	-0.521***
		(0.020)	(.021)	(0.021)	(0.017)
Religion: Hindu		-0.005	-.0265***	-0.049	-0.062***
		(0.010)	(.0097)	(0.01)	(0.01)
Islam		0.371***	.362***	0.254	0.218***
		(0.018)	(.017)	(0.018)	(0.018)
Christian		0.056***	.079***	0.065	0.067
		(0.017)	(.015)	(0.016)	(0.016)
Caste: OBS		-0.080***	-.077***	-0.086	-0.102***
		(0.008)	(.008)	(0.008)	(0.008)
Scheduled Caste		-0.049***	-.031***	-0.035	-0.053***
		(0.009)	(.009)	(0.009)	(0.009)
Scheduled Tribes		-0.178***	-.139***	-0.113	-0.132***
		(0.011)	(.010)	(0.011)	(0.011)
Location: Urban			.217***	0.21	0.23***
			(.007)	(0.007)	(0.007)
State: Kerala				0.402	
				(0.016)	
State: Madhya Pradesh				-0.306	
				(0.012)	
Region: North-East					0.318***
					(0.015)
Region: East					-0.126***
					(0.01)
Region: Central					-0.309***
					(0.011)
Region West					-0.03***
					(0.01)
Region: South					0.138***
					(0.009)
Constant	3.144***	2.925	2.804***	2.831***	2.813***
	(0.0240)	(0.011)	(.0114)	(0.011)	(0.012)
Inverse mills ratio	-1.24***	-.585 ***	-.141***	-0.031	0.218 ***
	(0.092)	(.043)	(.046)	(0.045)	(0.038)

Notes: The study only reported estimates of wage equations and excluded participation equations. The estimated inverse mills ratios are statistically significant for all estimated wage functions. The reference categories of covariates are: Lack of English language skill, below matriculation, age group 15-29, forward caste, male and rural sector, other states, and North states. Standard errors are shown in parentheses. Asterisks denote significance levels ***=.01, **=.05 and *=.10.

Heterogeneity in Impact of English Language Skills on Log Hourly Wage

Table 2 reports the return to English language skills by age, education, gender, location, and region. The coefficient of interaction effects shows how returns to English skills varies with each category of covariates. As far as the returns to English language skills by educational attainment is concerned, it is evident that the returns to little English language skills for matriculation is higher by 4.7 per cent compared to linguistically unskilled individuals with matriculation. The returns to fluency in English for matriculation is higher by 30 per cent, and the return is 23.3 per cent higher for individuals having a higher secondary level of education with fluency in English. The returns to fluent English skills for the degree and above qualifications is 28 per cent. It shows that fluent English language skills help increase the returns to all levels of educational qualifications. The comparative effect of English-speaking skills is higher for matriculation and even limited English skills for matriculation improve the return (see Table 2 column 5). The returns to both limited English and fluent English skills for females is higher by 6.3 per cent and 20 per cent respectively compared to males. The returns to both limited skills and fluent English skills for urban individuals are higher by 14 per cent and 15 per cent respectively compared to rural individuals. As far as the regional wise heterogeneity is concerned, column 4 in Table 3 shows that the return to limited English for the North East is 15.8 per cent and South is 5 per cent compared to the reference category. But the returns to fluent English skill for East is 12.6 per cent, for the North East is 6.8 per cent compared to the reference category. The returns to fluent English skill are lower for the Central and South regions by 12.6 per cent and 18.9 per cent respectively. It shows that English fluency skill is more important between the Eastern and North Eastern states. Comparatively, the relevance is lower among central and south Indian states.

Table 2: Heterogeneity in Impact of English Language Skills on Log Hourly Wage

	Base	Education	Gender	Urban/rural	Full model
Little English	0.457***	0.265***	0.170***	0.093***	0.055***
	(0.007)	(0.012)	(0.012)	(0.013)	(0.015)
Fluent English	1.156***	0.380***	0.255***	0.179***	0.158***
	(0.0123)	(0.054)	(0.052)	(0.053)	(0.053)
Limited English*Matriculation		-0.040*	0.024	0.023	0.047**
		(0.022)	(0.021)	(0.020)	(0.020)
Limited English*Plus Two		-0.077***	0.020	0.021	0.027
		(0.027)	(0.026)	(0.026)	(0.025)
Limited English* Degree& above		-0.117***	-0.024	-0.021	-0.023
		(0.039)	(0.037)	(0.037)	(0.036)
Fluent English*Matriculation		0.274***	0.340***	0.301***	0.308***
		(0.069)	(0.066)	(0.065)	(0.063)
Fluent English*Plus Two		0.191***	0.291***	0.263***	0.233***
		(0.065)	(0.062)	(0.061)	(0.060)
Fluent English* Degree& above		0.243***	0.338**	0.320***	0.280***
		(0.066)	(0.063)	(0.062)	(0.061)

	Base	Education	Gender	Urban/rural	Full model
Limited English*Female			0.086***	0.078***	0.063***
			(0.017)	(0.017)	(0.017)
Fluent English*Female			0.261***	0.216***	0.205***
			(0.024)	(0.027)	(0.026)
Limited English*Urban				0.121***	0.143***
				(0.014)	(0.014)
Fluent English*Urban				0.098***	0.150***
				(0.025)	(0.025)
Limited English*North East					0.158***
					(0.033)
Limited English*East					0.071***
					(0.024)
Limited English*Central					-0.0172
					(0.025)
Limited English*West					0.0347
					(0.022)
Limited English*South					-0.054***
					(0.017)
Fluent English*North East					0.068*
					(0.041)
Fluent English*East					0.1262***
					(0.0370)
Fluent English*Central					-0.126*
					(0.064)
Fluent English*West					0.004
					(0.037)
Fluent English*South					-0.189***
					(0.0287)
_cons	2.824***	2.792***	2.955***	2.89***	2.929***
	(0.008)	(0.003)	(0.004)	(0.004)	(0.006)

Human Development Survey, 2011-2012. Each column reports the results of a separate selectivity corrected regression model that controls for caste dummies, gender dummies, sector dummies and state fixed effect. Standard errors are reported in parentheses. The study only reported estimates of wage equations and excluded participation equations.

Is the English Language Skill Complementary?

Another important aspect that needs to be explored is whether English language premium acts as a complementary or substitute factor? In this section, the study tries to examine this by assessing how returns to English skills vary by age cohort. The study wants to find out which age category receives more English language premium in India. Table 3 (column 1) shows that the individuals in the younger age group (15-29), who are a limited fluent in English earn 26 per cent higher wage compared to those who have lack of skills in English and those who speak fluent English earn 83 per cent higher. The individuals aged between 30-44 have a return of 53.9 per cent for limited English skills and those who speak fluent English earn 120 per cent higher compared to those who are linguistically unskilled. Individuals aged between 45-65 have returns of 93.6 per cent for limited English skills and

164 per cent for fluent English skills. The English language premium is not equal across the age cohort as the younger people who enter the labour market with fluent English-speaking skills earn less than the returns enjoyed by middle-aged and older people. These empirical observations are consistent with the study by Azam, *et. al.* (2013). These results show the existence of language skills complementary in India. Language skills are important for highly paid jobs in developing countries like India. Hence, individuals with English skills are in a decent position to get well-paid jobs and jobs that have a promising growth potential. At the entry level, for high profile jobs, English is necessary for labour market absorption. However, this premium is not that high for the younger workforce as their experience is also important in determining the returns.

The returns to English language skills also vary by cohort and level of educational attainment. Table 3 (column 2) shows that the return to English skills by education for all age cohorts has an upward pattern. The returns to limited fluency in English for the workers in the age cohort of 15-29 are 25.6 per cent for matriculation, 28.9 per cent for higher secondary and 65.5 per cent for Degree and Above qualifications. The returns to fluent English skills for young workers are 44.2 per cent for matriculation, 56.2 per cent for higher secondary and 103.5 per cent for degree and above. That is, the English premium among young workers increases with the increase in educational qualifications. For the middle age cohort (30-44), workers receive an English language premium of 53.7 per cent for matriculation, 60 per cent for higher secondary, 88.3 per cent for degree and above for limited English skills. But the English language premium is comparatively higher for fluent English language skills. They received 53.7 per cent for matriculation, 86.5 per cent for higher secondary and 138.8 per cent for degree and above. That is, for the middle age cohort, returns to English language skills for both limited and fluent skills are relatively higher than the younger age cohort. But the elder age group 45-65, even for low education such as matriculation and higher secondary, receive a substantial English premium for both limited and fluent English skills. For them, English premium is 96.2 per cent for matriculation, 123.3 per cent for higher secondary and 136.1 per cent for degree and above qualifications for limited skills in English. The returns for fluent English skills of elderly workers is 138.1 per cent for matriculation, 156.8 per cent for higher secondary, 180 per cent for degree and above. This shows that returns to English language skills by level of education are moving upward for all age groups, but the elderly workers receive a comparatively high English premium for their English language skills. These results of returns to English skills for age-education give greater insight to the earlier discussion on returns by age cohort. In that discussion, it was found that the effect of English speaking is higher for the older and middle cohorts compared to the youngest cohort. But in this section, it is found that returns to English skills are higher for all levels of education for older workers and for highly educated young and middle-aged workers. It is observed that older and middle-aged workers receive a higher language premium for English language skills than younger workers. Highly educated young workers and middle-aged

workers receive high English language premium. But the older workers for all levels of education have a very high-level language premium for English skills. Hence, in the older cohorts, this study did not find language-education complementarity. Though it was previously easy for those who are linguistically skilled to find highly-paid jobs due to lesser availability of such skilled individuals in the labour market, it is not the case now. Nowadays, due to a large supply of workers with English language skills and competition, only workers with high levels of education can find high-profile jobs at the entry level. In addition to that, the structure of jobs has changed due to digitalisation in the workplace. So, these days, labour market absorption requires both higher levels of educational qualifications and skills, especially linguistic and technical skills.

Table 3: English Language Complementarity in Returns to Education and Experience

	English x age	English x Education x Age
Limited English x 15-29	0.260 (0.012)	
Limited English x 30-44	0.539 (0.012)	
Limited English x 45-65	0.936 (0.0151)	
Fluent English x 15-29	0.831 (0.022)	
Fluent English x 30-44	1.208 (0.019)	
Fluent English x 45-65	1.640 (0.022)	
Young workers		
Limited English x SSLC x age group 15-29		0.256 (0.020)
Limited English x Plus Two x age group 15-29		0.289 (0.021)
Limited English x Degree & above x age group 15-29		0.655 (0.028)
Fluent English x SSLC x age group 15-29		0.442 (0.078)
Fluent English x Plus two x age group 15-29		0.568 (0.047)
Fluent English x Degree & above x age group 15-29		1.035 (0.025)
Middle aged workers		
Limited English x SSLC x age group 30-44		0.537 (0.020)
Limited English x plus two x age group 30-44		0.600 (0.022)
Limited English x Degree & above x age group 30-44		0.883 (0.023)
Fluent English x SSLC x age group 30-44		0.537 (0.093)
Fluent English x Plus two x age group 30-44		0.865 (0.044)
Fluent English x Degree & above x age group 30-44		1.388 (0.022)
Older workers		
Limited English x SSLC x age group 45-65		0.962 (0.025)
Limited English x plus two x age group 45-65		1.233 (0.033)
Limited English x Degree & above x age group 45-65		1.361 (0.031)
Fluent English x SSLC x age group 45-65		1.381 (0.059)
Fluent English x Plus two x age group 45-65		1.568 (0.054)
Fluent English x Degree & above x age group 45-65		1.807 (0.026)

Note: Notes: Table reported the results of wage equations only. The estimated inverse mills ratio is statistically significant. The estimated models control for caste dummies, age dummies and state fixed effect. Standard errors are reported in parentheses. All estimated coeffects are statistically significant. The independent variables' categories have been rearranged to enhance the comprehension of the results.

V Summary and Conclusion

The extant study exhibits that English language skills are important determinants of wage earnings in the Indian labour market. The workers who can speak English, irrespective of their level of fluency, are able to enhance their wage earnings. However, wage differences are noted depending on the fluency level. The study finds that the return to linguistic skills is a positive function of educational qualifications and labour market experiences. The average return to fluent English-speaking skills approximates the return to an educational qualification of degree and above. Though the findings show that the returns to English skills are higher at higher levels of educational qualifications, considerable impacts of English skills can be seen even at the matriculation level. One of the key objectives of the study has been to assess the complementarity of English language skills with educational qualifications and job market experience in India. In order to study the impact of labour market experience, the study considers age as a proxy variable. It is evident from the results that there is a complementary effect of English language skills on labour market experience and education in India. Though the language premium is enjoyed by all age groups, such an impact is greatly seen among elderly and middle-aged workers and this has a complementary effect. It is interesting to note that English skills do not substitute experience as returns to English skills are comparatively less among the younger workforce. The study also finds that the return to English speaking skills by education for all age cohorts shows an upward pattern. The English language premium increases with an increase in educational qualifications for workers, irrespective of their age. However, the English language premium is relatively higher for elderly workers (45-65) followed by middle-aged workers (29-45) and then the younger workforce (15-29). Interestingly, the elder group receives a substantial English premium even for their educational qualifications of matriculation and higher secondary. The findings assert that the returns to English skills are higher for all levels of education in the case of the elderly workforce. Among the middle aged and younger workforce, English skills are found to be playing a significant role at the higher levels of educational qualifications. This indicates the complementarity effect of linguistic skills and education especially among middle-aged and younger labour market participants.

The results of this study are consistent with the hypothesis that greater proficiency in English enhances wage earnings in the Indian labour market. In addition, it has a complementary impact by further enhancing the returns to education and experience. This provides the interesting insight that the language skills are important determinants of wage earnings in India and a culmination of linguistic skills and education keeps the people in an advantageous position in the labour market by empowering their negotiation skills, labour market participation and ensuring a decent monetary return. Thus, the focus of educational policies in the country should be on imparting necessary skills rather than mere dissemination

of knowledge. In the modern world, jobs require skilled individuals and thus acquisition of skills ensues umpteen numbers of benefits in the labour market.

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Book Reviews

Madhavi Menon, *The Law of Desire: Rulings on Sex and Sexuality in India*, Speaking Tiger Books, New Delhi, 2021, p. 148, Price ₹499.

"The Law of Desire" delves into the historical and contemporary constraints on desire in India, using mythological characters to convey societal norms about women's dignity and sexual control. The author points out that despite evolving laws that decriminalise aspects of homosexuality, moral policing still infringes on private desires, categorizing and restricting them. Legal interference exposes private matters, while desire defies boundaries. The book explores how legal frameworks define and limit human desire and identity, including the recent recognition of the third gender for practical purposes like obtaining ration cards. It questions the link between gender identity and entitlements like subsidies. The state's role in regulating desire poses complex challenges: Is desire private property, a core aspect of identity, or a constitutional right? Private hopes often intersect with public expectations, that become legible only when made public. The state shapes desire using labels like criminal, immoral, obscene, and unnatural, reflected in legal orders. The book provokes reflection on the intricate relationship between desire, identity, and state regulation.

The first chapter explores the adjective "criminal," examining how desires are criminalized in the name of social and national security. It discusses how desires are restricted to religiously fixed, pre-written books. The narrative begins with a girl who has gone to the courtroom with her newly wedded husband of a different faith. Her parents claim the girl's ideology is being reshaped by radical organizations to convert her to another faith. Despite being an adult, the girl can't make the decision to choose her partner, as women in their twenties are considered vulnerable. Until marriage, personal choice and sexual desires are declared invalid, becoming subjects of scrutiny. Women need to be in the custody of their father until they are married to another man. The male judges' anger over the solo decision taken by the girl to change her religion is highlighted. The state's interference in surrogacy is also discussed, limiting it to close relatives who can carry the baby, and stating that the baby can only be owned by heterosexual couples. The biased lens used by the state to justify marriage and reproduction is best understood by heterosexuals only. The criminalization of Muslim men's desires and the restriction of women's desires to only religion are also explored, showing how beyond this, it becomes a collision between private marriage and the criminalizing nation-states.

Exploring the second adjective, "immoral," the narrative delves into significant legal cases and laws in India concerning devadasis, tawaifs, and efforts to combat trafficking through acts like SITA. These professions held high status in Indian society until the colonial period redefined them as sordid and coercive.

The law itself views women's sexual agency as immoral, portraying women in these professions as victims needing rescue and retraining for alternative careers. The criminalization of public prostitution confines women to narrow sexual boundaries dictated by the state, forcing the practice into private spaces free from legal interference. Historical texts like the Kama Sutra and Arthashastra view sex as an action rather than defining a person's identity. In ancient India, ganikas (courtesans) were respected and received government salaries. During the colonial era, British moral judgments repressed the perceived elevated status of women in sexual work, enforcing marriage as the sole outlet for female sexuality. Post-independence, laws like SITA aimed to control female desire to preserve community purity and honor. Activists like Ambedkar criticized prostitution as a historic wrong against lower-caste women. Over time, societal perceptions evolved, leading to stigmatization based on sexual history. The narrative contrasts the dependent "Sita" archetype with the independent "Sweety," exploring shifting morality and societal definitions of female agency. This chapter critiques the intersection of law, morality, and gender roles in shaping perceptions of women's autonomy and sexual identity in India.

Exploring 'obscene,' the narrative delves into how Indian society is defined by the state. Sections 292 and 294, dealing with obscenity charges, lack clear definitions and depend on individual viewpoints. The narrative discusses the ban on Bombay dance bars, citing shame brought upon tradition by dancers imitating Bollywood in traditional attire. Nudity can stimulate varied desires. Key questions arise: how do we delineate boundaries and contain obscenity? Private exhibitions are acceptable for the affluent but deemed obscene in public. Wealthy audiences are supposed to view sex scientifically, while street accessibility deems it obscene. The state values erotic sculptures yet condemns human nudity. Why does the state classify sex as good or bad? Obscenity relates to utilitarian sex—reproduction over personal desire. This is how the law shapes our view of sex.

The fourth adjective, "unnatural," highlights power exercised on people who do not follow the pre-decided structure with their sexual identity and thoughts. A transgender athlete, accused of rape by her girlfriend, underwent medical tests and was later found not to have fully developed male genitalia due to a medical condition. However, she couldn't be proven guilty under state law, because she was incapable of sexual intercourse like an adult male in the ordinary course of nature. In Indian law, rape is a crime that can only be perpetrated by a man against a woman. The classification of natural and unnatural is defined solely based on the existence of penis and testicles. The person was declared innocent due to the absence of a penis, and the charge of rape was dismissed. Subsequently, the NALSA judgment was passed to ease gender concepts and break the boundaries of gender constructs, allowing people to choose the third gender. However, they still need approval from the district magistrate for identification and a certificate for correct gender, revealing the gaze of law to continue to consider gender as an administrative fiction. The concept of natural and unnatural remains unclear even for those who fall under the dichotomy. Women who can bear children, who don't

have marital disturbances, and who don't need medical help to maintain predetermined hormonal levels are deemed natural women, while the rest are considered unnatural by (?).

Further the chapter discusses adultery laws in India, accepting women as the lead character responsible for sustaining a marriage by controlling her sexual desires outside of marriage. The restriction of female desire is considered synonymous with what is best for society, aimed at preserving the institution of marriage. Women's sexuality is always considered impure, and whether they have uncontrolled desires or are innocent and vulnerable remains an unsolved question. Society and the law have never been able to settle this question. Married men having affairs outside of wedlock are often accepted, but the fear of female desire has haunted patriarchal societies for centuries. Furthermore, the chapter extends to the Sabarimala case and menstruation, highlighting the heterosexual perspective in society that considers women naturally unnatural due to their biological system of menstruation, which is associated with security. Women who are still of age to engage in sexual activity are considered responsible for distracting men, with the presence of women's bodies being seen as both adulterated and adulterating.

Lastly, the discussion addresses the criminalization of unnatural sex and unclear versions of punishable laws for carnal acts against the order of nature. The conclusion reflects on the determination of what is natural based on a functional basis, where every organ of the body has a particular function to perform. Therefore, using an organ for a purpose inconsistent with its principal function is deemed unnatural. According to this logic, any form of sex other than penile-vaginal intercourse is considered unnatural, while heterosexual sex is viewed as procreation and natural.

"The Law of Desire" provides a comprehensive critique of how legal and societal frameworks in India regulate and constrain human desire. Through its exploration of criminal, immoral, obscene, and unnatural labels, the book underscores the state's role in shaping and controlling personal identities and desires. The author's examination of historical and contemporary cases reveals the persistent tensions between individual rights and state-imposed norms. The book challenges readers to reflect on the complex interplay between desire, identity, and state regulation, questioning the very foundations of what is considered natural and acceptable in society. By covering important points that directly or indirectly influence individuals' choices in attaining their sexual desires, the author successfully depicts the real picture of the state as a body imposing its laws and hampering individual rights. The four chapters clearly illustrate how legal orders reflect societal biases and moral judgments, ultimately shaping our understanding of human desire and identity.

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Ananta Kumar Giri, Michael Zirkler, Divya Kirti Gupta, and Minati Pradhan, *New Works in Consciousness Corridors: Dialogues with Subhash Sharma and Our Creative Planetary Futures*, Authors Press, New Delhi, 2023, Price ₹1200/- only

'New Works in Consciousness Corridors: Dialogues with Subhash Sharma and Our Creative Planetary Futures' is an insightful and thought-provoking anthology that delves into the multifaceted domain of consciousness studies. Edited by Ananta Kumar Giri, Michael Zirkler, Divya Kirti Gupta, and Minati Pradhan, the book is a testament to the interdisciplinary nature of consciousness research, blending philosophical inquiry, ethical considerations, and practical applications in management and leadership.

Overview

The anthology is structured into four parts, each exploring different dimensions of Subhash Sharma's pioneering work and its implications for future thinking and practice. The contributions from various scholars and practitioners reflect a rich diversity of perspectives, underscoring the depth and breadth of Sharma's influence in the fields of management, ethics, leadership, spirituality, and human development.

Part One: Walking and Meditating with Subhash Sharma

This section features eight papers that discuss the role of ethics in business, the transition from market-centric to self-centric paradigms, and the integration of spirituality into management. Highlights include M. V. Nadkarni's exploration of moral limits in market systems and Meera Chakravorty's analysis of Sharma's shift from market to self. These papers collectively underscore the importance of ethical and spiritual dimensions in business and leadership.

Part Two: Consciousness Works and New Horizons of Ethics, Leadership, Management, Science, and Spirituality

The second part comprises five essays that expand on the ethical and leadership paradigms introduced by Sharma. Ananta Kumar Giri's essay on Atmic Planetary Leadership stands out, offering a visionary framework for global leadership grounded in ethical and spiritual principles. Mala Kapadia's exploration of the ViSA approach to creating corporate rishis is another highlight, providing practical strategies for integrating spirituality into corporate environments.

Part Three: Consciousness Works and New Pathways of Consciousness Schools, Wisdom and Management

In this section, six essays delve into innovative approaches to management education and corporate learning. BVK Sastry's proposal for Consciousness Schools (C-Schools) as an alternative to traditional MBA programs is particularly compelling, suggesting a paradigm shift towards more ethically and spiritually aware business education. Pallavi Joshi and Ankur Joshi's discussion on nurturing wisdom through Indian ethos in management also provides valuable insights into integrating cultural wisdom with modern management practices.

Part Four: Consciousness Works and New Horizons of Human Quality Development, Social Poetry, and World Transformations

The final section comprises eleven essays that explore the broader implications of Sharma's work for human quality development, social poetry, and global transformation. Soni Harsh Srivastava's study of Human Quality Development (HQD) and Sony Kumari's essay on the role of yoga in HQD are notable for their practical applications in personal and professional development. Thomas Menamparampil's exploration of reciprocity in intercultural contexts and Charles Savage's philosophical inquiry into the concepts of space and time further enrich the anthology, offering profound reflections on the interconnectedness of consciousness and global harmony.

Conclusion

'New Works in Consciousness Corridors: Dialogues with Subhash Sharma and Our Creative Planetary Futures' is a seminal work that bridges the gap between traditional wisdom and contemporary challenges. The contributions in this anthology not only pay tribute to Subhash Sharma's pioneering ideas but also expand on them, providing fresh perspectives and practical applications for a more conscious and ethically grounded world. This book is a must-read for scholars, practitioners, and anyone interested in the intersections of consciousness, management, ethics, and spirituality. It offers a comprehensive and inspiring vision for the future, grounded in the principles of holistic development and global well-being.

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